DEPARTMENT OF PHARMACEUTICAL SCIENCES & TECHNOLOGY
MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਾਦਲ ਰੋਡ, ਬਠਿੰਡਾ
Dabwali/Badal Road, Bathinda -151001
(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)

Ref. No:MRSPTU/PHARM/ 1648 **Date:** 30/1/2019

Sub: Minutes of DDRC Meeting of Faculty of Pharmacy held on 30.01.2019

The DDRC meeting of Faculty of Pharmacy, MRSPTU, Bathinda was held on 30.01.2019 at Department of Pharmaceutical Sciences & Technology, MRSPTU, Bathinda. Following candidates presented themselves before the committee for Ph.D. admission Jan. – June 2019 in the discipline of Pharmaceutical Sciences under the Faculty of Pharmacy.

- Yedke Narhari Gangaram
- Mahesh Prasad Singh

The committee recommend the provisional admission of both the above candidates subjected to fulfillment/submission of following documents, as applicable.

a) Migration Certificate of Yedke Narhari Gangaram. in original

After successful submission of these documents and admission fee deposition, pre-Ph.D. course work and supervisor are recommended as given below:

Name of Candidate	Course Allocated with Sub-Code	L-T-P-C	Supervisor Allocated
Yedke Narhari Gangaram	Research Methodology (MREM0-101) Elements of Pharmaceutical Research (PPHD0-101)	4-0-0-4 3-1-0-4	Dr. Puneet Kumar
Mahesh Prasad Singh	Journal Club and Report Writing (PPHD 0-102) Seminar (PPHD 0-103)	0-0-3-2 0-0-2-1	Dr. Uttam Kumar Mandal

Further, it was proposed that before the Ph.D. registration 6-monthly performance report of Ph.D. candidates (during course work and research proposal preparation) enrolled with a Dept. may be presented before the faculty of concerned Dept. in the presence of Supervisor and certificate of satisfactory progress be submitted to O/o Dean (R&D) for records.

In the wake of change of affiliation of a Supervisor, candidate be asked to change his supervisor having MRSPTU affiliation from concerned FACULTY. The performa proposed by the O/o Dean (R&D), MRSPTU was approved for the purpose.

In case, a candidate remain absent before the Department Committee for evaluation of the 6 monthly Ph.D. progress report, his/her performance be treated as 'Unsatisfactory'. In the subsequent semester late fee fine @ Rs. 500/-month (as already notified in Ph.D. fee structure) be charged w.e.f. the due date. Further, two consecutive absents be treated as per MRSPTU Ph.D regulation 2016 Clause 8.1 (iii).

Meeting ended with vote of thanks to the Chairman.

30/1/19
Prof. Ashish Baldi
(Chairman DDRC & Convener)

ABSENT – on Leave
(Nominee of VC)

30.1.2019
Prof. R.K. Bansal
(Nominee of Dean R&D)

30/1/19
Dr. Puneet Kumar
(Dept. Ph.D. Faculty & Supervisor)

30/1/19
Dr. Uttam Kumar Mandal
(Supervisor)

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Department of Applied Mathematics

Ref No : Math/19/__ **Dated ____**

Sub: Mintues of DDRC Meetings of Deptt. of Applied Mathematics held on 23.01.2019

The DDRC Meeting of Deptt.ofApplied Mathematics, MRSPTU, Bathindais held on 23.01.2019 at mrsptu, Bathinda. Following candidate presented herself before the committee for MRSPTU, Ph.D. Admission Jan-June 2019.

1. Ms. Priyanka

The committee recommended the provisional admission of candidate subjected to fulfillment/submission of following documents, as applicable, within two weeks.

a) Supervisor Consent Form
b) NOC From Employer for pursuing Regular Course Work
c) Migration Certificate

After successful submission of these documents and admission fee deposition, pre-PhD course work and supervisor are recommended as follows-

Name of Candidate	Course Allocated with Sub-Code	L-T-P-C	Supervisor Allocated
Ms. Priyanka	1. Research Methodology MREM0-101 2. Fourier Analysis and Applications MMAT1-356 3. Advanced Numerical Analysis PMAT1-102 4. Numerical Analysis Lab MMAT1-210 5. Seminar PMAT1-104	4-0-0-4 4-0-0-4 4-0-0-4 0-0-4-2 0-0-2-1	Dr. KARANVIR SINGH
	Mg 23/1/19	15	

Further, it was proposed that before the Ph.D. registration, 6-monthly performance report of Ph.D. candidates (during course work and research proposal preparation) enrolled with a department may be presented before the faculty of concerned department in the presence of Supervisor and certificate of satisfactory progress be submitted to o/o Dean (R&D) for records.

The meeting ended with vote of thanks to the Chairman.

(Chairperson) Geeta Handa 23/1/19 **Member** **Member** 23.1.2019

Karanvir **Member** **Member** 23/1/19 (Dr Mukesh Grover) Mukesh 23/01/19 **Member** (Dr Mukesh)

MAHARAJA RANJIT SINGH
PUNJAB TECHNICAL UNIVERSITY, BATHINDA
(Estb. By Govt. of Punjab vide Act No. 5 [2015] and u/s 2(f) and 12 B of UGC Act, 1956)

University Business School

Ref. No. UBS/19/…….. **Dated… ……….**

Sub: **Minutes of DDRC Meeting of Deptt of Commerce & Business Management, held on 17.01.2019.**

The DDRC meeting of Deptt of **Commerce & Business Management,** MRSPTU, Bathinda was held on 17th Jan, 2019 at MRSPTU, Bathinda. Following candidates presented themselves before the committee for MRSPTU Ph.D admission Jan, 2019.

1. Deepak

The committee recommends the provisional admission of candidates subjected to fulfillment/submission of following documents, as applicable, within 2 weeks.

a) Supervisor consent form
b) NOC from employer for pursuing REGULAR course work
c) Migration certificate in original

After successful submission of these documents and admission fee deposition, Pre-PhD course work and supervisor are recommended as follows-

Name of candidate	Course allocated with sub code	L-T-P-C	Supervisor allocated
1. Deepak	i. Contemporary Issues in Management (PCBM1-101) ii. Research Methodology (MREM0-101) iii. Seminar (PCBM1-102) iv. Advanced Financial Management (PCBM1-103) v. Investment Banking and Corporate Restructuring (MBAD1-481)	4 - 0 - 0 - 4 4 - 0 - 0 – 4 0 - 0 - 2 – 1 4 - 0 - 0 – 4 4 - 0 - 0 – 4	Dr. M. K. Kulshrestha

Further, it was proposed that before the PhD registration, 6-monthly performance report of PhD candidates (during course work and research proposal preparation) enrolled with a Deptt may be presented before the faculty of concerned Deptt in the presence of Supervisor and certificate of satisfactory progress be submitted to o/o Dean (R&D) for records.

The meeting ended with vote of thanks to the Chairman

(Chairperson) Dean (Mgt) | Member (Supervisor) | 17.1.2019 Member

Member | Member | Member

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Department of Food Science & Technology

Ref No : ________ Dated ________

Sub: **Minutes of DDRC Meeting of Deptt. of Food Science & Technology held on 23.01.2019**

The DDRC Meeting of Deptt. of Food Science & Technology, Bathinda is held on 23.01.2019 at MRSPTU, Bathinda. Following candidates presented themselves before the committee for MRSPTU, Ph.D. Admission Jan-June 2019.

1. Puneet Kang d/o Gurdeep Singh
2. Gurjinder Kaur d/o Ghilla Singh
3. Shamandeep Kaur d/o Kulwinder Singh
4. Pinderpal Kaur d/o Gurcharan Singh

The committee recommended the provisional admission of above candidates subjected to fulfilment/submission of following documents, as applicable, within two weeks.

a) Supervisor Consent Form
b) NOC From Employer for pursuing Regular Course Work
c) Migration Certificate in original

After successful submission of these documents and admission fee deposition, pre-PhD course work and supervisor are recommended as follows-

Name of Candidate	Course Allocated with Sub-Code	L-T-P-C	Supervisor Allocated
Puneet Kang	Research Methodology	3-1-0-4	Dr. Kawaljit Singh Sandhu
Gurjinder Kaur	Advances in Food Technology	3-1-0-4	
Shamandeep Kaur	Journal Club and Report Writing	0-0-4-2	
	Seminar	0-0-2-1	
Pinderpal Kaur	Advances in Cereal Technology	3-1-0-4	
	Total Credit	15	

Further, it was proposed that before the Ph.D. registration, 6-monthly performance report of Ph.D candidates (during course work and research proposal preparation) enrolled with a department may be presented before the faculty of concerned department in the presence of Supervisor and certificate of satisfactory progress be submitted to o/o Dean (R&D) for records.

The meeting ended with vote of thanks to the Chairman.

(Chairperson) 23/1/19 Member 23/1/19 Member 23/1/19

Member 23/1/19 (Deptt Ph.D faculty) Member 23/1/19 (Candidate's Supervisor) Member 23/1/19 (Ph.D. Co-ordinator)

Maharaja Ranjit Singh Punjab Technical University

Dabwali Road, Bathinda -151001

(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)

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Department of Applied Physics

(head.physics.gzs@gmail.com, Ph. 87250-72490)

Ref No : Phy/19/________ **Dated ________**

Sub: Minutes of DDRC Meetings of Deptt. of Applied Physics held on 23.01.2019

The DDRC Meeting of Deptt. of Applied Physics, MRSPTU, Bathinda is held on 23.01.2019 at MRSPTU, Bathinda. Following candidates presented themself before the committee for MRSPTU, Ph.D. Admission Jan-June 2019.

1. Amit Kumar Singla
2. Sumandeep Kaur

The committee recommended the provisional admission of both the candidates. The admission of Sumandeep Kaur will be subjected to fulfillment/submission of following documents, as applicable, within two weeks.

a) Migration Certificate
b) M.Sc. Degree Certificate

After successful submission of these documents and admission fee deposition, pre-Ph.D. course work and supervisor are recommended as follows-

Namep of Candidate	Course Allocated with Sub-Code	L-T-P-C	Supervisor Allocated
Amit Kumar Singla	1. Research Methodology (MREM0-101) 2. Research and Computational Techniques Lab (PPHY-101) 3. Seminar (PPHY-102) 4. Radiation Protection and Dosimetry (PPHY-104) 5. Experimental Techniques in Nuclear and particle Physics (PPHY-105)	4-0-0-4 0-0-4-2 0-0-2-1 4-0-0-4 4-0-0-4	Dr. Sandeep Kansal
Sumandeep Kaur	1. Research Methodology (MREM0-101) 2. Research and Computational Techniques Lab (PPHY-101) 3. Seminar (PPHY-102) 4. Material Characterization Techniques (PPHY-106) 5. Vacuum Science and Thin Films (PPHY-107)	4-0-0-4 0-0-4-2 0-0-2-1 4-0-0-4 4-0-0-4	Dr. Satnam Singh

Further, it was proposed that before the Ph.D. registration, 6-monthly performance report of Ph.D. candidates (during course work and research proposal preparation) enrolled with a department may be presented before the faculty of concerned department in the presence of Supervisor and certificate of satisfactory progress be submitted to o/o Dean (R&D) for records.

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Department of Applied Physics
(head.physics.gzs@gmail.com, Ph. 87250-72490)

Contd P-2/2

Ref No : Phy/19/________ Dated ________

The meeting ended with vote of thanks to the Chairman/chairperson.

(Chairperson) 23/1/19

Member
(Dr Sanna Bansal)

Member
(Dr Rakesh Bansal)

Member 23/1/19
(Ph.D faculty)

Member 23/1/19
(Ph.D faculty) 23/1/19

Member/HOD 23/1/19

P-2/2

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Department of Civil Engineering
(hodcivilgzsccet@gmail.com, Ph. 98151-26102)

Ref No : **Dated** ________

Sub: Mintues of DDRC Meetings of Deptt. of Civil Engineering held on 25.01.2019

The DDRC Meeting of Deptt. of Civil Engineering, MRSPTU, Bathinda is held on 25.01.2019 at MRSPTU, Bathinda. Following candidate presented himself before the committee for MRSPTU, Ph.D. Admission Jan-June 2019.

1. Manik Goyal
2. Mukesh Kumar
3. Deepak Kumar

The committee recommended the provisional admission of candidate subjected to fulfillment/submission of following documents, as applicable, within two weeks.

a) Supervisor Consent Form
b) NOC From Employer for pursuing Regular Course Work
c) Migration Certificate in original

After successful submission of these documents and admission fee deposition, pre-PhD course work and supervisor are recommended as follows-

Name of Candidate	Course Allocated with Sub-Code	L-T-P-C	Supervisor Allocated
Manik Goyal	1. Research Methodology MREM0-101 2. Rural Construction Technology MCIE6-263 3. QA & QC Lab MCIE6-207 4. Seminar	4-0-0-4 4-0-0-4 0-0-4-2 0-0-2-1	Dr Sanjiv Aggarwal
Mukesh Kumar	1. Research Methodology MREM0-101 2. Project Safety Management MCIE6-261 3. QA & QC Lab MCIE6-207 4. Seminar	4-0-0-4 4-0-0-4 0-0-4-2 0-0-2-1	Dr. Manjeet Bansal
Deepak Kumar	1. Research Methodology MREM0-101 2. Project Safety Management MCIE6-261 3. QA & QC Lab MCIE6-207 4. Seminar	4-0-0-4 4-0-0-4 0-0-4-2 0-0-2-1	Dr. Manjeet Bansal

Further, it was proposed that before the Ph.D. registration, 6-monthly performance report of Ph.D. candidates (during course work and research proposal preparation) enrolled with a department may be presented before the faculty of concerned department in the presence of Supervisor and certificate of satisfactory progress be submitted to o/o Dean (R&D) for records.

25-1-2019

Department of Civil Engineering
(hodcivilgzsccet@gmail.com, Ph. 98151-26102)

Ref No : **Dated** ________

The meeting ended with vote of thanks to the Chairman.

Paramjit Singh 25.1.19
(Chairperson)

Member

25-1-2019
Member

25/01/19
Member

25/01/19
Member

25/1/19
Member

25/01/2019
Member

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MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA
(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12(b) of the UGC Act of 1956)
DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/......773...... **Dated:** 14-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 30th Jan, 2019, Mr. Mahesh Prasad Singh, S/o. Sh. Kalyan Singh Rajpurohit Smt. Sarswati Rajpurohit, Resident of House No. 65-66, Kheteshwar Nagar – B, Near Sunder Nagar, Pali - 306401, stand provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **FACULTY of PHARMACY** with effect from 12.02.2019. The PhD enrollment number issued to the candidate is **18211MPE02**. The candidate shall work under the supervision of Dr. Uttam Kumar Mandal (S202M75014), Associate Professor, Department of Pharmaceutical Sciences, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Research Methodology	MREM0-101	4-0-0-4
2	Elements of Pharmaceutical Research	PPHD0-101	3-1-0-4
3	Journal Club & Report Writing	PPHD0-102	0-0-3-2
4	Seminar	PPHD0-103	0-0-2-1

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

14/2/19
DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated..................... RH.

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Pharmacy), MRSPTU, Bathinda
9. Supervisor (Dr. Uttam Kumar Mandal)
10. Candidate (Mr. Mahesh Prasad Singh)
11. AR(Accounts), MRSPTU
12. Librarian, GZSCCET
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12(b) of the UGC Act of 1956)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/772 **Dated:** 14-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 30th Jan, 2019, Mr. Yedke Narhari Gangaram, S/o. Sh. Gangaram Manika Yedke Smt. Laxmibai, Resident of Post Penur, Palam Road, Loha – 431708, Distt. Nanded (Maharashtra), stand provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **FACULTY of PHARMACY** with effect from 11.02.2019. The PhD enrollment number issued to the candidate is **18211MFT01.** The candidate shall work under the supervision of Dr. Puneet Kumar (S202M79003), Associate Professor, Department of Pharmaceutical Sciences, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Research Methodology	MREM0-101	4-0-0-4
2	Elements of Pharmaceutical Research	PPHD0-101	3-1-0-4
3	Journal Club & Report Writing	PPHD0-102	0-0-3-2
4	Seminar	PPHD0-103	0-0-2-1

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

14/2/19

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Pharmacy), MRSPTU, Bathinda
9. Supervisor (Dr. Puneet Kumar)
10. Candidate (Mr. Yedke Narhari Gangaram)
11. AR(Accounts), MRSPTU
12. Librarian, GZSCCET
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ
MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA
(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)
DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/...771......... **Dated:** ..14-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Priyanka**, D/o. Sh. Ashok Kumar & Smt. Shashi Bala, Resident of H. No. 3275A,Street No. 3, Backside New Bus Stand, Bathinda - 151001, stand provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES** in the **Discipline MATHEMATICS** with effect from 07.02.2019. The PhD enrollment number issued to the candidate is **18415FPE01.** The candidate shall work under the supervision of Dr. Karanvir Singh (S405M64008), Associate Professor, Deptt. of Mathematics MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	4-0-0-4
2	Fourier Analysis and Applications	MMAT1-356	4-0-0-4
3	Advanced Numerical Analysis	PMAT1-102	4-0-0-4
4	Numerical Analysis Lab	MMAT1-210	0-0-4-2
5	Seminar	PMAT1-104	0-0-2-1

14/2/19
Dean (R&D)
R&D.

Endst No. DRD/MRSPTU/.................... Dated.....................

For information, records and further necessary action, as applicable. *(Discrepancy, if any, be intimated immediately for rectification)*

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Mathematics), MRSPTU, Bathinda
9. Supervisor (Dr. Karanvir Singh)
10. Candidate (Ms Priyanka)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/...770...... Dated: 13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendation dated 25th Jan, 2019, **Mr Mukesh Kumar,** S/o Sh. Dharam Pal & Smt. Om Pati Devi, Resident of House No 150, Naya Gaon, Samota Street, Barwala-125152, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **FACULTY OF ENGINEERING & TECHNOLOGY** in the Discipline Civil Engineering with effect from **06.02.2019**. The PhD enrollment number issued to the candidate is **18116MPE03.** Candidate shall work under the supervision of Dr. Manjeet Bansal (S106M72004), Professor, GZSCCET MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Research Methodology	MREM0-101	4-0-0-4
2	Project Safety Management	MCIE6-261	4-0-0-4
3	QA & QC Lab	MCIE6-207	0-0-4-2
4	Seminar	-	0-0-2-1

The candidate shall qualify course-work as per University PhD Regulations-2016 in **REGULAR** manner at GZSCCET, Bathinda.

13/2/19

Dean (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

Cc: For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of Hon'ble VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET, MRSTPU Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Civil Engg), GZSCCET, MRSTPU Bathinda
9. Supervisor (Dr. Manjeet Bansal)
10. Candidate (Mr Mukesh Kumar)
11. AR(Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU, Bathinda
13. Candidate`s Master File

Dean (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/...769........ **Dated:** 13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Shamandeep Kaur**, D/o. Sh. Kulwinder Singh & Smt. Veerpal Kaur, Resident of Village – Dhani Bhagsar (125077), Distt Sirsa (Haryana), stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline Food Science & Technology** with effect from 06.02.2019. The PhD enrollment number issued to the candidate is **18417FFT04.** The candidate shall work under the supervision of Dr. Kawaljit Singh Sandhu (S407M75001), Associate Professor, Deptt. of Food Science & Technology, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	3-1-0-4
2	Advances in Food Technology	*	3-1-0-4
3	Journal Club and Report Writing	*	0-0-4-2
4	Seminar	*	0-0-2-1
5	Advances in Cereal Technology	*	3-1-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

** To be approved by BoS/Academic Council*

13/2/19

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (FST), MRSPTU, Bathinda
9. Supervisor (Dr. Kawaljit Singh Sandhu)
10. Candidate (Ms Shamandeep Kaur)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/...768........ **Dated:** ..13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Pinderpal Kaur**, D/o. Sh. Gurcharan Singh & Smt. Amarjeet Kaur, Resident of House No. 119, Near Patwarkhana VPO – Sant Nagar, Distt. Sirsa, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline Food Science & Technology** with effect from 05.02.2019. The PhD enrollment number issued to the candidate is **18417FFT03.** The candidate shall work under the supervision of Dr. Kawaljit Singh Sandhu (S407M75001), Associate Professor, Deptt. of Food Science & Technology, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	3-1-0-4
2	Advances in Food Technology	*	3-1-0-4
3	Journal Club and Report Writing	*	0-0-4-2
4	Seminar	*	0-0-2-1
5	Advances in Cereal Technology	*	3-1-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

** To be approved by BoS/Academic Council*

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (FST), MRSPTU, Bathinda
9. Supervisor (Dr. Kawaljit Singh Sandhu)
10. Candidate (Ms Pinderpal Kaur)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/767 **Dated:** 13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Puneet Kang**, D/o. Sh. Gurdeep Singh & Smt. Simarjeet Kaur, Resident of House No. 515, Village – Gill Patti, Bathinda-151001, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline Food Science & Technology** with effect from 04.02.2019. The PhD enrollment number issued to the candidate is **18417FFT02.** The candidate shall work under the supervision of Dr. Kawaljit Singh Sandhu (S407M75001), Associate Professor, Deptt. of Food Science & Technology, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	3-1-0-4
2	Advances in Food Technology	*	3-1-0-4
3	Journal Club and Report Writing	*	0-0-4-2
4	Seminar	*	0-0-2-1
5	Advances in Cereal Technology	*	3-1-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

** To be approved by BoS/Academic Council*

13/2/19

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/..................... Dated.......................

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (FST), MRSPTU, Bathinda
9. Supervisor (Dr. Kawaljit Singh Sandhu)
10. Candidate (Ms Puneet Kang)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/.....766........ **Dated:** ..13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Gurjinder Kaur**, D/o. Sh. Ghila Singh & Smt. Balbir Kaur, Resident of House No. 131, Street No. 13, Village Bangi Dipa Singh, Tehsil – Talwandi Sabo, Raman-151301, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline Food Science & Technology** with effect from 01.02.2019. The PhD enrollment number issued to the candidate is **18417FFT01.** The candidate shall work under the supervision of Dr. Kawaljit Singh Sandhu (S407M75001), Associate Professor, Deptt. of Food Science & Technology, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	3-1-0-4
2	Advances in Food Technology	*	3-1-0-4
3	Journal Club and Report Writing	*	0-0-4-2
4	Seminar	*	0-0-2-1
5	Advances in Cereal Technology	*	3-1-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

** To be approved by BoS/Academic Council*

13/2/19

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/..................... Dated.....................

For information, records and further necessary action, as applicable. *(Discrepancy, if any, be intimated immediately for rectification)*

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (FST), MRSPTU, Bathinda
9. Supervisor (Dr. Kawaljit Singh Sandhu)
10. Candidate (Ms Gurjinder Kaur)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ
MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA
(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)
DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/...765......... **Dated:** 13-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Ms. Sumandeep Kaur**, D/o. Sh. Nachhater Singh & Smt. Sukhwinder Kaur, Resident of House No. MCB Z-6 19389, Street No. 5, Kheta Singh Basti, Bathinda-151002, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline PHYSICS** with effect from 01.02.2019. The PhD enrollment number issued to the candidate is **18416FPE02.** The candidate shall work under the supervision of Dr. Satnam Singh (S406M80006), Assistant Professor, Deptt. of Physics, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	4-0-0-4
2	Research and Computational Techniques Lab	PPHY-101	0-0-4-2
3	Seminar	PPHY-102	0-0-2-1
4	Material Characterization Techniques	PPHY-106	4-0-0-4
5	Vacuum Science and Thin Films	PPHY-107	4-0-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

12/2/19
DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated......................

For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Physics), MRSPTU, Bathinda
9. Supervisor (Dr. Satnam Singh)
10. Candidate (Ms Sumandeep Kaur)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ
MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA
(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)
DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/.....764........ **Dated: ..13-2-19**

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 23rd Jan 2019, the candidate **Mr. Amit Kumar Singla**, S/o. Sh. Rajinder Parshad & Smt. Kamlesh Rani, Resident of House No. 903, Jindal Road, Backside Bus Stand, Jakhal Mandi-125133, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of SCIENCES in the Discipline PHYSICS** with effect from 31.01.2019. The PhD enrollment number issued to the candidate is **18416MFT01.** The candidate shall work under the supervision of Dr. Sandeep Kansal (S406M72004), Professor & Head, Deptt. of Physics, MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1	Research Methodology	MREM0-101	4-0-0-4
2	Research and Computational Techniques Lab	PPHY-101	0-0-4-2
3	Seminar	PPHY-102	0-0-2-1
4	Radiation Protection and Dosimetry	PPHY-104	4-0-0-4
5	Experimental Techniques in Nuclear and Particle Physics	PPHY-105	4-0-0-4

The candidate shall qualify the course-work as per University PhD-Regulations-2016 in REGULAR manner at MRSPTU, Bathinda.

13/2/19

DEAN (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

For information, records and further necessary action, as applicable. *(Discrepancy, if any, be intimated immediately for rectification)*

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Physics), MRSPTU, Bathinda
9. Supervisor (Dr. Sandeep Kansal)
10. Candidate (Mr Amit Kumar Singla)
11. AR (Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU
13. Candidate`s Master File

DEAN (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/......761.......   Dated: ...5-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendation dated 25th Jan, 2019, **Mr. Deepak Kumar,** S/o Sh. Prem Kumar & Smt. Satya Devi, Resident of House No 27474, Street No. 12/1, Lal Singh Nagar, Bathinda-151001, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **FACULTY OF ENGINEERING & TECHNOLOGY** in the Discipline Civil Engineering with effect from **31.01.2019**. The PhD enrollment number issued to the candidate is **18116MPE02.** Candidate shall work under the supervision of Dr. Manjeet Bansal (S106M72004), Professor, GZSCCET MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Research Methodology	MREM0-101	4-0-0-4
2	Project Safety Management	MCIE6-261	4-0-0-4
3	QA & QC Lab	MCIE6-207	0-0-4-2
4	Seminar	-	0-0-2-1

The candidate shall qualify course-work as per University PhD Regulations-2016 in **REGULAR** manner at GZSCCET MRSPTU, Bathinda.

5/2/19

Dean (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.....................   Dated.......................

Cc: For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of Hon'ble VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET, MRSTPU Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Civil Engg), GZSCCET, MRSTPU Bathinda
9. Supervisor (Dr. Manjeet Bansal)
10. Candidate (Mr Deepak Kumar)
11. AR(Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU, Bathinda
13. Candidate`s Master File

Dean (R&D)
MRSPTU, Bathinda

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਬਠਿੰਡਾ

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Estb. under Act 5(2015) of Punjab Govt & under section 2 (f) & 12 (b) of the UGC Act at SNo 428)

DABWALI ROAD, BATHINDA (Punjab) -151 001

Ref. No. DRD/MRSPTU/....760........ Dated: ..5-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendation dated 25th Jan, 2019, **Mr Manik Goyal,** S/o Sh. Dassu Ram Goyal & Smt. Krishna Vati, Resident of House No 14300/A, Street No. 2, Ganesha Basti, Bathinda-151001, stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **FACULTY OF ENGINEERING & TECHNOLOGY** in the Discipline Civil Engineering with effect from **31.01.2019**. The PhD enrollment number issued to the candidate is **18116MPE01**. Candidate shall work under the supervision of Dr. Sanjiv Kumar Aggarwal (S106M70002), Professor, GZSCCET MRSPTU, Bathinda. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Research Methodology	MREM0-101	4-0-0-4
2	Rural Construction Technology	MCIE6-263	4-0-0-4
3	QA & QC Lab	MCIE6-207	0-0-4-2
4	Seminar	-	0-0-2-1

The candidate shall qualify course-work as per University PhD Regulations-2016 in **REGULAR** manner at GZSCCET, Bathinda.

5/2/19

Dean (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated......................

Cc: For information, records and further necessary action, as applicable. (*Discrepancy, if any, be intimated immediately for rectification*)

1. PA to Vice-Chancellor for kind information of Hon'ble VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET, MRSTPU Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. DSW, MRSPTU, Bathinda
8. HoD (Civil Engg), GZSCCET, MRSTPU Bathinda
9. Supervisor (Dr. Sanjiv Kumar Aggarwal)
10. Candidate (Mr Manik Goyal)
11. AR(Accounts), MRSPTU
12. Librarian, GZSCCET MRSPTU, Bathinda
13. Candidate`s Master File

Dean (R&D)
MRSPTU, Bathinda

Ref. No. DRD/MRSPTU/...759........ Dated: 5-2-19

PROVISIONAL PhD ENROLLMENT CUM ADMISSION ORDER

As per the DDRC recommendations dated 17th Jan, 2019, the candidate **Ms Deepak,** D/o Sh. Mejor Singh & Smt. Manjeet Kaur, Resident of House No 187, Ward No. 13, Model Town, Kalanwali-125201, Distt - Sirsa (Haryana), stands provisionally enrolled in the PhD PROGRAM OF MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA in the **Faculty of COMMERCE & MANAGEMENT** with effect from **31.01.2019**. The PhD enrollment number issued to the candidate is **18311FPE01.** The candidate shall work under the supervision of Dr. M. K. Kulshrestha (S303M71005), Professor, GGSCMT, Gidderbaha. The Pre-PhD course work allocated to the candidate is as follows:

SN	Pre-PhD Course work	Code	L-T-P-C
1.	Contemporary Issues in Management	PCBM1 -101	4-0-0-4
2.	Research Methodology	MREM0-101	4-0-0-4
3.	Seminar	PCBM1-102	0-0-2-1
4.	Advanced Financial Management	PCBM1 -103	4-0-0-4
5.	Investment Banking and Corporate Restructuring	MBAD1-481	4-0-0-4

The candidate shall qualify the course-work as per University PhD Regulations-2016 in **REGULAR** manner at MRSPTU, Bathinda

5/2/19
Dean (R&D)
(Dr. Savina Bansal)

Endst No. DRD/MRSPTU/.................... Dated.....................

Cc: For information, records and further necessary action, as applicable. *(Discripancy, if any, be intimated immediately for rectification)*

1. PA to Vice-Chancellor for kind information of the VC
2. Dean Academic Affair, MRSPTU, Bathinda
3. Campus Director, GZSCCET MRSPTU, Bathinda
4. Registrar, MRSPTU, Bathinda
5. Dean Academic Affair, GZSCCET MRSPTU, Bathinda
6. CoE, MRSPTU Bathinda
7. HoD (University Business School), MRSPTU, Bathinda
8. Supervisor (Dr. M. K. Kulshrestha)
9. Candidate (Ms. Deepak)
10. AR(Accounts), MRSPTU
11. Librarian, GZSCCET MRSPTU, Bathinda
12. Candidate`s Master File
13. DSW, MRSPTU

Dean (R&D)
MRSPTU, Bathinda

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY,
DABWALI ROAD, BATHINDA-151001
[Established by Govt. of Punjab vide Act No. 5 of 2015, UGC Act 2(f)]
DEAN ACADEMIC AFFAIRS
Ph. 0164-2284298, 8725072488
www.mrsptu.ac.indaa.mrsstu@gmail.com, daa@mrsptu.ac.in

Ref. No. PSAEC/183 **Board of Studies** Date. 13/02/19

Aeronautical Engineering, Aerospace Engineering
(Up to 30.09.19)

Programmes:

1. **B. Tech.(Aeronautical Engineering),**
2. **B. Tech. (Aerospace Engineering)**

Board of Studies in Aeronautical Engineering & Aerospace Engineering is hereby proposed for a period up to 30.09.19.

S.N.	Nomenclature	Name & Address	Designation
(i)	Head of the University Department concerned	**Dr. Rakesh Kumar,** Associate Professor & Head, Department of Aerospace Engineering, Punjab Engineering College, Sector-12, Chandigarh (9878215676) rakpec@gmail.com	Chairperson (Ex-officio)
(ii)	One Faculty Member from University Department concerned (of each specialization)	**Dr.Tushar Siag** Assistant Professor, Department of Aerospace Engineering, Punjab Engineering College, Sector-12, Chandigarh (9041625956) tusharsiag@gmail.com	Member
(iii)	One Subject Expert (in the subject from outside the Univ.)	**Dr Jimmy Kansal** Joint Director Head, Remote Sensing (ops) & Technical Coordination Division Snow & Avalanche Study Establishment Defence Research & Development Organization Plot No. 1, Him Parisar Sector - 37 A (Chandigarh - 160 036) (9888866222) jimmy.kansal@gmail.com	Member
(iv)	Two Subject Experts (nominated by the Vice Chancellor)	**1. Dr. Bhawani Singh,** Dean Acadmic Swami Vivekanand University Sagar M.P (7696645560) bhawanisinghiitm@gmail.com	Members

(1)

		2. **Subhash Chander** Joint Director (PDS), TBRL Ministry of Defence, Sector 30-D, Chandigarh -160030 (01733-307162, 9463602027) subhaschander@tbrl.drdo.in	
(v)	Two Faculty Members (from Affiliated/ Constituent Colleges)	1. **Sh. Rajesh Sharma** Training Manager Punjab Aircraft Maintenance Engg. College Patiala (7889170717) rajeshsharma.272@rediffmail.com 2. **Sh. Jasvir Singh Tiwana,** Associate Prof. Mech. Engg. Dept. GZSCCET Bathinda (8725072402, 9217486480) jstiwana1@rediffmail.com	Members
(vi)	One Representative (from Industry/ Corporate sector)	**Sh. Kanwardeep Singh,** Chief Engineer Department of Civil Aviation, Punjab (9855542828) kanwar_dsingh@yahoo.co.in	Member
(vii)	One Post Graduate meritorious alumnus	**Dr. Amarjit Singh** Visiting professor Aerospace Engineering Department PEC Ex Director SASE DRDO (9478711255)amarjit100@gmail.com	Member

The main functions of BOS are as follows:

a) Prepare syllabi for various Programmes keeping in view the objectives of the institution, interest of stakeholders and national requirements for consideration and approval of the Academic Council.
b) Suggest methodologies for innovative teaching and evaluation techniques.
c) Suggest panel of experts to the Academic Council for appointment as examiners.
d) Coordinate research, teaching, extension and other academic activities in the department/institution.
e) The Board of studies will also suggest a panel of faculty members for setting the question papers and for appointment as External examiners for practical Programmes.
f) Any other assignment given by the Vice-Chancellor from time to time.

Quorum:

Quorum of the Board of Studies is a minimum of half of the members of the Board of Studies including the Chairperson, Board of Studies.

Director
PSAEC, Patiala

Submitted for consideration & approval

S/d

20/2/19

Dean Academic/ Hon'ble Vice-Chancellor

Gmail

daa mrsstu <daa.mrsstu@gmail.com>

Regarding proposed BOS in Aeronautical/Aerospace

1 message

psaec patiala <patialapsaec@gmail.com> Thu, Feb 14, 2019 at 3:19 PM
To: "Dean Academics, MRSPTU" <daa@mrsptu.ac.in>
Cc: Gurpreet Singh <myselfgurpreet@gmail.com>

Respected Sir
Please find enclosed letter regarding proposed BOS in Aeronautical/Aerospace Engg. for further necessary action please.

Thanks & Regards
Director
PSAEC Patiala

BOS PSAEC.PDF
556K

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਬਠਿੰਡਾ।

Sub.: Constitution of BoS in Fashion Technology.

It is being brought to your kind notice that the BoS in Fashion Technology is to be constituted. Thereafter, an email has been sent to the previous chairperson of BoS in Fashion Technology to propose the names of members/experts as per the constitution. The chairperson BoS proposed the names for Sr. 2, 3, 6 and 7 and informed to nominate the experts at Sr. No. 4 and 5 in consultation with the University. Accordingly, list of faculty members has been sought from the Affiliated colleges. After discussion with Dean Academic Affairs, MRSPTU, constitution of BoS in Fashion Technology is given below;

Sr. No.	Name of BOS	Name & Address	Designation
1	Head of the department concerned	Dr. Poonam Aggarwal Thakur, Principal, Northern India Institute of Fashion Technology, Mohali (Ph.0172-5044994,9417303649) principal@niiftindia.com thakur10poonam@yahoo.co.in	Chairperson
2	One faculty member (of each specialization)	1. Ms. Sonia Govt. Home Science College,Sec-10, Chandigarh, (Ph. 9463396179) saloniya20@gmail.com 2. Dr. Rita Kant PU, Chandigarh 8054499999/Doc.ritak@gmail.com	Members
3	One expert (in the subject from outside the university)	Ms. Chhaya Verma Govt. Home Science College,Sec-10, Chandigarh, Ph. 9417862612 chhayaghsc@gmail.com	Member
4	Two Expert (nominated by the vice chancellor)	1. Ms. Deepti Sharma Northern India Institute of Fashion Technology, Mohali (9041622326/ 9417542138 deeptiniift@yahoo.co.in 2. Ms. Navdeep kaur, Assistant Professor Desh Bhagat Foundation group of Institutions, Moga	Members
5	Two faculty members (from affiliated /constituent colleges)	1. Mrs. Jaspreet Kaur, Assistant Professor, Ideal Inst. of Mgt. & Tech., Manuke Gill (Moga), Moga 2. Ms. Baljit kaur, Assistant Professor Ideal Inst. of Mgt. & Tech., Manuke Gill (Moga), Moga	Members
6	One representative (from industry/ corporate sector)	1. Mr. Madan Lal LKA, Chandigarh 9814904403/Madan_artist@yahoo.com	Member
7	One post graduate meritorious alumnus	1. Mr. Jaspal Kalra, Associate Professor Indian Institute of Art and Design, Delhi (Ph:9871509897) jaspal@jaspalkalra.in	Member

Maharaja Ranjit Singh Punjab Technical University Bathinda (Pb.)
Diary No./VC/ 356
DATE 26.4.19

Submitted for approval please.

26/4/19

Deputy Registrar (A & R)

Apr.

Dean Academic Affairs

for your concurrency & approval pl.
26/4/19

The tenure of other BOS's are upto 30.09.2019. The tenure of this BOS may please be suggested
30/4/19

Vice Chancellor

Dean Academic

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਬਠਿੰਡਾ।

To be decided in AC
AC 8/4/14
DR(Acad)

Sub: Constitution of BoS in Fashion Technology.

It is being brought to your kind notice that the BoS in Fashion Technology is to be constituted. Thereafter, an email has been sent to the Chairperson of BoS in Fashion Technology to propose the names of members experts as per the Constitution. The chairperson BoS proposed the names for Sr. 2, 3, 6 and 7 and informed to nominate the experts at Sr. No. 4 and 5 in consultation with the University. Accordingly, list of faculty members has been sought from the affiliated colleges. After discussion with Dean Academic Affairs, MRSPTU, constitution of BoS in Fashion Technology is given below:

Sr. No	Name of BOS	Name & Address	Designation
1	Head of the department concerned	Dr Poonam Aggarwal Thakur, Principal, Northern India Institute of Fashion Technology, Mohali (Ph 0172-5044994,9417359449) poonamp@rediffmail.com, dr.poonam@niiftindia.com	Chairperson
2	One faculty member (of each specialisation)	1. Ms. Sonia, Govt. Home Science College Sec-10, Chandigarh, (Ph 9463386179) soniayad0@gmail.com 2. Dr. Rita Kant, PU, Chandigarh, 9914999999 Dr.rita@gmail.com	Members
3	One expert (in the subject from outside the university)	Ms Chhaya Verma, Govt. Home Science College Sec-10, Chandigarh, Ph 9814788752 chhayasac@gmail.com	Member
4	Two Expert (nominated by the vice chancellor)	1. Ms. Deepti Sharma, Northern India Institute of Fashion Technology, Mohali (9041622267, 9417582138) deepti@yahoo.co.in 2. Ms. Navdeep Kaur, Assistant Professor, Desh Bhagat Foundation group of Institutions, Moga	Members
5	Two faculty members (from affiliated constituent colleges)	1. Mrs. Jaspreet Kaur, Assistant Professor, Desh Inst. of Mgt. & Tech., Mehnake Gill (Moga), Moga 2. Ms. Baljit Kaur, Assistant Professor, Desh Inst. of Mgt. & Tech., Mehnake Gill (Moga), Moga	Members
6	One representative (from industry/ corporate sector)	Mr. Madan Lal, I.E.A. Chandigarh, 9814904403 Madan_arts@yahoo.com	Member
7	One post graduate meritorious alumnus	1. Mr. Jaspal Kalra, Associate Professor, Indian Institute of Art and Design, Delhi (Ph 9871350897) jaspal@iiad.edu.in	Member

Submitted for approval please.

Deputy Registrar (A & R)

Dean Academic Affairs

The tenure of other BOS are upto 30.12.19.
The tenure of this BOS may please be suggested.
Dean Academic

The Chancellor

Mining Engineering

SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE3- 738	Underground Mining Methods-Coal	3	0	0	40	60	100	3
BCIE3-739	Industrial Management	3	0	0	40	60	100	3
BCIE3-740	Mining Planning & Design	3	0	0	40	60	100	3
BCIE3-741	Mineral Processing	3	0	0	40	60	100	3
BCIE3-742	Mineral Processing Lab	0	0	2	60	40	100	1
BCIE3-743	Training#	0	0	0	60	40	100	2
Total		**12**	**00**	**02**	**280**	**320**	**600**	**15**

In House / Industrial Training of 8 weeks during summer vacation after 6th semester.

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE3- 844	Mine Economics & Investment	3	0	0	40	60	100	3
BCIE3- 845	Underground Mining Methods-Metal	3	0	0	40	60	100	3
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BCIE3- 856	Mine Legislation & Safety							
BCIE3- 857	Mine Safety Engineering							
BCIE3- 858	Rock Reinforcement							
BCIE3- 859	Rock Excavation Engineering							
BCIE3- 846	Major Project	0	0	4	60	40	100	2
Total		**09**	**00**	**04**	**180**	**220**	**400**	**11**

7th Semester

MRSPTU

UNDERGROUND MINING METHODS - COAL

Subject Code: BCIE3-738 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT I

INTRODUCTION: Status of coal industry and deposit factors affecting choice of mining methods, classification of mining methods, grading and analysis of coal.

BORD AND PILLAR METHOD-DEVELOPMENT: Design and development of a district, bord and pillar, room and pillar methods, with conventional and continuous mining techniques; panel system.

UNIT II

BORD AND PILLAR METHOD – Extraction: Pillar extraction by caving and stowing methods; mechanized extraction of pillars, shaft pillar extraction, systematic supports, surface, underground and face arrangements for stowing.

UNIT III

LONGWALL METHOD : Advance and retreat methods, continuous and cyclic systems, extraction with different machines-ploughs, shearers, design of long wall workings, optimum length of face, size of panel, gates, support system, personnel, organization and safety measures, salvaging in long wall.

UNIT IV

SPECIAL METHODS OF WORKING : Problems of working thick & thin seams, multi slices, sublevel caving, horizon mining, gallery blasting method, contiguous seam working, working steeply inclined seams, working under surface structures and seams liable to spontaneous heating, outburst and bumps, etc. hydraulic mining.

REFERENCES:

1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company, 1971.
3. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York, 1990.
4. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.
5. Vijayendra, H.G., Handbook on Mineral Dressing, Vikas Publishing House Pvt. Ltd. 1995.

INDUSTRIAL MANAGEMENT

Subject Code: BCIE3-739 **L T P C 3 0 0 3** **Duration: 36 Hrs.**

UNIT I

INTRODUCTION: Technology Management – Definition – Functions – Evolution of Modern Management –Scientific Management – Development of Management thought. Approaches to the study of Management, Forms of Organization – Individual Ownership – Partnership – Joint Stock companies – Co-operative Enterprises – Public sector Undertakings, Corporate Frame Work – Share Holders - Board of Directors – Committees – Chief Executive – Constraints – Environmental – Financial – Legal – Trade Union.

UNIT II

FUNCTIONS OF MANAGEMENT : Planning – Nature and Purpose – Objectives – Strategies – Policies and Planning Premises – Decision Making – Organizing – Nature and Process – Premises – Departmentalization – Line and Staff – Decentralization – Organizational culture – Selection and training – Placement – Performance appraisal – Controlling – Process of Controlling – Controlling techniques – Preventive control, industrial safety.

UNIT III

ORGANIZATIONAL BEHAVIOUR : Definition – Organization – Managerial Role and functions – Organizational approaches, individual behavior – Causes – Environmental effect – Behavior and Performance, Perception – Organizational implications. Personality – Contributing factors – Theories of motivation – Job satisfaction – Learning Curves, Work Design and approaches.

UNIT IV

GROUP DYNAMICS: Group behavior – Groups – Contributing factors – Group norms – Communication – Process– Barriers to communication – Effective communication leadership – Managerial Grid –Leadership Role in Group Decision, Group Conflicts – Types – Causes – Conflict Resolution– Inter group relations and conflict organization – Centralization and decentralization – Formal and informal.

MODERN CONCEPTS: Management by objectives (MBO) – Management by Exception (MBE) – Developing strategies, information technology in management – Decision support system – Business Process Reengineering (BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM).

REFERENCES

1. Herald Knottz and Heinz Weihrich. Essentials of Management, McGraw Hill Publishing Company, Singapore International Edition, 1980.
2. Chandran, S. Organizational Behaviour, Vikas Publishing House Pvt. Ltd., 1994.
3. Ties, A.F. Stoner and R. Edward Freeman, Management, Prenticie Hall of India Pvt. Ltd.
4. Joseph J. Massie, Essentials of Management, Prentice Hall of India Pvt. Ltd., 1985.

MINE PLANNING AND DESIGN

Subject Code: BCIE3-740 | **L T P C 3 0 0 3** | **Duration: 36 Hrs.**

UNIT I

INTRODUCTION: Technical factors in mine planning, methodology of mine planning, short range & long range, mine modeling, mine simulation systems approach to mine planning based on mine subsystem and their elements, mine plan generation.

OPENCAST MINING: Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limits 90 and optimization, calendar plan, production planning, production scheduling, economic productivity indices.

UNIT II

UNDERGROUND MINING: Location of mine entries, mine and auxiliary, optimization of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives / raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring/stopping method, manpower management economic/productivity indices, techno economic analysis, mine reclamation design.

UNIT III

EQUIPMENT PLANNING: Latest technological developments in increase in both types and capacities of equipment used in mining operations, Planning and selection of equipment for different mining conditions, Equipment design for optimum drilling and blasting operations, Equipment information –performance monitoring and expert systems, Innovative mining systems.

UNIT IV

PROJECT IMPLEMENTATION AND MONITORING: Pre-project activities – feasibility report, environment clearance, detailed project, report, sources of funds, import of technology, selection of contracts and contract administration, time management, cost control material management system, project quality assurance, social responsibility, government orders and guidelines. Environmental impact assessment and preparation of environmental management plan. Mine closure plan.

REFERENCES

1. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
2. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.
3. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
4. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier, 1993.
5. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
6. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
7. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986.
8. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mines, CMRS Dhanbad, 1993

Mineral Processing

Subject Code: BCIE3-741 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Unit I

INTRODUCTION: Scope, objectives, minerals/ores for mineral processing, methods of treatment, choice of methods, sequence of operations, product, flow sheets, ore sorting – hand mechanical, electronic, removal of harmful materials, ore transportation.

Unit II

COMMINUTION: Introduction to comminution, primary/secondary/tertiary crushing, purpose, duty, theory of crushing, crushing sequence, reduction ratio, types of crushers and comparison, general crushing flow sheet, wet/dry grinding, mechanism and various affecting parameters.

Unit III

LABORATORY & INDUSTRIAL SIZING AND SAMPLING AND CONTROL:
Purpose, factors governing particle behavior, laboratory and industrial screens, trommels, Vibrating screens wet and dry screening, classification, classifiers, Purpose, sampling - solid ore, pulp, head feed, grinding circuit samples, flotation products, etc., X-ray fluorescence, automatic sampling, Metallurgical accounting.

Unit IV

SEPARATION/CONCENTRATION: Newton's and Stoke's Laws of particle settlement, different concentration techniques – gravity, chemical froth flotation, wet & dry magnetic separation, electromagnetic, amalgamation, heavy media, jigging, shaking tables, sluicing, spirals, thickeners, filtration, etc., coal washing.
SPECIAL METHODS: Chemical extraction, cyanide process, leaching, use of ion exchange, solvent extraction, pilot plant studies on ores, tailing dams; generalized plant practice/flow sheets for coal and other important ores – copper, aluminum, lead, zinc, silver, gold, uranium, iron, limestone, magnesite.

REFERENCES:

1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company, 1971.
3. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York, 1990.
4. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.
5. Vijayendra, H.G., Handbook on Mineral Dressing, Vikas Publishing House Pvt. Ltd. 1995.

Mineral Processing Lab

Subject Code: BCIE3-742 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

1. Study of grab sampling and different sample division techniques like coning and quartering, riffle sampling techniques, etc.
2. Determination of crushing characteristics of a given mineral sample using jaw crusher.
3. Determination of the grinding characteristics of a given mineral sample using ball mill.
4. Sieve analysis of a given sample and to calculate (a) Percentage sample retained on screens (b) Average size of sample material and (c) To plot sizing curves.
5. Concentration of a given mineral sample using mineral jig.
6. Concentration of a given mineral using Wilfley table.
7. Concentration of a given mineral using froth flotation cell.
8. Concentration of a given mineral using magnetic separator.
9. Study of wash ability characteristic of a coal sample using float and sink test.
10. Study of sedimentation characteristics of a given sample.

8th Semester

MINE ECONOMICS AND INVESTMENT

Subject Code: BCIE3-844 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Unit I

INTRODUCTION: Mineral industry and its role in national economy; world and national mineral resources; Mining - A unique investment environment; special risk factors in mine investment and evaluation; 87 national mineral policy.

Unit II

ORE RESERVE ESTIMATION: Methods of sampling, sampling frequency; analysis of sampling data, estimation of reserves, introduction to geo-statistica l methods, and classification of reserves.

Unit III

MINE VALUATION: Time value of money; annuity; redemption of capital, net present value; depletion allowance; depreciation; inflation; escalation; rates of return; Hoskold's Two rate method; capital and operating cost including wages, incentives, material, etc.; assets; liabilities; cash flows and discounted cash flow; profitability index – their implications in mine economic evaluation.

Unit IV

PROJECT APPRAISAL: Methods of project evaluation – pay back, annual value, benefit/cost ratio, ERR and IRR, etc., evaluation of exploratory mining areas and operating mines; mine project financing, its risks and constraints; mine taxation; critical impact of depreciation, depletion, type of funding, reserves, life, etc., on mine profitability.

UNIT V FINANCE AND ACCOUNTING: Sources of mine funds – shares, debentures, fixed deposit, sinking fund, capital gearing, P & L account, balance sheet, typical case studies of mine feasibility. Cost estimation of individual mining operations and overall mining cost, cost control methods.

REFERENCES:

1. Sloan, D.A., Mine Management, Chapman and Hall, London, 1983.
2. Deshmukh, R.T., Mineral and Mine Economics, Mira Publications, Nagpur, 1986.
3. Arogyaswamy, R.N.P. Courses in Mining Geology, Oxford and IBH Publishing Co., 1994.
4. Chatterjee, K.K., Mineral economics, Wiley Eastern, 1992.
5. Park, R.J., Examination and Valuation of mineral property
6. How to read a balance sheet ILO 1992.
7. Indian Mining Year Book 1994 – MMRD Act and Mineral Concession Rules.

UNDERGROUND MINING METHODS - METAL

Subject Code: BCIE3-845 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT I

BASICS : Metal Mining Terminology; Typical modern metal mine features; typical pre stopping ore block constructional features; classification of methods; Techno economic characteristics impacting on choice of method; Typical unit cost parameters; optimum size of mine and stope.

UNIT II

GENERAL MINE DESIGN : Mode of mine and stope entry; Layouts; optimum production; Basic design – Level Intervals, ore pass, common ore pass, size of blocks ore handling in stope and other openings, overview of constructional features – X cuts, Raises, Winzes etc.

UNIT III

STOPING – GENERAL DESCRIPTION: Unsupported methods – Room and pillar, shrinkage, sublevel stoping etc. Supported stopes– Cut and fill, square set etc. Caving methods – Top slicing, sublevel caving, block caving.

STOPE PLANNING AND LAYOUT: Preparing a stoping block; sequence of stoping; organization; production cycle; unit cost calculation.

UNIT IV

NOVEL INNOVATIVE TECHNIQUES & SPECIAL APPLICATIONS: Rapid excavation; Hydraulic mining; slurry mining; solution mining; Radial – axial splitter;Thermal fragmentation; shock wave breaking; Nuclear mining. Deep mining; narrow contiguousveins; shaft and remnant pillars; VCR; Ring drilling; Large Blast hole stoping. Cast studies of Indian and foreign underground metal mines.

REFERENCES:

1. Cummings, A.B. and Given, I, V., SME Mining Engg. Handbook Vol. I And II, Society Of Mining Engineers Of American Institute Of Mining, Metallurgical, Petroleum Engineers Inc., New York 1992.
2. Hartman, H.L., Introductory Mining Engineering, John Wiley and Sons, New York, 1987.
3. Hustrulid, W.A. Ed., Underground Mining Methods Handbook Society of Mining Engineering, AMIE, New York, 1990.

MINE LEGISLATION AND SAFETY

Subject Code: BCIE3-856 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT I

INTRODUCTION TO MINING LAWS AND LEGISLATION: General principles of mining laws, development of mining legislation of India.

UNIT II

ACTS, RULES AND REGULATIONS – I : Mines Act, Mines Rules, Coal and metalliferous mines Regulations, Bye-laws, Circulars, and standing orders (Except the ones which are collected in course Drilling & Blasting, Surface Mining, Mining Machinery I & II, Mine Environmental Engineering I, II & III, Underground Mining methods (Coal & Metal)

UNIT III

ACTS RULES AND REGULATIONS – II : Indian electricity rules, coalmines conservation and development act, Workman's compensation act., General provisions of Mines and Minerals Regulation and Development Act, Mineral Concession Rules, Vocational Training .Rules, Crèche rules, Maternity benefit act, Payment of Wages Act, Gratuity and P.F. Rules, Explosives act, Rescue Rules, Factory Act, Environmental Protection Act.

UNIT IV

ACCIDENTS AND DISEASES: Classification of accidents, causes and prevention of accidents, accident enquiry reports, cost of accidents, occupational diseases and their social effects.

MINE SAFETY: Role of management, Labour and government, Safety audit, Instrumentation, organization for disaster management in mines, safety conferences.

REFERENCES

1. Mines Act 1952, Lovely Prakashan, Dhanbad, 1995.
2. Coal Mines Regulations, 1961, Lovely Prakashan, Dhanbad, 1995.
3. Metal Mines Regulations, 1961, Lovely Prakashan, Dhanbad, 1995.
4. DGMS Circulars, By National Council of Safety in Mines, Dhanbad, 1995.
5. Mines rules, 1955, Lovely Prakashan, Dhanbad, 1995.
6. The Mines Rescue Rules, 1986, Lovely Prakashan, Dhanbad, 1995.
7. The Indian Electricity Rules, 1995, Lovely Prakashan, Dhanbad, 1995.
8. The Payment of Wages Act, 1936, Ram Narain Lal Beni Prasad, 1995.
9. Vocational Training Rules, Lovely Prakashan, Dhanbad, 1995.

MINE SAFETY ENGINEERING

Subject Code: BCIE3-857 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT I

MINE ACCIDENTS: Accident in mines- different types, accident investigations; accident analysis; accident prevention and corrective action, accident proneness, creating and maintaining safety awareness, ZAP and MAP, job safety analysis, safety meeting and committee.

UNIT II

HEALTH AND MINE SAFETY: Definition of health and safety, management's role – function; evolution of management involvement, management's training, responsibility, cost of health and safety, role of labour organizations – Union impact and involvement, role of government – statutory controls and directions, spot and regular inspections, enforcement of standards, penalties for violations, collection and distribution of statistical data.

UNIT III

FAULT TREE ANALYSIS: Introduction – methodology, symbols and Boolean techniques, qualitative analysis, computerized methods, statistical analysis, safety information, systems design.

MINER'S OCCUPATIONAL DISEASES AND ENQUIRYCOMMITTEE: Miner's occupational health and diseases, preventive medical examinations, various types of injuries, compensable diseases, medical attention and removable of causative factors in the mines.

UNIT IV

RISK ASSESSEMENT AND DISASTER MANAGEMENT: Principles, risk and hazard control, risk and hazard evaluation and data collection for identified health risks, exposure assessment and risk characterization, probabilistic risk analysis, risk management, safety culture, human factors, reliability evaluation, safety audit. Identification of causes of mine disasters, preventive action, disaster management and mitigation, typical cases of mine disasters in India

REFERENCES

1. Brown, D.B., System Analysis and Design for Safety, Prentice Hall, 1976.
2. Stranks, J., Management Systems for Safety, Pitman Publishing, 1994.
3. DeReamer, R., Modern Safety Practices, John Wiley and Sons.
4. Wahab Khair. A., New Technology in Health and Safety, SMME, 1992.
5. Zyl, D.A., Koval, M, Li Ta, M. (Ed.). Risk Assessment / Management Issues in the Environmental Planning in Mines, SMME, 1992.
6. Prasad, S.D. and Rakesh., A Critical Appraisal of Mine Legislations. Lovely Prakashan, 1995. Dhanbad.
7. Mine Disasters of India, NCSM Publication.
8. Kejriwal, B.K., Safety in Mines, Gyan Khan Prakashan, Dhanbad, 1994.

ROCK REINFORCEMENT

Subject Code: BCIE3-858 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT I

ROCKMASS CLASSIFICATION: Basic concepts of rock mass classification; Rock Quality Designation (RQD) ; Norwegian Geo-mechanics Classification i.e. Q-system; Rock Mass Rating (RMR); CMRI system; Application of rock mass classification in assessing the support requirement for underground caverns.

UNIT II

GROUTING, GUNITING AND SHOTCRETING : Mechanisms of rock reinforcement by grouting; selection of optimum pressure and water cement ratio for grouting; layout for grouting, working principle and field of application for grouting; Guniting and shotcreting operations and their field of application; fibre reinforced shotcreting.

UNIT III

ROCK BOLTS : Elements of rock bolts; types of rock bolts and their fields of application; rock bolting machines and installation of rock bolts; pre-tensioning of rock bolts; principles of rock bolting; anchorage test and factors affecting anchorage strength of bolts; modes of failure; Design of rock bolting system for underground excavation i.e. determination of bolt length and bolt pattern.

UNIT IV

CABLE BOLTS AND ROCK ANCHORS : Classification of cable bolts; installation and testing; modes of failure; different type of grouting materials; types of anchors; use of anchors for stabilizing rock slope, dam etc. ; testing of anchors.

SPECIAL METHODS OF ROCK REINFORCEMENT : Ground freezing for slope stabilization; berms for slope stabilization; fore-poling; resin grouted rock bolts of fibre glass; geo-textiles and it's area of application; water drainage and rock reinforcement; dump stabilization by vegetation.

REFERENCES

1. Schach, R., Garshael, K. and Heltzen, A. M., Rock Bolting – A Practical Handbook, Pergamon Press, 1979.
2. Peng, S.S. Ground Control, Wiley Interscience, New York, 1987

ROCK EXCAVATION ENGINEERING

Subject Code: BCIE3-859 **L T P C 3 0 0 3** **Duration: 36 Hrs.**

UNIT I

INTRODUCTION: Concepts, historical developments in rock excavation, systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods for rock fragmentation – explosive action, cutting, ripping and impacts.

UNIT II

ROCK MECHANICS: Rock properties related to machining process; application of compressive, tensile and multi-axial strengths, index tests and abrasivity, anisotropy, elasticity, porosity, laminations, bedding and jointing in rock fragmentation process.

UNIT III

ROCK CUTTING TECHNOLOGY: Mechanism of drilling – rotary, percussive, rotary, rotary percussive, mechanics of rock machining, theory of single tool rock cutting, crack initiation and propagation, breakage pattern, rock excavation by cutting action – picks, discs, roller cutters water jet cutting, methods of evaluation of drillability and cuttability of rocks.

UNIT IV

ROCK CUTTING TOOLS: Rock cutting tool materials, different types, relative applications and their choice, tool shape and size, specific energy consumption, tool wear, effect of operational parameters on tool performance, maintenance and replacement of cutting tools of excavating machines.

ROCK EXCAVATING MACHINES: Excavating machines, principles, operation, applicability and technical indices of road headers, TBM'S coalface machines and bucket wheel excavators.

REFERENCES

1. Cummings, A.B. and Given, I.V., SME Mining Engg. Vol. I and II, Society of Mining Engineers, America, 1992.
2. Hartman, H.L., Introductory Mining Engineering, John Wiley and Sons, New York, 1987.
3. Chugh, C.P., Diamond Drilling, Oxford-IBH, 1984.
4. Clark, G.B., Principles of Rock Fragmentation, John Wiley and Sons, New York, 1987.

MAJOR PROJECT

Subject Code: BCIE3-846 **L T P C**
0 0 4 2

To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems and suggest solution.

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Petrochemical & Petroleum Refinery Engineering

SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE2-735	Petroleum Exploration & Production Operation	3	0	0	40	60	100	3
BCIE2-736	Petroleum Refining-III	3	0	0	40	60	100	3
BCIE2-737	Pipeline Engineering	3	0	0	40	60	100	3
BCIE2-738	Advanced Offshore Engineering	3	0	0	40	60	100	3
BCIE2-739	Chemical Process Plant Design-II	0	0	2	60	40	100	1
BCIE2-740	Training-III#	0	0	0	60	40	100	2
Total		**12**	**00**	**02**	**280**	**320**	**600**	**15**

In House / Industrial Training of 8 weeks during summer vacation after 6th semester.

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE2-841	Reservoir Modelling & Simulation	3	1	0	40	60	100	4
BCIE2-842	Enhanced Oil Recovery Techniques	3	0	0	40	60	100	3
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BCIE2-860	Natural Gas Technology							
BCIE2-861	Drilling & Well Engineering							
BCIE2-862	Petroleum Economics							
BCIE2-863	Oil & Gas Processing System Design							
Open Elective-I (Select any one)		3	0	0	40	60	100	3
BCIE2- 843	Major Project	0	0	4	60	40	100	2
Total		**12**	**01**	**04**	**220**	**280**	**500**	**15**

7th Semester

MRSPTU

Petroleum Exploration & Production Operation

Subject Code: BCIE2-735 L T P C 3 0 0 3 Duration: 36 Hrs.

Unit I

Distribution of Reserves: Worldwide distribution of oil and gas reserves, Subsurface data sampling and data interpretation, Measurement scaling.

Unit II

Origin of Hydrocarbons: Origin of hydrocarbons, accumulation and migration of hydrocarbons, Reservoir traps, International trending in oil & gas.

Unit III

Properties of Reservoir Rocks and Fluids: Properties of reservoir rocks and fluids, Rock – fluid interface, Reservoir description by direct and indirect methods, Oil and Gas in place.
Drilling Operations: Drilling of oil and gas wells, Classification of wells, Drilling operating systems, Drilling fluids, new trends in drilling Engineering.

Unit IV

Unit V: Well Stimulation: Well completions and stimulations, Gun perforating, Hydrocarbon production techniques, Hydrocarbon recovery mechanisms, artificial lift techniques, Secondary recovery.

Reference Books:

1. Bradley, "Petroleum Engineering Handbook", SPE.
2. Mian, M. A., "Petroleum Engineering Handbook for Practicing Engineer", Vol. I and II, Pennwell Publication, 1992.
3. Deshpande, B.G., "World of Petroleum", Wiley, 1990.
4. John, F., Cook, M., and Graham, M., "Hydrocarbon Exploration and Production", Elsevier, 1998

Petroleum Refining-III

Subject Code: BCIE2-736 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Octane Improver: TEL, MTBE, Viscosity Index Improver, Pour Point Depressor, Anti Oxidants and others.

UNIT II

Heavy oil Upgradation processes: Carbon rejection, hydrogen addition; Instability of petroleum products – distillate and residual products; Incompatibility in refining Operations.

UNIT III

Support Systems: Control systems, offsite systems, safety systems

UNIT IV

Quality Control, Planning & Economics: Quality control of products, Refinery operation planning, process evaluation and economics.

Books Recommended:

1. Jones, D.S.J. and Pujadó, P.R., Handbook of petroleum processing, Springer, The Netherlands, 2006
2. Nelson, W. L "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985.
3. Watkins, R. N "Petroleum Refinery Distillations", 2nd Edition, Gulf Publishing Company, Texas, 1981.
4. Parkash, S., Refining processes handbook, Gulf Professional Publishing, 2003
5. Hobson, G. D "Modern Petroleum Refining Technology", 4th Edition, Institute of Petroleum,U. K.

Pipeline Engineering

Subject Code: BCIE2-737 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Objectives: Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products.
Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.

UNIT II

Fluid Flow: Flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non- Newtonian fluids through pipes; multiphase flow and loop pipelines.

UNIT III

Construction & Maintenance: Construction and Maintenance of pipelines; Route location survey, materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodymetric tapping plant. Pigging, Pigging Technology; pig launcher and receiver, intelligent pigging, types of pigs.

UNIT IV

Corrosion protection and control: Design of cathodic protection system, Pipeline automation.
Hydrates, Wax & Scale: Formation and prevention; Crude conditioning and use of additives to improve flow conditions.
Distribution Network: City distribution network of oil/gas. Lease and custody transfer.

Books Recommended:

1. Piping & Pipeline Engineering, George A. Antaki
2. Pipeline Engineering, Henry Liu, Lewis Publishers.
3. Fundamentals of Pipeline Engineering, J. Vincent-Genod, Editions Technip.
4. Pipeline Engineering, Duraid Alkazraji, Woodhead Publishing Limited.

Advanced offshore Engineering

Subject Code: BCIE2-738 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Introduction: Deviations from onshore drilling, Challenges, Rig types: Jack-up, Semi-sub, Floaters
Deepwater Drilling: Introduction - History & Geology, Floating Drilling Rigs and chronological Advancements, Basic Floating Rig equipment, Rig Automation.

UNIT II

Dynamic Positioning: Types and Basic operations of a DP system, Major components of the DP system , DP rig vs. moored rig , Types of thrusters used by DP vessels, Basic layout of a power distribution system onboard a DP vessel and associated protection systems, Power management system. Watch Circles - Drive-off; Drift-Off.
Subsea Wellheads: Overview of Wellhead Components, Tool Description, Wellhead sizing.

UNIT III

Open Water Operations: Remotely operated vehicles: Wellhead components for open water operations, Guidance systems; Guideline system; Guideline less system; Mud mat, connector selection, Jetting structural casing versus cementing in a drilled hole , Operational Procedures, Special considerations , high currents, shallow water , flows, drill with mud – "pump and dump" concept , Special cementing operations.
Riser Systems: Riser system Components, Buoyancy, Riser Tensioners & Tensioning Criteria, Basic Riser Analysis, Riser Operations, Emergency Disconnect, High Current Operations.

UNIT IV

BOP System: Wellhead & LMRP Connectors, RAM preventers, Annular Preventers, Choke & Kill line valves, LMRP, Landing & latching the BOP, Control System, Back-up system, BOP Stack Testing, Diverter System.
Deepwater Casing & Cementation: Review of conductor and surface casing design, Casing design process flow, Casing seat Selection, Kick Tolerance, Burst, Collapse, Tensile and bucking criteria & Calculations, Software assisted Casing Design, Casing running, Casing connections, Cementing Procedures , Casing and liner cementing; squeeze cementing, Cementation Hardware.

Books Recommended:

1. Offshore Engineering, Subrata Chakrabarti, Elsevier.
2. Offshore Engineering & Production, Angus Mather, Seamanship International, 2011
3. Offshore Structures, Mohamed A. El-Reddy, GP Publishers.

Chemical Process Plant Design-II

Subject Code: BCIE2-739 L T P C 0 0 2 1 Duration: 24 Hrs.

1. Design of Sieve Tray Column and column internals.

2. Design of Bubble Cap Column and column internals.

3. Design of Packed Column and column internals.

4. Specification sheet for fractionating column.

5. Design of Homogeneous Reactors.

6. Design of Heterogeneous reactors – Fixed bed.

7. Design of Heterogeneous reactors – fluidized bed.

8. Types of Flow Sheets.

9. Overview of plant layout.

The student is to appear in a viva-voce examination based on design report.

Books Recommended:

1. Coulson, Richardson & Sinnott R.K., Chemical Engineering Volume-6 – an Introduction to Chemical Engineering Design, 4th Ed., Elseveir Butterworth Heinemann, 2005
2. Perry R.H., Green D. W., Chemical Engineers' Handbook, 8th ed., Mc-Graw Hill, 2008
3. Coker A.K., Ludwig's Applied Process Design in Chemical & Petrochemical Plants- Vol 1, 4th Ed.,Gulf Publication- Butterworth Heinemann, 2007
4. Siddiqui S., Ludwig's Applied Process Design in Chemical & Petrochemical Plants – Volume 2, 4th Ed., Gulf Publication, 2010
5. Ludwig E.E., Applied Process Design in Chemical & Petrochemical Plants- Vol 3, 3rd Ed., Gulf Publication- Butterworth Heinemann, 2001
6. Vilbrandt F.C., Dryden C. E., Chemical Engg. Plant Design, 4th Ed., McGraw Hill, 1959
7. Peters M.S. , Timmerhaus K.D., Plant Design and Economics for Chemical Engg., 5th Ed., McGraw Hill, 2003
8. Molyneux F., Chemical Plant Design –I, Butterworth Heinemann, 1963.

8th Semester

Reservoir Modeling & Simulation

Subject Code: BCIE2-841 | L T P C 3 1 0 3 | Duration: 45 Hrs.

UNIT I

Reservoir Modeling: Introduction to general modeling: Introduction to concept geological modeling, Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties – concept of back oil model, compositional model.

UNIT II

Reservoir Simulation Overview: Introduction, Historical background, application of simulator, various types of models.
Flow Conditions: Single phase, two phase and multiphase flow equations for one, two and three dimension models.
Data Preparation & Function: Types of data & their preparations, Pseudo functions.

UNIT III

Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES), implicit pressure and implicit saturation (IMPIS).
Preview of numerical solution methods: Direct process, iterative process.
History Matching: Mechanics and parameters of match.

UNIT IV

Models simulation: Special Concept on Coning and Compositional Models simulation.
Economic and Techno-economic evaluation: Computation of economic indices viz. different variants base on technical and economic consideration.
Streamline Simulation: Introduction to streamline simulation & comparison of conventional & Streamline simulation.

Books Recommended:

1. Mattax Dalton, Reservoir Simulation", SPE series, USA, 1990.
2. Bradley HB, Petroleum Engineering Handbook, 3rd Edition GPE, 1992.
3. Principles of Applied Reservoir Simulation, John R. Fanchi, GPU.
4. Practical Reservoir Simulation, Mike Carlson.

Enhanced Oil Recovery Techniques

Subject Code: BCIE2-842 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Fundamental of Enhanced Oil Recovery: Pore Geometry, Microscopic Aspects of Displacement, Residual Oil Magnitude and Mobilization, Buoyancy Forces and Prevention of Trapping, Wettability, Residual Oil and Oil Recovery, Macroscopic Aspect of Displacement.

UNIT II

Water Flooding: Properties, sampling and analysis of Oil Field Water; Injection waters; Water flooding – Sweep Efficiency, Predictive Techniques, Improved Water Flood Processes, Performance of some Important Water Floods.

UNIT III

Enhanced Oil Recovery Operations-1: Flooding – miscible, CO2, polymer, alkaline, surfactants, steam

Enhanced Oil Recovery Operations-2: Gas injection, In-situ combustion technology, Microbial method

UNIT IV

Problems in Enhanced Oil Recovery: Precipitation and Deposition of Asphaltenes and Paraffin's, Scaling Problems, Formation of Damage Due to Migration of Fines, Environmental factor.

Books Recommended:

1. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, "Enhanced oil Recovery – I & II".
2. Fundamentals and Analysis, Elsevier Science Publishers, New York, 1985.
3. Lake, L.W., "Enhanced oil recovery", Prentice Hall, 1989.
4. Schumacher, M.M., "Enhanced oil recovery: Secondary and tertiary methods", Noyes Data Corp., 1978.
5. Van Poollen, H.K. "Fundamentals of enhanced oil recovery", Penn Well Books, 1980.

Natural Gas Technology

Subject Code: BCIE2-860 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Natural Gas Resources: Oil and gas reserves, Natural gas and associated gas, Outlook for world gas production, Indian Scenario. Future sources of natural gas – Coal Bed Methane and Hydrates, Composition of natural gas, Origin of hydrocarbon & non-hydrocarbon components, Formation of natural gas reservoirs, Sweet and sour gas.

UNIT II

Natural Gas Properties: Phase diagram of a reservoir fluid, Cricondentherm and Cricondenbar, Retrograde condensation, Dry gas, Wet gas, Condensate gas, associated gas, and Chemical components. Sampling methods for natural gas, Measurements taken during sampling. Volumetric properties of natural gas, Equations of state, Viscosity, thermal conductivity, surface and interfacial tension, Net and Gross Heating value – VLE calculations for natural gas.

UNIT III

Hydrates: Water-hydrocarbon systems, Hydrate structures, Thermodynamic conditions for hydrate formation, Kinetics of hydrate formation, Hydrate prevention.
Natural Gas Processing: Different specifications required for transport and use, Separation of condensates, Gas-Liquid separators and their design, Fractionation and purification operations, Dehydration methods, Hydrocarbon liquids recovery, Acid gas removal, Removal of nitrogen, helium and mercury, Integrated natural gas processing.

UNIT IV

Natural Gas Transport & Storage: Different gas chains – Pipeline transport systems, Steady state flow calculations for a pipeline, Pipeline thickness calculation, Welding problems in large diameter steel pipelines, Corrosion protection, Recompression stations, Types of compressors, Multiphase flow handling, Instrumentation, Monitoring and control, Safety considerations, Expansion systems. Flow measurement. LNG transport chain, Natural gas liquefaction, LNG carriers. Natural gas storage-Cryogenic and Underground.
Natural Gas Outlets: Downstream utilization technologies for natural gas in petrochemical, fertilizer and power sectors, Lower hydrocarbons Upgradation technologies, Methane conversion technologies.

Books Recommended:

1. A. Rojey, C. Jaffret, "Natural Gas Production, Processing, Transport", Second Editions Technip, 1994.
2. Chi U. Ikoku, "Natural Gas Production Engineering", John Wiley and Sons, 1984.
3. A. Kohl and F. Riesenfeld, "Gas Purification", Gulf Publishing Company, 1985.
4. Sanjay Kumar, "Gas Production Engineering', Gulf Publishing Company, 1987.

Drilling & Well Engineering

Subject Code: BCIE2-861 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Drilling Geology, Oil and Gas Migration: Rock Strengths and Stresses, Hydrostatic Pressure Forced by a Fluid, Rock Properties, Primary Migration, Reservoir Rock, Seal Rock and Secondary Migration. Reservoir Drives.

Planning And Drilling of Well: Well Proposal, Gathering Data, Designing the Well, Drilling and Testing the Well. Planning of Well, Hole and Casing Sizes, Selecting a suitable Drilling Rig, Classification of Drilling Rig, Rig Systems and Equipments.

UNIT II

Drill Bits and Drilling Fluids: Roller Cone Bits, Fixed Cutter Bits and Cone Bits, Optimizing Drilling Parameters- Grading the Dull Bit and Bit Selection, Functions of Drilling Fluid, Basic Mud Classification Designing the Drilling Fluid.

UNIT III

Directional Drilling, Casing, Cementing & Evaluation: Controlling the Well Path of a Deviated Well, Horizontal Wells and Multi Lateral Well. Importance of Casing in a Well, Designing the Casing String, Role of the Cement Outside the Casing, Mud Removal, Cement Design, Running and Cement Casing and other Cement Jobs, Evaluation Techniques, Physical Sampling at Surface and Down hole, Electrical Logging and Production testing.

UNIT IV

Drilling Operations, Safety & Environmental Issues: Personnel involved in drilling Operation, Decision Making at the Well site and in the Office, Estimating the Well Cost, Safety Meetings, New Comers on the Rig, Training and Certification, Permit to Work Systems, Safety Alerts, Safety Equipments, Minimizing Spills and Environmental Impact Studies.

Books Recommended:

1. Devereux, S., “Drilling Technology”, Penn Well Publishing Company, 2006.
2. Azar, J.J. and G. Rabello Samuel, “Drilling Engineering”, Penn Well Corporation, 2001.
3. Devereux, S., “Practical Well Planning and Drilling”, Penn Well Corporation, 1998.

Petroleum Economics

Subject Code: BCIE2-862 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Production Forecast and Reserves Estimation: Decline Curve Analysis, Types and utility in production forecast, Reserves to Production Ratio, Statistical analysis, Hubert curves. Reserves auditing, standard practices for reporting of reserves, SEC/ SPE/WPC norms.
Risk and Uncertainty: Definition, Exploration and Production Probabilistic Analysis, Risk Analysis, Management and Economic Assessment, Decision Analysis, Preference Theory, Real Option Theory, Stochastic Modeling.

UNIT II

Oil and Gas Prices: International Market and Geopolitics, Crude oil characteristics, marketing and trading of crude oil, Crude oil pricing mechanism and oil price elasticity, Inflation and effects on oil pricing. Factors control ling oil and gas pricing.
Cash Flow Analysis and Economic Parameters: Time value of money, types of costs, Economic Yardsticks: Return on Investment, Payout Period, Net Present Value, Discounted Cash flow, DCFROR, Incremental Analysis, Replacement Analysis, Sensitivity analysis, Optimization.

UNIT III

Asset Management and Accounting: Asset definition, performance evaluation, Analysis of ongoing costs, analysis of field development investments, purchase / sale of producing property, sources of funds, Project management techniques. Petroleum Industry Accounting and types, Petroleum Auditing, Tax Analysis, Cost, Expenditure and revenues under different heads and their proportion in Asset, Depreciation, Depletion, Amortization Methods and their use in tax calculations.

UNIT IV

Petroleum Fiscal System: E and P Business in world and India, Historical development, Role of OPEC and non OPEC countries, Reasons for development of a fiscal system for petroleum industry, Classification of Petroleum Fiscal Systems, Current distribution of exploration and production contract types, and their comparison with possible equivalence. National Oil Companies and International Oil Companies: comparative assessment Petroleum industry in India, Product ion fiscal system in India and abroad, NELP and bidding process in India.

Books Recommended:

1. Abdel A. A., Bakr A. B, and Al Sahlawi M. A., “Petroleum Economics and Engineering”, Decker Publications, 1992.
2. Johnston, D, “International Exploration Economics, Risk, and Contract Analysis”, Penwell Books, 2003.
3. IFP, Oil and Gas Exploration and Production, Reserves, Costs and Contracts, Technip Publication, 2007.
4. Mian M A, Project Economics and Decision Analysis, Penwell publications, Volume I and II.
5. Seba R. D., “Economics of Worldwide Petroleum Production”, OGCL Publications, USA.

Oil & Gas Processing System Design

Subject Code: BCIE2-863 | L T P C 3 0 0 3 | Duration: 36 Hrs.

UNIT I

Oil desalting: Operation, variables, Heater theater design.
Natural Gas Dehydration: Glycol Process: operation, effect of variables, dew point depression, stage calculation, NTU - graphical and analytical methods, Absorber sizing. Lean oil absorption. Solid-bed process: design & operation, effect of process variables, Regeneration and cooling calculations, Hydrocarbon recovery. Hydrate formation & inhibition.

UNIT II

Natural Gas Sweetening: Acid gases, Toxicity, Pipeline specification. Solid-bed Process : Design, operation & effect of variables, Adsorbent selection, Multistage Separation, Hengsteback's Flash calculation, stabilizer design, Amine and other absorptive process details.

UNIT III

Crude Oil & Condensate Stabilization: LTX Stabilization.
Oil & Gas Treatment: Oil desalter, emulsion treatment theory and practice, Emulsifiers & Demulsifiers, Gravity Separation, coalescence, coalescing media, electrostatic coalescers.

UNIT IV

Treating Equipment: Vertical, horizontal, Electrostatic, Process heat duty, Sensible heat of natural gas, Water, Heat transfer from fire-tube, Heat exchangers- types, fluid placement, sizing, number of tubes.

Books Recommended:

1. Essentials of Oil & Gas Utilities, Alireza Bahadori, Gulf Professional Publishing.
2. Handbook of Natural Gas Transmission & Processing, James G. Speight, William A. Poe, Saeid Mokhatab

Major Project

Subject Code: BCIE2-843

L T P C
0 0 4 2

The project may be considered as the ultimate exercise presented to the final year semester student before graduation to measure accumulated engineering knowledge and experience , At the same time, the project it-self should provide the students with some new skills, innovation and information, and strengthen the acquired ones.

The project program consists of different assignments, allotted time, submission of report under internal faculty guidance and evaluation by external member along with internal faculty. The activities performed during a project may cover one or more of the following: **Data Collection, Critical literature review, Laboratory experience and tests, Mathematical modeling, Software application, Industrial visits, Design and assembly, Process analysis, etc**. The project topic allotted may be of theoretical, experimental or industrial projects to be carried out under the supervision of internal guide and external guide**.**

On completion of the project work, each student has to prepare a project report and submit the same to the department.

Environmental Technology & Safety

Subject Code: BCIE0-F91 L T P C Duration: 36 Hrs.
3 0 0 3

Unit I

Basic Environmental Compartments: Air pollution, Water pollution, Land pollution, Hazardous material s in relation to petroleum industry, HAZOP analysis, Environmental Impact of Gas flaring, sampling methods, Environmental control and engineering – aqueous wastes, emission to the atmosphere, noise pollution.

Unit II

Fire Hazards and Control: Components of Fire, Classification of Fires and Fire Extinguishment, Fire safety equipments, Causes of Refinery Fires and Explosion Hazards, Safety in Handling and Storage, Emergency Preparation, DOW fire index.

Unit III

Waste Disposal and Treatment: Surface and subsurface disposal, treatment of water, solid material and air emissions, Oil field waste management, effluent water treatment methods, sampling methods.

Other Aspects: Occupational health hazards, Estimation of Total Petroleum Hydrocarbon (TPH) and suggested measures. Case studies of history of accidents in petroleum industry**.**

Unit IV

Regulatory Approaches and Safety Measures: Provisions in the oil mines regulation act in India related to management, drilling, production and transport. Protect ion against leakage and fire, care of machinery, plant and equipment, Safety aspect s during drilling, logging, production, transportation, handling etc at onshore and offshore. Emergency Response Plan (ERP), Regulatory requirements for ERP, Determination of initial planning zone.

Books Recommended:

1. Boesch D F and Rabalis Nancy, Long-term Environmental Effects of Offshore Oil and Gas Development, Elsevier Applied Science, 2003, 719 pp.
2. Boyce, A., “Introduction to Environmental Technology”, John Wiley and Sons, 1996.
3. Orzu Orszulik, “Environmental Technology in oil Industry”, Springer – Verlag, 1996.
4. Reis, J.C., “Environmental control in Petroleum Engineering”, Gulf publications.1998.

Semester –VII [Final Year]

Branch/Course: Automobile Engineering

Subject Code	Course Title	Hours per week			Credits
		L	T	P	
BMEE3-736	Hydraulic & Pneumatics System for Automobile	4	0	0	4
BMEE3-737	Vehicle Maintenance & Diagnostics	4	0	0	4
BMEE3-738	Automotive Electronics Systems	4	0	0	4
BMEE3-739	Automotive Electronics Systems Lab	0	0	2	1
BMEE3-740	Vehicle Maintenance Lab & Diagnostics Lab	0	0	2	1
BMEE3-741	Maintenance of hydraulics and pneumatics systems Lab	0	0	2	1
BMEE3-742	Major Project*	0	0	6	3
Department Elective –II (Select Any One)		4	0	0	4
BMEE3-761	Modern Vehicle Technology				
BMEE3-762	Alternate Fuels and Energy Systems				
BMEE3-763	Microprocessor Application in Automobiles				
xxxxx	Open Elective	3	0	0	3
Total Credits		19	0	12	25

* The problem formulated in the minor project during 6th semester is to be extended and executed in the major project by the same group of students. The design/construction/fabrication/computer modeling/experimentation etc. is to be carried out. The results and analysis followed by discussion regarding suitability / non suitability of the project or any positive gain in the project made with conclusions and recommendations for future extension of the project must be covered.

LIST OF ELECTIVE-II (Select any one)

1. Modern Vehicle Technology
2. Alternate Fuels and Energy Systems
3. Microprocessor Application in Automobiles

Open Elective (Select any one)

1. Industrial Engineering **BMEE0-F94**
2. Total Quality Management **BMEE0-F95**

Semester –VIII [Final Year]

Branch/Course: Marine Engineering

Subject Code	Course Title	Hours per week			Credits
		Lecture	Tutorial	Practical	
BMEE3-743	Software Training	**0**	**0**	**0**	**8**
BMEE3-744	Industrial Oriented Project Training	**0**	**0**	**0**	**10**
Total Credits		**0**	**0**	**0**	**18**

Total Contact Hours per week = 36 (minimum)

Industrial Training in reputed industries will be arranged for complete one semester.

HYDRAULIC & PNEUMATICS SYSTEM FOR AUTOMOBILE

Subject Code:BMEE3-736 **L T P C** **Duration: 48 Hrs.**

4 0 0 4

Unit –I

Introduction to Fluid Power: Application of hydraulics and pneumatics in various fields ofengineering, properties of fluids, effect of temperature, Hydraulic symbols- Circuit elements,fluid pumps, motors, valves, types of control, reservoirs, advantages and disadvantages ofhydraulic systems.

11 Hrs

Unit –II

Elements of Hydraulic System: Pumps- Types of pumps and its selection. Hydrauliccylinders and rams- IISingle acting and double acting, telescopic, seals, design considerationsfor pump, motor, cylinder and ram, fluid power plumbing requirements, type and purpose ofstrainer, filter, accumulator and its types, design considerations, reservoir, fluid temperaturecontrol, types of heat exchangers.

Control of Hydraulic Elements: Types of pressure control, Directional control Valves- Twoway, four way two position, four way three position, manual operated, solenoid operated.Flow control valves, pressure switches, check valves, quick exhaust valve.

12 Hrs

Unit –III

Hydraulic Circuits: Pressure regulating circuit, speed control circuit, accumulator circuit,booster and intensifier circuit, motion synchronizing circuit, servo circuit.

Elements of Pneumatic System: Air compressor - Types, selection criteria, capacity control,piping layout, fittings and connectors, pneumatic control, Direction control valves, two way,three way, four way check valves, flow control valves, pressure control valves, speedregulators. Quick exhaust valves, solenoid, pilot operators, Cylinders- Types and theirmountings, hoses and connections, Air motors- Types, comparison with hydraulic andelectric motor. Filters- Types of filters, regulators, lubricators, mufflers, dryers.Pneumatics Circuits and Applications: Basic pneumatic circuit, impulse operation, speedcontrol, pneumatic motor circuit, sequencing of motion time delay circuit & theirapplications.

13 Hrs

Unit –IV

Automatic Control: Need of control: Manual v/s automatic control, advantages of automaticcontrol, open loop v/s closed loop control, generalized control system, merits, demerits andApplications, Mathematical conversion of control components: Helical spring, viscousdamper and their combinations, resister, inductors, capacitor, series and parallel electricalcircuits and mech. Systems, thermal and fluid systems, direct and inverse analog, groundedchair representation for material system. Block diagram algebra: Rules of block diagramalgebra, reduction of block diagram, block diagram transfer function representation of speed,temperature and fluid systems, AC & DC Motors. Modes of control: On off control,proportional (P) control, integral (I) control, derivative control, P+I, P+D, P+I+D (includingan analytical treatment). **12 Hrs**

Recommended Books

1. Majumdar S.R., “Pneumatics Systems-Principles and Maintenance”, Tata Mc Graw Hill Book Co., New Delhi;
2. Majumdar S.R., “Oil Hydraulic Systems-Principles and Maintenance”, Tata Mc Graw Hill Book Co., New Delhi;51B.Tech. Automobile Engineering (AE) Batch 2011
3. Pippenger J.J, “Industrial Hydraulic”, Mc-Graw Hill Book Co. Ltd., New Delhi;
4. Pease D.A., “Basic fluid power” Prentice Hall of India, New Delhi;
5. Stewart H.L., “Pneumatics and Hydraulics”, Taraporevala, Mumbai;
6. Esposito A., “Fluid power with application”, Prentice Hall of India, New Delhi;
7. Yeaple, “Fluid power design handbook”, Marcel DekkarInc, New York;
8. Pneumatic handbook: R.S.Warrring;

VEHICLE MAINTENANCE & DIAGNOSTICS

Subject Code: BMEE3-737 **L T P C** **Duration: 49 Hrs.**

4 0 0 4

Unit –I

Introduction: Maintenance Objectives, classification, preventive, running and breakdownmaintenance, maintenance schedules, workshop manuals, owner's manual, Warranty Procedures, pre-delivery inspection (PDI): front manager, service advisor: functions and duties. Condition Based Maintenance (Cbm): Benefits, Objectives, Principles, what and when to monitor, Techniques, manual inspections, performances monitoring, vibration monitoring, oildebris spectroscopy, thermography and corrosion monitoring, Reliability centered maintenance (RCM), logic, benefits evaluations.

12 Hrs

Unit –II

Vehicle Maintenance Tools and Equipments: Specifications of standard tools, non-Standard tools, denting tools, painting equipments, testing equipments, Service station equipments, Hydraulic lift, Tyre changer, Tyre inflation gauge, Car Washer, Air Compressor, Spark Plug Cleaner and Tester, brake and transmission bleeding equipment, Grease Guns, Hydraulic Hoist, Analyzers: CO, HC, NOx, smoke meter, Engine analyzer- Petrol and Diesel, Ignition timing light, Wheel Balancer, Wheel aligner, Headlight aligner, Cylinder boring and honing, crankshaft grinder, Brake lathe m/c, ridge cutter and boring m/c, Trolley Jacks, Engine lifting cranes.

Maintenance Schedule: Difference between chassis and ball bearing grease, use oflubricants: SAE 20 -30, SAE 40-50, SAE 90-120, Machine oil, Brake fluid, Lubrication and maintenance schedules for clutch system, Gear Box, Propeller shaft, universal joints, differential, axles, wheel bearings, tires, Cooling and lubrication system, Specification of petro / diesel Engine, Engine Troubles and Diagnosis. **13Hrs**

Unit –III

Engine Tuning: S.I Engine tuning; use of compression gauge, vacuum gauge, engineanalyzer, exhaust analyzer, battery tester S.G tester, Cam-dwell angle, valve tappet clearance, replacement of engine oil and filter, ignition timing setting, Tyre inflation pressure, checking fuel consumption, MPFI and CRDI, Engines: assembly line diagnostic link (ALDL) connector, ALDL read out scan tool, test light, ohmmeter, digital volt meter, jumper wires, vacuum gauge, Tachometer, computerized automotive maintenance system. Knowledge of diagnostic codes, service engine soon (SES) light, ECM, CALPAK, TPS, IAC valve, ECM, MAP sensor, engine coolant temp sensor, IAT sensor, VSS, camshaft and Crankshaft – position sensor, start signal, PSP switch, Oxygen sensor, Fuel VapourCannister, Catalytic Converter, Particulate filter, Troubles and diagnosis MPFI engines.

12Hrs

Unit –IV

Clutch, Drive Line, Suspension, Steering and Brakes: Disassembly, cleaning, visualinspection; inspection by measurement and assembly of clutch; gearbox; universal joints; propeller shaft; differential; axles; steering and suspension system (leaf spring and McPhearsonstrut); Drum and disc Brakes; bleeding of brakes; Gaps and Clearances. Tyremaintenance and wheel balancing; service limits and wheel alignment

Engine Overhauling: Procedure for engine removal from vehicle; disassembly; cleaningprocedures; agents; Decarburizing; Top overhauling; Visual inspection; inspection by measurement; Engine inspection sheets: Service limits; machining of component parts:boring and honing of Engine components; camshaft grinding and lapping of engine valves; Fitting valve seat inserts and guides; Idea of oversize pistons and undersize split bearings; testing of cylinder heads and valve springs; Cooling system : maintenance and Service; troubles and diagnosis**.12Hrs**

Recommended Books

1. Shrivastava, Sushil Kumar., “Industrial Maintenance Management”, S Chand & Company Ltd.
2. Kohli, P.L., “Automotive Chassis and Body”, McGraw Hill;
3. Maruti Suzuki Manual;

AUTOMOTIVE ELECTRONICS SYSTEM

Subject Code: BMEE3-738 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

Unit –I

Fundamental of Automotive Electronics: Current trend in Automobiles - Open loop and closed loop systems - Components for electronic engine management. Electronic management of chassis system.

08 Hrs

Unit –II

Sensors and Actuators: Introduction, basic sensor arrangement, types of sensors such as – oxygen sensors, Crank angle position sensors - Fuel metering, vehicle speed sensor and detonation Sensor-Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

Electronic Fuel Injection and Ignition Systems: Introduction, Feed-back carburetorsystems (FBC), Throttle body injection and multi point fuel injection, Fuel injection systems, injection system controls, Advantages of electronic ignition system, Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, Electronic spark timing control. **13 Hrs**

Unit –III

Digital Engine Control System: Open loop and closed loop control systems –Enginecranking and warm up control -Acceleration enrichment - Deceleration leaning and idle speed control. Distributor less ignition -Integrated engine control system, Exhaust emission control engineering.

Vehicle Motion Control and Stabilization Systems: Vehicle motion control – Adaptivecruise control, Electronic transmission control, Vehicle stabilization system – Antilock braking system, Traction control system, Electronic stability program, onboard diagnosis system. **12 Hrs**

Unit –IV

Future Automotive Electronic Systems: Knock control, Linear solenoid idle speedControl,Sequential fuel injection, Distributor-less ignition, Self-diagnosis for fail-safe operation, Back-up MPU, Crankshaft angular position measurement for ignition timing, Direct mass air flow sensor, Continuously Variable Transmission, Collision Avoidance Radar Warning System, Low Tire Pressure Warning System, Speech Synthesis, Radio/signpost Navigation, intelligent transportation system.

12 Hrs

Recommended Books

1. William B. Ribbens, “Understanding Automotive Electronics”, Butterworth, Heinemann Woburn;1998.
2. Tom Weather Jr and ClandC.Hunter, “Automotive Computers and Control system”, Prentice Hall Inc. New Jersey.
3. BOSCH, Automotive Handbook, 6th Edition, Bentley publishers.
4. Young. A.P. and Griffths.L, “Automobile Electrical Equipment”, English Language Book Society and New Press;
5. Crouse. W. H., “Automobile Electrical equipment”, McGraw Hill Book Co Inc.,
6. Robert N Brady., “Automotive Computers and Digital Instrumentation”, A Reston Book, Prentice Halls
7. Bechtold., “Understanding Automotive Electronics

AUTOMOTIVE ELECTRONICS SYSTEM LAB

Subject Code: BMEE3-739	L T P C	Duration: 31 Hrs
	0 0 2 1	

LIST OF EXPERIMENTS

1. OPAMP as integrator
2. 555 timers as a stable multivibrator
3. Implementing study of gates and Logic Operations like, NOT, AND, OR,
4. Realization of basic gates using universal gates
5. Light dimmer circuit using Diac-Triac
6. Simple programs using microcontroller
7. Simple programs for microcontroller based applications
8. Study of electronic fuel injection & ignition system
9. Study of Digital Engine Control System
10. Vehicle motion control & stabilization systems

VEHICLE MAINTENANCE LABORATORY & DIAGNOSTICS LAB

Subject Code: BMEE3-740	**L T P C**	**Duration: 31 Hrs**
	0 0 2 1	

LIST OF EXPERIMENTS

Section A

(Power unit including electrcal)

1. Engine Reboring
2. Crank shaft grinding
3. Valve Seat grinding and Valve Lapping.
4. Silencer Decarbonising
5. Fuel Nozzle reconditioning
6. Fuel Injection Pump Calibration.
7. Engine Ignition System of a SI system
8. Engine Starting system of a CI system

Section B

(Transmission unit &power train)

9. Demonstration of garage, garage equipments& tools, preparation of different garage layouts
10. Demonstration of washing & greasing of vehicle
11. Engine oil change & periodic maintenance of vehicle
12. Clutch overhaul of light / heavy duty vehicle
13. Clutch overhaul of two or three wheeler vehicle
14. Dismantling & assembly of sliding mesh gearbox
15. Dismantling & assembly of synchromesh gearbox
16. Automobile Electrical & lighting circuit.

MAINTENANCE HYDRAULICS AND PNEUMATICS SYSTEMS LAB

Subject Code: BMEE3-741	L T P C	Duration: 31 Hrs
	0 0 2 1	

LIST OF EXPERIMENTS

1. ISO/JIC symbols for hydraulic and pneumatic system.
2. Study of Accumulators, actuators, intensifiers, hydraulic and pneumatic power brakes.
3. Demonstration & study of sequence valve in hydraulic and pneumatic circuit.
4. Demonstration on meter-in & meter-out control circuit for hydraulic system.
5. Demonstration on meter-in & meter-out control circuit for pneumatic system.
6. Experiment on On Off temperature controller.
7. Experiment on DC/AC Motor speed control
8. Design of hydraulic system and related components for hydraulic system for agricultural tractor
9. Design of hydraulic system and related components for hydraulic system for tipper/hydraulic clamps, pneumatic clamp.
10. Design of hydraulic system and related components for shaping machine/broaching machine/slotting machine.

MODERN VEHICLE TECHNOLOGY

Subject Code: BMEE3-761 **L T P C** **Duration: 45 Hrs**

4 0 0 4

Unit –I

Trends in Automotive Power Plants: Hybrid Vehicles – Stratified charged / lean burn engines – Hydrogen Engines-battery vehicles – Electricpropulsion with cables – Magnetic track vehicles.

11 Hrs

Unit –II

Suspension Brakes and Safety: Air Suspension-Closed loop suspension-antiskid braking system, Retarders, Regenerative braking safety cageair bags-crash resistance – passenger comfort. Oise & Pollution: Reduction of noise – Internal & external pollution control through alternatefuels/ power Plants-Catalytic converters and filters for particular emission. **12 Hrs**

Unit –III

Vehicle Operation and Control: Computer Control for pollution and noise control and for fuel Economy-Transducers and operation of thevehicle like optimum speed and direction. **11 Hrs**

Unit –IV

Vehicle Automated Tracks: Preparation and maintenance of proper road Network-National highway network with automated roads andvehicles-Satellite control of vehicle operation for safe and fast travel. **11 Hrs.**

Recommended Books

1. Beranek. L.L. Noise Reduction, McGraw-Hill Book Co., Inc, Newyork, 1993
2. Bosch Hand Book, 3rd Edition, SAE,1993

ALTERNATE FUELS AND ENERGY SYSTEMS

Subject Code: BMEE3-762 | **L T P C** | **Duration: 45 Hrs**

4 0 0 4

Unit –I

Introduction: Estimation of petroleum Reserve-Need for alternate Fuel-Availability and properties of alternate fuels-general use of alcoholsLPG-Hydrogen-Ammonia, CNG, and LNG-Vegetable oils and Biogas-Merits and demerits of various alternate fuels. **11 Hrs**

Unit –II

Alcohols: Properties as engine fuels, alcohols and gasoline Blends-Combustion characteristics in engines-emission characteristics.

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties modification required to use in engines-performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG-Hydrogen-Storage and handling, performance and safety aspects. **12 Hrs**

Unit –III

Vegetable Oils: Various vegetable oils for Engines-Esterification-Performance in Engines-Performance and emission characteristics. **08 Hrs**

Unit –IV

Electrical and Solar Powered Vehicles: Layout of an electric Vehicle-Advantage and Limitations-Specifications-System component, Electronic control System-High energy and power density Batteries-Hybrid Vehicle-Solar powered vehicles

10 Hrs

Recommended Books

1. MaheswarDayal, Energy today & tomorrow, I & B Horishr India,1982
2. Nagpal, Power Plant Engineering, Khanna Publishers,1991.
3. Alchohols and Motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
4. SAE paper Nos.840367, 841156,841333,841334.
5. The properties and performance of modern alternate fuels SAE paper No 841210.
6. Bechtold.R.L. Alternative Fuels Guide Book, SAE, 1997.

MICROPROCESSOR APPLICATION IN AUTOMOBILES

Subject Code: BMEE3-763 **L T P C** **Duration: 46 Hrs**

4 0 0 4

Unit –I

Architecture: General 8-bit microprocessor and its architecture 8085, Z-80 and MC 6800 MPU and its pin Functions-Architecture-Functions of different sections. **10 Hrs**

Unit –II

Instruction Set: Instruction format-addressing modes-instruction set of 8085 MPU-T-STATE-Machine cycle and instruction Cycles-Timing Diagrams-Different Machine Cycles-Fetch and execute operations-estimation of execution times. **11 Hrs**

Unit –III

Assembly Language Programming: Construct of the language Programming-Assembly format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to Binary and Binary to BCD Multiplication, Division, Code conversion using look up tables-stack andsubroutines.

12 Hrs

Unit –IV

Data Transfer Schemes: Interrupt Structure-Programmed I/O, DMA-Serial I/O.Interfacing Devices: Types of interfacing Devices-Input/Output ports 8212, 8255,8251,8279. Octal latches and tristate buffers-A/D and D/A Converters-Switches, LED's ROM and RAM interfacing.

Applications: Data Acquisitions-Temperature Control-Stepper Motor Control-Automotive applications engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

13 Hrs

Recommended Books

1. Ramesh, Goankar.S., Microprocessor Archietecture Programming and Applications, Wiley Eastern Ltd.,New Delhi,1986.
2. Aditya .P. Mathur, Introduction to Microprocessors, III Edition Tata McGraw Hill Publishuing Co Ltd New Delhi,1989.

3. Ahson. S. I., Microprocessors with Applications in Process Control,Tata McGraw Hill New Delhi,1986.
4. JabezDhinagfar .S., Microprocessor Applications in Automobiles.

INDUSTRIAL ENGINEERING

Subject Code:BMEE0-F94 **L T P C** **Duration: 41 Hrs**

3 0 0 3

Unit –I

Production Planning and Control; Product: product design, customer requirements, value engineering, quality, reliability, service life, and competitiveness. **10 Hrs**

Unit –II

Plant: location, layout, material handling, equipment selection, maintenance of equipment and facilities. **08 Hrs**

Unit –III

Processes: Job, batch and flow production methods, Group Technology Work study and Time and Motion study, Work/job evaluation, quality control (SPC), control charts. **11 Hrs**

Unit –IV

Resource planning: production/ operation control, forecasting, capacity management, scheduling and loading, line balancing, breakeven analysis, inventory of materials and their control, manufacturing planning, MRP - II, JIT.

12 Hrs

Recommended Books

1. Production, Planning and Inventory Control by S.L.Narasimhan, D.W.McLeavey, P.J.Billington, Prentice Hall.
2. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.
3. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan

TOTAL QUALITY MANAGEMENT

Subject Code:BMEE0-F95 **L T P C** **Duration: 40 Hrs**

3 0 0 3

Unit –I

Basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives.

Economics of quality and measurement of the cost of quality. Quality considerations in design.

10 Hrs

Unit –II

Process control: Machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan. **08 Hrs**

Unit –III

Acceptance Sampling: single, double and multiple sampling, lot quality protection, features and types of acceptance sampling tables, acceptance sampling of variables and statistical tolerance analysis. Quality education, principles of participation and participative approachesto quality commitment. **12 Hrs**

Unit –IV

Emerging concepts of quality management: Taguchi's concept of off-line quality control and Ishikawa's cause and effect diagram. **10 Hrs**

Recommended Books

1. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
2. Quality Control and Applications by Housen&Ghose
3. Industrial Engineering Management by O.P. Khanna

MAJOR PROJECT

Subject Code: BMEE3-742

L	T	P	C
0	0	6	3

MAJOR PROJECT GUIDELINES

1. The problem formulated in the minor project during 6th semester is to be extended and executed in the major project by the same group of students.
2. The design/construction/fabrication/computer modeling/experimentation etc. is to be carried out.
3. The results and analysis followed by discussion regarding suitability / non suitability of the project or any positive gain in the project made with conclusions and recommendations for future extension of the project must be covered.
4. A Project Report is a documentation of a Graduate student's project work—a record of the original work done by the student. It provides information on the student's research work to the future researchers.
5. The final copy of the report has to contain all the modifications/corrections suggested by the examiners (including the members of the Viva-Voce Board) and is to be submitted after the student successfully defends the project in the viva-voce examination.
6. The report has to contain an appropriate copyright notice.
7. The report has to include a declaration by the student to the effect that he/she has not resorted to any unethical practice while carrying out the research work and preparing the report.

MRSPTU B-TECH MARINE SYLLABUS

Semester –VII [Final year]

Branch/Course: Marine Engineering

Sr. No	Subject Code	Course Title	Hours per week			Credits
			L	T	P	
1	BMEE4-738	Mechanical Vibrations	3	0	0	**3**
2	BMEE4-739	Refrigeration and Air Conditioning	**3**	**1**	**0**	**4**
3	BMEE4-740	Project	**0**	**0**	**12**	**6**
4	BMEE4-741	Design of Machines-II	**3**	**1**	**0**	**4**
5	BMEE4-742	Refrigeration and Air Conditioning lab	**0**	**0**	**2**	**1**
Department Elective (select any one)						
	BMEE4-756	Marine Control and automation	**3**	**1**	**0**	**4**
	BMEE4-757	Environment science and Engineering				
					Total Credits	**22**

LIST OF ELECTIVES (Select any one)

1. Marine Control and automation
2. Environment science and Engineering

Semester –VIII [Final year]

Branch/Course: Marine Engineering

Sr. No	Subject Code	Course Title	Hours per week			Credits
			L	T	P	
1	BMEE4-843	Marine Training	**0**	**0**	**0**	**8**
2	BMEE-844	Industrial Training	**0**	**0**	**0**	**10**
					Total Credits	**18**

Total Contact Hours per week = 36 (minimum)

Industrial Training in reputed industries will be arranged for complete one semester.

MECHANICAL VIBRATIONS

Subject Code:BMEE4-738 **L T P C** **Duration: 43 Hrs.**

3 0 0 3

Unit –I

Introduction; Basic concepts, Methods of vibration analysis, Types of vibration, Periodic &Harmonic vibrations **08 Hrs.**

Unit –II

undammed free vibrations, damped free vibrations and damped force vibrations of single degree of freedom system,vibration isolation transmissibility.vibration measuring instruments. **10 Hrs**

Unit –III

Two degrees of Freedom systems: a) principal modes of vibrations, natural frequencies, amplitude ratio, forced harmonic vibration.combined rectilinear & angular modes. b) Application; Vibration absorber - principle, centrifugal pendulum vibration absorber, torsional vibration damper, untunedviscous damper, dry friction dampers, torsional vibration of two rotor systems. **10 Hrs.**

Unit –IV

a) Multi-degree of freedom systems: undamped free vibrations, influence coefficients, generalized coordinates,orthogonalityprincipal,matrix alteration methods, Rayleigh andDunkerley, Holzer's ,stodolamethod,Eigen values &eigen vector.

b) continuous systems: Vibration of a string, longitudinal vibrations of bars, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts **15 Hrs**

Recommended Books:

1. Mechanical Vibrations by GK Grover, Hem chand and Bros, Roorkee
2. Mechancial Vibrations by KK Purjara, DhanpatRai and Sons, Delhi
3. Mechanical Vibrations by V.P.Singh,

REFRIGERATION AND AIR CONDITIONING

Subject Code: BMEE4-739 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

Unit –I

Basic Concept Natural and Mechanical refrigeration; Application of Refrigeration; Units ofrefrigeration and Coefficient of performance; Refrigeration effect, cooling capacity and COP of a
refrigerator; heating effect, heating capacity and COP as heat pump; Reversed Carnot cycle and its limitations

Bell Coleman Cycle and Aircraft Refrigeration Bell Coleman Cycle and its analysis; optimumCOP and pressure ratio, necessity of air craft refrigeration - air cycle refrigeration systems and their comparison

Vapour Compression Refrigeration Cycle Vapour compression cycle on P-V, P-H and T-Sdiagrams; Deviation of actual cycle from theoretical cycle; Compressor capacity and volumetric efficiency, Analysis of theoretical and actual vapour compression cycles; Effect of suction pressure, discharge pressure, subcooling, super heating and pressure drop in valves on performance and cooling capacity.

11 Hrs.

Unit –II

Vapour Compression Refrigeration with Multiple Evaporators and Compressors Compoundcompression with single and multiple expansion valves, water intercooling and flash intercooling; multiple load systems with single and multiple expansion valves

Vapour Absorption Refrigeration Cycle (No Mathematical Analysis) Principle of absorption system; components of the system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia absorption refrigeration system; Lithium Bromide - water absorption system; Theory of mixtures; temerature concentration and enthalpy concentration diagrams; comparison between absorption and compression systems; Electrolux refrigeration system.**13Hrs**

Unit –III

Refrigerants Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Effect of moisture and oil miscibility; Refrigerants dying agents and antifreeze solution; leak detection and charging of refrigerants; environmental aspects of conventional refrigerants; Ecofriendly refrigerants and action plan to reduce ecological hazards.Non-Conventional Refrigeration Systems (No Mathematical Analysis) Steam Jet Refrigeration; Cascade Refrigeration System; Mixed Refrigeration Systems; Vortex Tube Refrigeration, Thermoelectric cooling; Linde and Claude cycles, cryogenics and its engineering applications.

12Hrs

Unit –IV

Air Conditioning Concept and Applications; Psychometric properties of air; Dry bulb, wet bulb and dew point temperatures; Relative and specific humidity; degree of saturation adiabaticsaturation temperature, enthalpy of air and water vapours; psychometric chart. Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

Psychometric Processes Sensible heating and cooling, cooling with dehumidification; Heatingwith dehumidification; by-pass factor; chemical dehumidification; adiabatic mixing, air washer.

Calculations for Air –conditioning Load and for Rate and state of Supply Air Sources of heatload; sensible and latent heat load; sensible heat factor; apparatus dew point temperature; Rate and state of supply - air for air- conditioning of different types of premises.Refrigeration and Air Conditioning Equipment Brief description of compressors, condensers,evaporators and expansion devices; Cooling towers; Ducts; dampers; grills; air filters; fans; roomair conditioners; split units; Package and central air conditioning plants.

12Hrs

Recomanded Books

1. Refrigeration and Conditioning by CP Arora, Tata McGraw Hill
2. Refrigeration and Conditioning by Manohar Prasad, Wiley Eastern Limited
3. Refrigeration and Conditioning by Jordan and Priester, Prentice Hall of India
4. Refrigeration and Conditioning by WF Stoecker, McGraw

DESIGN OF MACHINES-II

Subject Code: BMEE4-741 **L T P C** **Duration: 44 Hrs**

3 1 0 4

Unit –I

1. Understand the selection/ Design of each of the transmission components
   a. Flat, V-Belt and rope drive
   b. Chain drives
   c. Gear drives of different types
   d. Selection of sliding and rolling bearings and their housing
   e. Flywheel and pulley
   f. Closed coiled, helical and leaf springs
   g. Various types of clutches and brakes
   h. Lubrication in the transmission systems **12 Hrs**

Unit –II

2. To learn the design or design modification for manufacturing and assembly
3. To understand the basic concept of computer aided design i.e.
   a. The basic Theory of CAD Techniques
   b. Design stragergies of different CAD/Softwares
   c. Functioning/ Structure of CAD Softwares **10Hrs**

Unit –III

4. To handle live projects of transmission systems efficiently Detailed Contents 1. Design of Flat belt, V-belt and rope (steel wire), Design of the pulley for the same 2. Selection of Chain Drive 3. Design of spur, helical, straight bevel gears, worm and worm wheel 4. Bearing Selection, Design of sliding and rolling type of bearings, Detailed of bearing housing. **10 Hrs.**

Unit –IV

5. Design of Flywheel for different operation
6. Design of Close-coil, Helical and Leaf springs
7. Design of Contact clutches i.e. Plate and cone types, Band, Block, Band and block brakes
8. Design of Lubrication in transmission system
9. Computers in Design: Basic Theory of CAD Software, structure of CAD software, Design

Philosophy, Structure of CAD Softwares, Designing a CAD Software**12 Hrs**

Recommended Books

1. Machine Design by Shigley Tata McGraw hill
2. Machine Design by Juvinal, John-Wiley Publishers
3. Machine Design by Spots, Prentice hall
4. Machine Design by Norton, Prentice Hall

5. Machine Design by Sharma, Aggarwal, Kataria Publishers

6. Machine Design by Goyal and Bahl, Standard Publishers

REFRIGRATION AND AIR CONDITIONING LAB

Subject Code: BMEE4-742 **L T P C** **Duration: 35 Hrs**

0 0 2 1

1. Study of various elements of a mechanical refrigerator system through cut sections models /actual apparatus
2. Study and performance of domestic refrigerator,
3. Study the performance of and Eectrolux refrigerator
4. Study of an Ice plant and visit to a cold storage for study
5. Calculation/ Estimation of cooling load for large building
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning
7. Study and performance of window type room air conditioner

MARINE CONTROL & AUTOMATION

Subject Code:BMEE4-756 **L T P C** **Duration: 47 Hrs**

3 1 0 4

Unit –I

Control System: Introduction to control terms, Block diagrams for control systems, open loopandclosed loop feedback control, comparison of closed loop and open loop, Feed forward control. Feed forward modification. Regulators and Servomechanism. Proportional plus integralplus derivative controls, use of various control modes.

Graphical Representation of Signals: Inputs of Step Ramp sinusoid, Pulse andImpulse, Exponential Function etc. Error Detector, Controller output elements. **12 Hrs**

Unit –II

The Dynamics of a simple servo-mechanism for Angular Position Control: The TorqueProportional to Error, Servomechanism, Different response of servomechanism. Technique forimproving the general performance of servomechanism. The frequency response test. Seriescompensation using Nyquist Diagram. Parallel compensation using the Inverse Nyquist Diagram.

11 Hrs

Unit –III

Process Control Systems: Automatic Closed loop process. Control system Dynamic characteristic of Processes. Dynamic characteristic of controllers. Practical pneumatic controllers. Electronic Instrumentationfor Measurement and control.

Analog Computing and Simulation: Introduction, Basic concepts. Analog computers. Simulation. The use of Digital computer in the simulation control system. Hybrid Computers.

11 Hrs

Unit –IV

Transmission: Pneumatic and electric transmission, suitability for marine use. Pneumatic and types of Controllers hydraulic, electric and electronic controllers for generation of control action. Time Function controllers.CorrectingUnits: Diaphragm actuators, Valve-positioners, piston actuators, Electro-pneumatictransducers. Electro-hydraulic actuators and Electric actuator control valves.

Application of Controls on ships: Marine Boiler-Automatic combustion control, Air/fuelRatiocontrol feed water control single two and three element type, steam pressure control,Combustionchamber pressure control, fuel oil temperature control, Control in Main Machinery units forTemperature of lubricating oil, jacket cooling water, fuel valve cooling water, pistonCoolingwater and scavenage air, fuel oil viscosity control Bridge control of main machinery. Instrumentfor UMS classification.

13 Hrs

Recommended Books

1. Industrial Automationby R.G.Jamkar, Global Education Limited
2. Marine Automation & Control Systemsby VikramGokhale,Bhandarkar Publications; Third Edition edition (2014)
3. Marine Control Technology by Elstan A. Fernandez, Shroff Publishers and Distributors Pvt. Ltd.; 1 edition (April 24, 2007)

ENVIRONMENTAL SCIENCE AND ENGINEERING

Subject Code:BMEE4-757 **L T P C** **Duration: 45 Hrs**

3 1 0 4

UNIT I

COMPONENTS OF ENVIRONMENT

Components – Water, air and land – Inter-relationship between components – Subcomponents;Ecosystem – Structure and functional components of ecosystem –Development and evolution of ecosystem – Energy flow and material cycling inecosystem – Natural and manmade impacts on water, air and land; Environment anddevelopment – Concept of sustainable development.**10 Hrs.**

UNIT II

SCIENCE OF ENVIRONMENT

Chemistry, Physics and biology of water, air and land; Stress on the Chemistry, Physicsand Biologyof water, air and land owing to the impacts; Environmental quality objectiveandgoles – policies ondevelopment projects and their impacts, with emphasis on thebranch of engineering of the student. **12 Hrs**

UNIT III

CURRENT ENVIRONMENTAL ISSUES

Current Environmental issues at country level – management of municipal sewage,municipal solidwaste, Hazardous waste and Bio-medical waste – Air pollution due to industries and vehicles; Global issues – Biodiversity, Climate change, Ozone layer depletion**.**

11Hrs

UNIT IV

THE ENVIRONMENTAL STRESSES

Minimization of Stress – Principles of Physics, chemistry and biology in engineering interventions such as waste treatment – Flow sheets of engineering interventions relevant to the

Engineering discipline of the student – Waste minimization techniques –Clean technology options – Standards of performance of the interventions.

(A) TOOLS FOR ENVIRONMENTAL MANAGEMENT

Environmental impact assessment; Precautionary Principle and Polluter PaysPrinciple; Constitutional provisions, Legal and economic instruments in Environmental Management; Role of Non-government organizations – Community participation environmental management works; International conventions and protocols; Pollution Control Boards and Pollution Control Acts.

(B) FIELD STUDY

In-depth study of environmental issues at least one environmentally sensitive site relevant to thediscipline of the student and preparation of a report thereupon. **12 Hrs**

Recommended Books:

1. G.M. Master, "Introduction to Environmental Engineering & Science", Prentice Hall, New Delhi,1997.
2. J.G. Henry and G.W. Heike, "Environmental Science & Engineering", Prentice Hall International Inc., New Jersy, 1996.

MAJOR PROJECT

Subject Code: **L T P C**

MAJOR PROJECT GUIDELINES

1. The problem formulated in the minor project during 6th semester is to be extended and executed in the major project by the same group of students.
2. The design/construction/fabrication/computer modeling/experimentation etc. is to be carried out.
3. The results and analysis followed by discussion regarding suitability / non suitability of the project or any positive gain in the project made with conclusions and recommendations for future extension of the project must be covered.
4. A Project Report is a documentation of a Graduate student's project work—a record of the original work done by the student. It provides information on the student's research work to the future researchers.
5. The final copy of the report has to contain all the modifications/corrections suggested by the examiners (including the members of the Viva-Voce Board) and is to be submitted after the student successfully defends the project in the viva-voce examination.
6. The report has to contain an appropriate copyright notice.
7. The report has to include a declaration by the student to the effect that he/she has not resorted to any unethical practice while carrying out the research work and preparing the report.

B.Tech.CSE(3rd SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMATH1-301	Calculus and Ordinary Differential Equation	3	0	0	40	60	100	3
BCSES1-301	Computer Peripherals & Interfaces	3	0	0	40	60	100	3
BCSES1-302	Data structure &Algorithms	3	1	0	40	60	100	4
BCSES1-303	Digital Electronics	3	1	0	40	60	100	4
BCSES1-304	Data structure & Algorithms Laboratory	0	0	4	60	40	100	2
BCSES1-305	Digital Electronics Laboratory	0	0	2	60	40	100	1
BCSES1-306	IT Workshop (SciLab / MATLAB) Laboratory	0	0	4	60	40	100	2
BCSES1-307	Training-I*	-	-	-	60	40	100	3
BHSMC0-007	Development of Societies	3	0	0	40	60	100	3
Total 5 Theory &3 Lab. Courses		**15**	**2**	**10**	**440**	**460**	**900**	**25**

***NOTE:** Training after the 2nd Semester.

B.Tech. CSE (4th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSES1-401	DiscreteMathematics	3	1	0	40	60	100	4
BCSES1-402	ComputerOrganization &Architecture	3	0	0	40	60	100	3
BCSES1-403	OperatingSystems	3	1	0	40	60	100	4
BCSES1-404	Object Oriented Programming	3	1	0	40	60	100	4
BCSES1-405	OperatingSystems Laboratory	0	0	2	60	40	100	1
BCSES1-406	Object Oriented Programming Laboratory	0	0	4	60	40	100	2
BHSMC0-016	Organizational Behaviour	3	0	0	40	60	100	3
Total 5 Theory & 2 Lab. Courses		**15**	**3**	**06**	**320**	**380**	**700**	**21**

B.Tech. CSE (5th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BCSES1-501	Compiler Design	3	1	0	40	60	100	4
BCSES1-502	Database Management System	3	0	0	40	60	100	3
BCSES1-503	Formal Language and Automata Theory	3	0	0	40	60	100	3
BCSES1-504	Design &Analysis ofAlgorithms	3	1	0	40	60	100	4
BCSES1-505	Database Management System Laboratory	0	0	4	60	40	100	2
BCSES1-506	Design &Analysis ofAlgorithms Laboratory	0	0	2	60	40	100	1
BCSES1-507	Training-II*	-	-	-	60	40	100	4
BHSCM0-015	Finance & Accounting	3	0	0	40	60	100	3
	Departmental Elective-I	3	0	0	40	60	100	3
BCSED1-511	Computer Graphics							
BCSED1-512	Graph Theory							
BCSED1-513	Web Technologies							
BCSED1-514	Java Programming							
Total 7 Theory & 2 Lab. Courses		**18**	**2**	**06**	**420**	**480**	**900**	**27**

***NOTE:** During the summer vacation after 4th.

B.Tech. CSE (6th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BCSES1-601	Software Engineering	3	0	0	40	60	100	3
BCSES1-602	Computer Networks	3	1	0	40	60	100	4
BCSES1-603	Computer Network Laboratory	0	0	2	60	40	100	1
BCSES1-604	***Project-I	0	0	6	60	40	100	2
	Departmental Elective-II (Select any One)	3	0	0	40	60	100	3
BCSED1-611	Mobile Application Development							
BCSED1-612	Machine Learning							
BCSED1-613	Distributed Systems							
BCSED1-614	Signals and Systems							
	Departmental Elective-II (Select any One)	3	0	0	60	40	100	3
BCSED1-621	Data Mining							
BCSED1-622	Cloud Computing							
BCSED1-623	Parallel Processing							
BCSED1-624	Embedded Systems							
XXXX	**Open Elective-I****	3	0	0	40	60	100	3
Total 5 Theory &2 Lab. Courses		**15**	**1**	**08**	**340**	**360**	**700**	**19**

**** Open Elective Subject may be chosen from the list of open elective offered by other departments of university**

*****Project work, seminar and internship in industry or at appropriate work place**

B.Tech. CSE (7th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BCSES1-701	*Project-II	0	0	10	60	40	100	2
BCSES1-702	***Training-III	-	-	-	60	40	100	4
	Departmental Elective-IV	3	0	0	40	60	100	3
BCSED1-711	Distributed Operating System							
BCSCD1712	Soft Computing							
BCSCD1-713	Human Computer Interaction							
BCSCD1-714	Ad-hoc & Sensor Networks							
	Departmental Elective-V	3	0	0	40	60	100	3
BCSED1-721	Bioinformatics							
BCSED1-722	Image processing							
BCSED1-723	Cryptography & Network Security							
BCSED1-724	Artificial Intelligence							
XXXX	**Open Elective-II***	3	0	0	40	60	100	3
BMNCC0-002	EnvironmentalSciences	3	0	0	40	00	40	0
Total 4 Theory &1 Lab. Courses		**12**	**0**	**10**	**280**	**260**	**540**	**15**

*Open Elective Subject may be chosen from the list of open elective offered by other departments of university

**Continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place

***During the summer vacation after 6th semester.

B.Tech. CSE (8th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BCSES1-801	Project-III**	0	0	12	60	40	100	5
	Departmental Elective-VI	3	0	0	40	60	100	3
BCSED1-811	Enterprise Resource Planning							
BCSED1-812	Internet of things							
BCSED1-813	Advanced Database Management Systems							
BCSED1-814	Software Project Management							
XXXX	**Open Elective-III***	3	0	0	40	60	100	3
XXXX	**Open Elective—IV***	3	0	0	40	60	100	3
	Mandatory Courses- noncredit* **	3	0	0	40	00	40	0
BMNCC0-001	Constitution of India							
BMNCC0-006	Essence of Indian Knowledge Tradition							
Total 4 Theory &1 Lab. Courses		**12**	**0**	**12**	**220**	**220**	**440**	**14**

***Open Elective Subject may be chosen from the list of open elective offered by other departments of university**

****Project III to be made by student during the semester.**

*****choose any one subject from mandatory Courses.**

Calculus and Ordinary Differential Equation

Subject Code- BMATH1-301	L T P C 3 0 0 3	Duration – 45hrs

COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in basiccalculus and linear algebra. It aims to equip the students with standard concepts and tools at anintermediate to advanced level that will serve them well towards tackling more advanced level ofmathematics and applications that they would find useful in their disciplines.

COURSE OUTCOME

CO1 To apply differential and integral calculus to notions of curvature and to improper integrals.Apart from various applications, they will have a basic understanding of Beta and Gammafunctions.

CO2 The essential tools of matrices and linear algebra including linear transformations,eigenvalues, diagonalization and orthogonalization.

COURSE CONTENT

UNIT-I (12hrs)

Sequences and Series: Basic concept of Convergence, tests for convergence, power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions.

Multivariable Calculus: Partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers.

UNIT-II (11 hrs)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables, Theorems of Green, Gauss and Stokes (without proof), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-III(11 hrs)

First order ordinary differential equations: Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

UNIT-IV (11 hrs)

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

RECOMMENDED BOOKS

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
6. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
7. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

COMPUTER PERIPHERALS & INTERFACES

Subject Code- BITES1-301	L T P C 3 0 0 3	Duration – 45 hrs.

COURSE OBJECTIVCE

To learn the functional and operational details of various peripheral devices.

COURSE CONTENT

UNIT I

SYSTEM RESOURCES: Interrupt, DMA Channel, I/O Port Addresses and resolving and resolving the conflict of resources. I/O buses- ISA, EISA, Local bus, VESA Local bus, PCI bus, PCI Express, Accelerated graphics port bus.

IDE & SCSI Interfaces: IDE origin, IDE Interface ATA standards. ATA feature, ATA RAID and SCSI RAID, SCSI Cable and pin Connector pin outs SCSI V/s IDE Advantages and limitation, SATA, SSD drives.

UNIT II

Video Hardware: Video display technologies, DVI Digital signals for CRT Monitor, LCD, LED, OLED Panels, Video adapter types, Integrated Video/ Motherboard chipset, Video RAM,Video driver and multiple Monitor, Graphic accelerators. Advanced 3D Technologies,TV Tuner and Video Capture upgrades troubleshooting Video Cards and Drivers.

UNIT III

I/O Interfaces: I/O Interfaces from USB1.0, 2.0, 3.0, lighting port, I/O Interface from serial, Parallel to SCSI converter. Testing of serial andparallel port, USB Mouse/ Keyboard Interfaces like HDMI

Input/ Output Driver software aspects: Role of device driver DOS and UNIX/ LINUX device drivers.

UNIT IV

Design & Integration of Peripheral devices to a computer system as a Case Study

Future Trends: Detailed Analysis of recent Progress in the Peripheral devices. Some aspects of cost Performance analysis and applications of latest digital devices like WiFi-LED projectors, HDMI devices, wireless printers and other devices

RECOMMENDED BOOKS

1. Douglas V. Hall,“Microprocessors and Interfacing”, Tata McGraw Hill 2006.
2. Barry B. Brey&C.R.Sarma, “The intel microprocessors,” Pearson 2003.

3. P. Pal Chandhari, “Computer Organization and design” Prentice Hall of India Pvt. Ltd, 1994.
4. Del Corso, H.Kirrman, JD Nicond “Microcomputer buses & links” Academic Press 1986.

DATA STRUCTURE & ALGORITHMS

Subject Code-BITES1-302	**L T P C** **3 1 0 4**	**Duration – 45hrs**

COURSE OBJECTIVE

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques.
3. To understand basic concepts about stacks, queues, lists, trees and graphs
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Basic Terminologies: Elementary Data Organizations, Data StructureOperations: insertion, deletion, traversal etc.; Analysis of an Algorithm, AsymptoticNotations, Time-Space trade off. Searching: Linear Search and Binary Search Techniquesand their complexity analysis.

UNIT-II (12 hrs)

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexityanalysis, Applications of Stacks: Expression Conversion and evaluation –corresponding algorithms and complexity analysis. ADT queue, Types of Queue: SimpleQueue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithmsand their analysis.

UNIT-III (11 hrs)

Linked Lists: Singly linked lists: Representation in memory, Algorithms of severaloperations: Traversing, Searching, Insertion into, Deletion from linked list; Linkedrepresentation of Stack and Queue, Header nodes, Doubly linked list: operations on it andalgorithmic analysis; Circular Linked Lists: all operations their algorithms and thecomplexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search trees, Binary Search Tree,Tree operations on each of the trees and theiralgorithms with complexity analysis. Introduction to B Tree, B+ Tree and AVL Tree

UNIT-IV (11 hrs)

Sorting and Hashing: Objective and properties of different sorting algorithms:Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort;Performance and comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

RECOMMENDED BOOKS:

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

SUGGESTED REFERENCE BOOKS:

2. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition byMark Allen Weiss, Addison-Wesley Publishing Company

3. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

COURSE OUTCOMES

CO1 For a given algorithm student will able to analyze the algorithms to determine the timeand computation complexity and justify the correctness.

CO2 For a given Search problem (Linear Search and Binary Search) student will able toimplement it.

CO3 For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.

CO4 Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort,Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Spaceand Time complexity.

CO5 Student will able to implement Graph search and traversal algorithms and determinethe time and computation complexity.

DIGITAL ELECTRONICS

Subject Code-	L T P C	Duration – 45hrs
BITES1-303	3 1 0 4	

COURSE OBJECTIVE

To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 Understand working of logic families and logic gates.

CO2 Design and implement Combinational and Sequential logiccircuits.

CO3 Understand the process of Analog to Digital conversion and Digital to Analog conversion.

CO4 Be able to use PLDs to implement the given logical problem.

COURSE CONTENT

UNIT-I (11 hrs)

Fundamentals of Digital Systems and logicfamilies: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations,Boolean algebra, examples ofICgates, number systems-binary, signed binary, octal hexadecimalnumber, binaryarithmetic,one's and two's complements arithmetic, codes, error detecting andcorrectingcodes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOSlogic, interfacing CMOS and TTL, Tri-statelogic.

Combinational DigitalCircuits: Standard representation for logic functions, K-map representation, simplification oflogicfunctionsusing K-map, minimization of logical functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder,serialadder,ALU, elementary ALU design, popular MSI chips, digital comparator,paritychecker/generator, codeconverters, priority encoders, decoders/drivers for display devices,Q-M method offunctionrealization.

UNIT-II (12 hrs)

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallelconverter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters,

counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT-III (11 hrs)

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter,specificationsfor D/A converters, examples of D/A converter lCs, sample and hold circuit,analog to digitalconverters: quantization and encoding, parallel comparator A/Dconverter,successive approximationA/D converter, counting A/D converter, dual slope A/Dconverter,A/DconverterusingVoltagetofrequencyandvoltagetotimeconversion,specificationsofA/Dconverters, example of A/DconverterICs

UNIT-IV (11 hrs)

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification andcharacteristicsofmemories, sequential memory, read only memory (ROM), read and write memory(RAM), contentaddressable memory (CAM), charge de coupled device memory (CCD), commonly used memorychips, ROM as a PLD, Programmable logic array, Programmable array logic, complexProgrammable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

RECOMMENDED BOOKS

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

8.

DATA STRUCTURE & ALGORITHMS LABORATORY

Subject Code-BITES1-304	**L T P C** **0 0 4 2**	**Duration – 60hrs**

COURSE OUTCOMES

CO1 To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.

CO2 To introduce the structured data types like Stacks and Queue and its basic operation's implementation

CO3 To introduces dynamic implementation of linked list

CO4 To introduce the concepts of Tree and graph and implementation of traversal algorithms.

PRACTICALS

1. Write a program for Linear search methods.
2. Write a program for Binary search methods.
3. Write a program for insertion sort, selection sort and bubble sort.
4. Write a program to implement Stack and its operation.
5. Write a program for quick sort.
6. Write a program for merge sort.
7. Write a program to implement Queue and its operation.
8. Write a program to implement Circular Queue and its operation.
9. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
10. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.

11. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.

DIGITAL ELECTRONICS LABORATORY

Subject Code-	**L T P C**	**Duration – 30hrs**
BITES1-305	**0 0 21**	

COURSE OUTCOMES

CO1 To Familiarization with Digital Trainer Kit and associated equipment.
CO2 To Study and design of TTL gates
CO3 To learn the formal procedures for the analysis and design of combinational circuits.
CO4 To learn the formal procedures for the analysis and design of sequential circuits
PRACTICALS: Implementation all experiments with help of Bread- Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates. 13 13 Punjab Technical University B.Tech. Computer Science Engineering (CSE)
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder using IC74153 chip.
7. Demultiplexer: Truth-table verification and realization of Halfsubtractor and Full subtractor using IC74139 chip.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF using IC7476 chip.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 & IC7493 chip.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 & IC74193 chip.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.
12. DAC Operation: Study of 8-bit DAC (IC 08/0800 chip), obtain staircase waveform using IC7493 chip.
13. ADC Operations: Study of 8-bit ADC.

IT WORKSHOP (SciLab / MATLAB) LABORATORY

Subject Code-	**L T P C**	**Duration – 60hrs**
BITES1-306	**00 4 2**	

Following experiments to be conducted using Sci Labs / MATLAB

1. Introduction to Sci Labs / MATLAB environment and types of Sci Labs / MATLAB files.
2. Use of help command to get help about different inbuilt functions.
3. Write a program to show the output of various unary and binary operators.
4. Write programs for Matrix Manipulations, (reshaping matrices, expanding matrix size, appending or deleting a row/column to a matrix, concatenation of matrices).
5. Write programs which demonstrate the use special matrices.
6. Write programs to show output for various matrix and array operations.
7. Write programs for demonstrating the use for various control statements.

8. Write a MATLAB code for computing factorial of a number n. Assume n is already defined. The code should return a scalar, not a vector.
9. Write programs using functions and plot results.

*other programs related to some application area may also be done

TRAINING-1

Subject Code-	**L T P C**	**Duration – 4 WEEKS**
BITES1-307	**0 0 0 3**	

Training after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/Design/ Innovation/ Business Completion/ Technical Expos etc.

DEVELOPMENT OF SOCIETIES

Subject Code-	**L T P C**	**Duration – 45hrs**
BHSMC0-007	**3 0 0 3**	

COURSE OBJECTIVE:

This is one of the foundation courses of Humanities (in Foundation Area 1). It is envisaged that this course will provide a natural link between engineering and humanities with an emphasis that Development is not just materialistic, larger view of all round human development should also be considered. Importance of sustainable development, inter-dependence and co-existence in nature should be realised through this course. It is to gain an understanding of alternative models of development**.**

UNIT-I (11hrs)

Social Development: Concepts behind the origin of Family, Clan and Society, Different Social Systems, Relation between Human being and Society, Comparative studies on different models of Social Structures and their evolution

UNIT-II (11hrs)

Political Development: Ideas of Political Systems as learnt from History, Different models of Governing system and their comparative study

UNIT-III(23hrs)

Economic Development: Birth of Capitalism, Socialism, Marxism, Concept of development in pre-British, British and post British period- Barter, Jajmani, Idea of development in current context., E. F. Schumacher's idea of development, Buddhist economics. Gandhian idea of development.Swaraj and Decentralization.

RECOMMENDED BOOKS:

3.1 TEXTBOOK:

1. 'Indian Society' by Dr S.K Jena & B.N Mohanty
2. 'Indian Society' by C.N Shankar Rao
3. 'Foundations of Political Science, Indian Constitution & Government' by GulshanRai, SomNathVerma& Suresh Kumar

3.2 *REFERENCE BOOKS:

1. 'The Interpretation of Cultures: Selected Essays' by Geertz & Clifford. 1973, New York
2. 'Dictionary of Modern Sociology Hoult' by Thomas Ford, ed. 1969) Totowa, New Jersey, United States: Littlefield, Adams & Co.
3. 'Sociology –In a Changing Society' by William Korblum
4. 'The Origin of Humankind' by Leakey, Richard 1996, New York Basic Books

4. OTHER SESSIONS

4.1 *TUTORIALS:

4.2 *LABORATORY:

4.3 *PROJECT: Possible projects in this course could be

a) Interact with local communities and understand their issues.

b) Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.

c) Evaluation of technology in the context of its application. Social impact of technology. Environmental impact of technology. Evaluation from a holistic perspective.

DISCRETE MATHEMATICS

Subject Code-BMATH1-401	**L T P C** **3 1 0 4**	**Duration – 60 hrs.**

COURSE OBJECTIVE

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 For a given logic sentence express it in terms of predicates, quantifiers, and logicalconnectives

CO2 For a given a problem, derive the solution using deductive logic and prove the solutionbased on logical inference

CO3 For a given a mathematical problem, classify its algebraic structure

CO4 Evaluate Boolean functions and simplify expressions using the properties of BooleanAlgebra

CO5 Develop the given problem as graph networks and solve with techniques of graphtheory**.**

COURSE CONTENTS

UNIT-I (12hrs)

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products,Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sumand Product of Functions, Bijective functions, Inverse and Composite Function, Size of aSet, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argumentand The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursivedefinition, The Division algorithm: Prime Numbers, The Greatest Common Divisor:Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT-II (11hrs)

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation andcombination.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives andTruth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules ofInference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and

Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof ofNecessity and Sufficiency.

UNIT-III (11 hrs)

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation,Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free andCyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups,Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields.Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality,Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT-IV (11 hrs)

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle,Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring mapsand Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph,definition properties and Example, rooted trees, trees and sorting, weighted trees andprefix codes, Bi-connected component and Articulation Points, Shortest distances.

RECOMMENDED BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, WadsworthPublishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

SUGGESTED REFERENCE BOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application toComputer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

COMPUTER ORGANIZATION & ARCHITECTURE

Subject Code-	**L T P C**	**Duration – 45hrs**
BITES1-401	**3 0 0 3**	

COURSE OBJECTIVE

To expose the students to the following:
1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

COURSE CONTENT

UNIT-I (11 hrs)

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.Instruction set architecture of a CPU–registers, instruction execution cycle, RTLinterpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating pointrepresentations, character representation. Computer arithmetic – integer addition andsubtraction, ripple carry adder, carry look ahead adder etc. multiplication shift and add.

UNIT-II (12 hrs)

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches.

Memory system design: semiconductor memory technologies, memory organization.

UNIT-III (11 hrs)

Peripheral devices and their characteristics: Input-output subsystems, I/O deviceinterface, I/O transfers–program controlled, interrupt driven and DMA, software interrupts and exceptions. Programs andprocesses–role of interrupts in process state transitions.

UNIT-IV (11 hrs)

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors.

Memory organization: Memory interleaving, concept of hierarchical memory organization,cache memory, cache size vs. block size, mapping,replacement algorithms.

RECOMMENDED BOOKS:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

SUGGESTED REFERENCE BOOKS:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

COURSE OUTCOMES

CO1 Draw the functional block diagram of a single bus architecture of a computer anddescribe the function of the instruction execution cycle, RTL interpretation ofinstructions, addressing modes, instruction set.

CO2 Write assembly language program for specified microprocessor for computing16 bit multiplication, division and I/O device interface (ADC, Control circuit, serialport communication).

CO3 Write a flowchart for Concurrent access to memory and cache coherency in ParallelProcessors and describe the process.

CO4 Given a CPU organization and instruction, design a memory module and analyze itsoperation by interfacing with the CPU.

CO5 Given a CPU organization, assess its performance, and apply design techniques toenhance performance using pipelining, parallelism and RISC methodology

OPERATING SYSTEMS

Subject Code-	**L T P C**	**Duration – 45hrs**
BITES1-402	**3 1 0 4**	

COURSE OBJECTIVE

To learn the fundamentals of Operating Systems.

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 Create processes and threads.

CO2 Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

CO3 For a given specification of memory organization develop the techniques foroptimally allocating memory to processes by increasing memory utilization andfor improving the access time.

CO4 Design and implement file management system and For a given I/O devices and OS (specify) develop the I/O management functions in OSas part of a uniform device abstraction by performing operations for synchronizationbetween CPU and I/O controllers.

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Concept of Operating Systems, Generations of Operating systems, Typesof Operating Systems, OS Services, System Calls, Structure of an OS-Layered,Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study onUNIX and WINDOWS Operating System.

UNIT-II (12 hrs)

Processes: Definition, Process Relationship, Different states of a Process, Process Statetransitions, Process Control Block (PCB), Context switching

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, **Scheduling criteria:** CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessorscheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

UNIT-III (11 hrs)

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, DeadlockPrevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memoryallocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation -Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging,Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC),Not recently used (NRU) and Least Recently used (LRU).

UNIT-IV (11 hrs)

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked,indexed), Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Diskreliability, Disk formatting, Boot-block, Bad blocks

RECOMMENDED BOOKS

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

SUGGESTED REFERENCE BOOKS:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

OBJECT ORIENTED PROGRAMMING

Subject Code- BITES1-403	L T P C 3 1 0 4	Duration – 45hrs

COURSE OBJECTIVE

To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System

COURSE OUTCOME

CO1 To introduce the basic concepts of object oriented programming language and its representation

CO2 To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.
CO3 To introduce polymorphism, interface design and overloading of operator.
CO4 To handle backup system using file, general purpose template and handling of raised exception during programming

COURSE CONTENT

UNIT-I (11 hrs)

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.
Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

UNIT-II (12 hrs)

This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,
Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance

UNIT-III (11 hrs)

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding
Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.
Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception.

UNIT-IV (11 hrs)

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.
Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates
Introduction: design patterns, Classifications
Introduction: model- view- controller pattern

RECOMMENDED BOOKS:

4. Robert Lafore, 'Object Oriented Programming in Turbo C++',2nd Ed., The WAITE Group Press, **1994**.
5. Herbert shield, 'The complete reference C ++', 4th Ed., Tata McGraw Hill, **2003**.
6. Shukla, 'Object Oriented Programming in C++', Wiley India, 2008.
7. H M Deitel and P J Deitel, 'C++ How to Program',2nd Ed., Prentice Hall, **1998**.
8. D Ravichandran, 'Programming with C++', 3rd Ed., Tata McGraw Hill, **2003**.
9. BjarneStroustrup, 'The C++ Programming Language',4th Ed.,Addison Wesley,**2013**.
10. R. S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House, **2016**.

OPERATING SYSTEMS LABORATORY

Subject Code- -	L T P C	Duration – 30hrs
BITES1-404	0 0 2 1	

1. Installation Process of various operating systems

2. Virtualization, Installation of Virtual Machine Software and installation of Operating System on Virtual Machine
3. Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in linux, connecting processes with pipes, background processing, managing multiple processes. Manual help. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file. File related commands ws, sat, cut, grep.
4. Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shellvariables, shell keywords, creating shell programs for automate system tasks, report printing.

OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Subject Code-	**L T P C**	**Duration – 60hrs**
BITES1-405	**0 0 4 2**	

PRACTICALS

1. Classes and Objects- Write a program that uses a class where the member functions are defined inside a class.
2. Classes and Objects- Write a program that uses a class where the member functions are defined outside a class.
3. Classes and Objects- Write a program to demonstrate the use of static data members.
4. Classes and Objects- Write a program to demonstrate the use of const data members.
5. Constructors and Destructors- Write a program to demonstrate the use of zero argument and parameterized constructors.
6. Constructors and Destructors- Write a program to demonstrate the use of explicit constructor.
7. Initializer Lists- Write a program to demonstrate the use of initializer list.
8. Operator Overloading- Write a program to demonstrate the overloading of increment and decrement operators.
9. Operator Overloading- Write a program to demonstrate the overloading of binary arithmetic operators.
10. Typecasting- Write a program to demonstrate the typecasting of basic type to class type.
11. Typecasting- Write a program to demonstrate the typecasting of class type to basic type.
12. Typecasting- Write a program to demonstrate the typecasting of class type to class type.
13. Inheritance- Write a program to demonstrate the multilevel inheritance

ORGANIZATIONAL BEHAVIOR

Subject Code-	**L T P C**	**Duration – 40hrs**
BHSMC0-016	**3 0 0 3**	

Course Objectives: The course aims to provide an understanding of basic concepts, theories and techniques in the field of human behaviour at the individual, group and organizational levels in the changing global scenario. The course must be taught using case study method.

UNIT-I (10 Hrs)

Organizational Behaviour: Concepts, Theories and organization aspects of OB, Contributing Disciplines to OB, challenges and opportunities for OB. Foundations of Individual Behaviour: Biographical Characteristics, Course, Theories of Course, Attitudes, Attitude Change, Values & Believes, Prejudices Personality: Determinants of Personality, Perception, Attribution Theory, Person's Perception.

UNIT-II (10 Hrs)

Motivation: Definition & Process, Early Theories of Motivation, Contemporary Theories of Motivation, Nature and process of Motivation, Application of Motivation Concept. Job Satisfaction: Nature & Significance of Job satisfaction. Leadership: Nature Significance & Theories; Leadership Effectiveness Model; Leadership Traits & Skills; Behavioural Styles in Leadership. Transactional Analysis, Life Position, Johari Window Model.

UNIT-III (10 Hrs)

Foundations of Group Behaviour: Nature & Concept of Group Formation, Stages of Group Formation, Theories of Group Formation. Teams, Difference between Group and Team Group Decision Making: Meaning & Nature, Decision Making Process; Decision Making Styles; Advantages & disadvantages of Decision Making; Techniques of Decision Making; Group Size & Decision Making.

UNIT-IV (10 Hrs)

Organizational Change & Development: Meaning & Definition, Change Agents, Change Models, Resistance to Change. Power and Politics in Organization: Nature & Concepts, Sources & Types of Power, Techniques of Politics. Stress Management: Meaning and Concept of Stress, Stress in Organizations

Recommended Books

1. Robbins, 'Organization Behavior', Pearson Education.
2. Luthans, Organization Behavior', Tata McGraw Hill.
3. Hersey, 'Management of Organizational Behavior', Prentice Hall India.
4. Aswathappa, 'Organization Behavior', Himalaya Publications.
5. L.M. Prasad, 'Organization Behavior', Sultan Chand & Sons
6. Parikh, Gupta, 'Organizational Behavior', Tata McGraw Hill

DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code- BCSES1-504	L T P C 3 1 0 4	Duration – 45hrs

COURSE OBJECTIVE

To learn the fundamentals of Design and Analusis of Algorithms.
1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.

5. Synthesize efficient algorithms in common engineering design situations.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 For a given algorithms analyze worst-case running times of algorithms based onasymptotic analysis and justify the correctness of algorithms.

CO2 Describe the greedy paradigm and explain when an algorithmic design situation callsfor it. For a given problem develop the greedy algorithms.

CO3 Describe the divide-and-conquer paradigm and explain when an algorithmic designsituation calls for it. Synthesize divide-and-conquer algorithms. Derive and solverecurrence relation.

CO4 Describe the dynamic-programming paradigm and explain when an algorithmicdesign situation calls for it. For a given problems of dynamic-programming anddevelop the dynamic programming algorithms, and analyze it to determine itscomputational complexity.

CO5 For a given model engineering problem model it using graph and write thecorresponding algorithm to solve the problems.

CO6 Explain the ways to analyze randomized algorithms (expected running time,probability of error).

CO7 Explain what an approximation algorithm is. Compute the approximation factorof an approximation algorithm (PTAS and FPTAS).

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis ofcomplexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms throughrecurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT-II (12 hrs)

Fundamental Algorithmic Strategies: Brute-Force, Greedy,Dynamic Programming, Branchand-Bound and Backtracking methodologies for the design of algorithms; Illustrationsof these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.

UNIT-III (11 hrs)

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems andReduction techniques.

UNIT-IV (11 hrs)

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

RECOMMENDED BOOKS

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

SUGGESTED REFERENCE BOOKS:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.

3. Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

DESIGN & ANALYSIS OF ALGORITHMS LABORATORY

Subject Code- - BCSES1-506	**L T P C 0 0 21**	**Duration – 30hrs**

COURSE OBJECTIVE

To get a first-hand experience of implementing well-known algorithms in a high-level language.To be able to compare the practical performance of different algorithms for the same problem.

COURSE OUTCOMES

PRACTICALS

1. Code and analyze to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyze to find the median element in an array of integers.
3. Code and analyze to find the majority element in an array of integers.
4. Code and analyze to sort an array of integers using Heap sort.
5. Code and analyze to sort an array of integers using Merge sort.
6. Code and analyze to sort an array of integers using Quick sort.
7. Code and analyze Knapsack problem using dynamic programming
8. Code and analyze to find the shortest path for single source shortest path using dynamic programming.
9. Code and analyze to find the shortest path for All pair shortest path using dynamic programming.
10. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as to find the topological sort of a directed acyclic graph.
11. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as (i) to find connected components of an undirected graph, OR (ii) to check whether a given graph is bipartite.
12. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
13. Code and analyze to find all occurrences of a pattern P in a given string S using KMP Method
14. Code and analyze to compute the convex hull of a set of points in the plane.

TRAINING –II

Subject Code- BCSES1-507	**L T P C 0 0 0 4**	**Duration – 6-8 WEEKS**

During the summer vacation after 4th, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

TRAINING- III

Subject Code-	**L T P C**	**Duration – 6-8 WEEKS**

BCSES1-702 0 0 0 4

During the summer vacation after 6th, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

B.Tech. IT (3rd SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMATH1-301	Calculus and Ordinary Differential Equation	3	0	0	40	60	100	3
BITES1-301	Computer Peripherals & Interfaces	3	0	0	40	60	100	3
BITES1-302	Data structure & Algorithms	3	1	0	40	60	100	4
BITES1-303	Digital Electronics	3	1	0	40	60	100	4
BITES1-304	Data structure & Algorithms Laboratory	0	0	4	60	40	100	2
BITES1-305	Digital Electronics Laboratory	0	0	2	60	40	100	1
BITES1-306	IT Workshop (SciLab / MATLAB) Laboratory	0	0	4	60	40	100	2
BITES1-307	Training-I*	-	-	-	60	40	100	3
BHSMC0-007	Development of Societies	3	0	0	40	60	100	3
Total 5 Theory & 3 Lab. Courses		**15**	**2**	**10**	**440**	**460**	**900**	**25**

***NOTE:** Training after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/Design/ Innovation/ Business Completion/ Technical Expos etc.

B.Tech. IT (4th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMATH1-401	Discrete Mathematics	3	1	0	40	60	100	4
BITES1-401	Computer Organization & Architecture	3	0	0	40	60	100	3
BITES1-402	Operating Systems	3	1	0	40	60	100	4
BITES1-403	Object Oriented Programming	3	1	0	40	60	100	4
BITES1-404	Operating Systems Laboratory	0	0	2	60	40	100	1
BITES1-405	Object Oriented Programming Laboratory	0	0	4	60	40	100	2
BHSMC0-016	Organizational Behaviour	3	0	0	40	60	100	3
Total 5 Theory & 2 Lab. Courses		**15**	**3**	**06**	**320**	**380**	**700**	**21**

COMPUTER PERIPHERALS & INTERFACES

Subject Code- BITES1-301 **L T P C 3 0 0 3** **Duration – 45 hrs.**

COURSE OBJECTIVCE

To learn the functional and operational details of various peripheral devices.

COURSE CONTENT

UNIT I

SYSTEM RESOURCES: Interrupt, DMA Channel, I/O Port Addresses and resolving and resolving the conflict of resources. I/O buses- ISA, EISA, Local bus, VESA Local bus, PCI bus, PCI Express, Accelerated graphics port bus.

IDE & SCSI Interfaces: IDE origin, IDE Interface ATA standards. ATA feature, ATA RAID and SCSI RAID, SCSI Cable and pin Connector pin outs SCSI V/s IDE Advantages and limitation, SATA, SSD drives.

UNIT II

Video Hardware: Video display technologies, DVI Digital signals for CRT Monitor, LCD, LED, OLED Panels, Video adapter types, Integrated Video/ Motherboard chipset, Video RAM, Video driver and multiple Monitor, Graphic accelerators. Advanced 3D Technologies, TV Tuner and Video Capture upgrades troubleshooting Video Cards and Drivers.

UNIT III

I/O Interfaces: I/O Interfaces from USB1.0, 2.0, 3.0, lighting port, I/O Interface from serial, Parallel to SCSI converter. Testing of serial andparallel port, USB Mouse/ Keyboard Interfaces like HDMI

Input/ Output Driver software aspects: Role of device driver DOS and UNIX/ LINUX device drivers.

UNIT IV

Design & Integration of Peripheral devices to a computer system as a Case Study

Future Trends: Detailed Analysis of recent Progress in the Peripheral devices. Some aspects of cost Performance analysis and applications of latest digital devices like WiFi-LED projectors, HDMI devices, wireless printers and other devices

RECOMMENDED BOOKS

1. Douglas V. Hall,"Microprocessors and Interfacing", Tata McGraw Hill 2006.
2. Barry B. Brey & C.R.Sarma, "The intel microprocessors," Pearson 2003.
3. P. Pal Chandhari, "Computer Organization and design" Prentice Hall of India Pvt. Ltd, 1994.
4. Del Corso, H.Kirrman, JD Nicond "Microcomputer buses & links" Academic Press 1986.

DATA STRUCTURE & ALGORITHMS

Subject Code- BITES1-302 **L T P C 3 1 0 4** **Duration – 45 hrs**

COURSE OBJECTIVE

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques.
3. To understand basic concepts about stacks, queues, lists, trees and graphs

4. To enable them to write algorithms for solving problems with the help of fundamental data structures

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT-II (12 hrs)

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT-III (11 hrs)

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search trees, Binary Search Tree, Tree operations on each of the trees and their algorithms with complexity analysis. Introduction to B Tree, B+ Tree and AVL Tree

UNIT-IV (11 hrs)

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

RECOMMENDED BOOKS:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

SUGGESTED REFERENCE BOOKS:

2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
3. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

COURSE OUTCOMES

CO1 For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2 For a given Search problem (Linear Search and Binary Search) student will able to implement it.

CO3 For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.

CO4 Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

CO5 Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

DIGITAL ELECTRONICS

Subject Code- BITES1-303	**L T P C 3 1 0 4**	**Duration – 45 hrs**

COURSE OBJECTIVE

To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 Understand working of logic families and logic gates.

CO2 Design and implement Combinational and Sequential logiccircuits.

CO3 Understand the process of Analog to Digital conversion and Digital to Analog conversion.

CO4 Be able to use PLDs to implement the given logical problem.

COURSE CONTENT

UNIT-I (11 hrs)

Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT-II (12 hrs)

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT-III (11 hrs)

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using Voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

UNIT-IV (11 hrs)

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

RECOMMENDED BOOKS

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Calculus and Ordinary Differential Equation

Subject Code- BMATH1-301	-	L T P C 3 0 0 3	Duration – 45 hrs

COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

COURSE OUTCOME

CO1 To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.

CO2 The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

COURSE CONTENT

UNIT-I (12 hrs)

Sequences and Series: Basic concept of Convergence, tests for convergence, power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions.

Multivariable Calculus: Partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers.

UNIT-II (11 hrs)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables, Theorems of Green, Gauss and Stokes (without proof), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-III(11 hrs)

First order ordinary differential equations: Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

UNIT-IV (11 hrs)

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

RECOMMENDED BOOKS

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
6. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
7. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

DATA STRUCTURE & ALGORITHMS LABORATORY

Subject Code- BITES1-304	L T P C 0 0 4 2	Duration – 60 hrs

COURSE OUTCOMES

CO1 To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.

CO2 To introduce the structured data types like Stacks and Queue and its basic operation's implementation

CO3 To introduces dynamic implementation of linked list

CO4 To introduce the concepts of Tree and graph and implementation of traversal algorithms.

PRACTICALS

1. Write a program for Linear search methods.
2. Write a program for Binary search methods.
3. Write a program for insertion sort, selection sort and bubble sort.
4. Write a program to implement Stack and its operation.
5. Write a program for quick sort.
6. Write a program for merge sort.
7. Write a program to implement Queue and its operation.
8. Write a program to implement Circular Queue and its operation.
9. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
10. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.

DIGITAL ELECTRONICS LABORATORY

Subject Code-	**L T P C**	**Duration – 30 hrs**
BITES1-305	**0 0 2 1**	

COURSE OUTCOMES

CO1 To Familiarization with Digital Trainer Kit and associated equipment.
CO2 To Study and design of TTL gates
CO3 To learn the formal procedures for the analysis and design of combinational circuits.
CO4 To learn the formal procedures for the analysis and design of sequential circuits

PRACTICALS: Implementation all experiments with help of Bread- Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates. 13 13 Punjab Technical University B.Tech. Computer Science Engineering (CSE)
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder using IC74153 chip.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using IC74139 chip.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF using IC7476 chip.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 & IC7493 chip.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 & IC74193 chip.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.
12. DAC Operation: Study of 8-bit DAC (IC 08/0800 chip), obtain staircase waveform using IC7493 chip.
13. ADC Operations: Study of 8-bit ADC.

IT WORKSHOP (SciLab / MATLAB) LABORATORY

Subject Code-	**L T P C**	**Duration – 60 hrs**
BITES1-306	**0 0 4 2**	

Following experiments to be conducted using Sci Labs / MATLAB

1. Introduction to Sci Labs / MATLAB environment and types of Sci Labs / MATLAB files.
2. Use of help command to get help about different inbuilt functions.
3. Write a program to show the output of various unary and binary operators.
4. Write programs for Matrix Manipulations, (reshaping matrices, expanding matrix size, appending or deleting a row/column to a matrix, concatenation of matrices).
5. Write programs which demonstrate the use special matrices.
6. Write programs to show output for various matrix and array operations.
7. Write programs for demonstrating the use for various control statements.
8. Write a MATLAB code for computing factorial of a number n. Assume n is already defined. The code should return a scalar, not a vector.
9. Write programs using functions and plot results.

*other programs related to some application area may also be done

HUMANITIES (DEVELOPMENT OF SOCIETIES)

Subject Code- BHSMC0-007	**L T P C 3 0 0 3**	**Duration – 45 hrs**

COURSE OBJECTIVE:

This is one of the foundation courses of Humanities (in Foundation Area 1). It is envisaged that this course will provide a natural link between engineering and humanities with an emphasis that Development is not just materialistic, larger view of all round human development should also be considered. Importance of sustainable development, inter-dependence and co-existence in nature should be realised through this course. It is to gain an understanding of alternative models of development**.**

UNIT-I (12 hrs)

Social Development: Concepts behind the origin of Family, Clan and Society, Different Social Systems, Relation between Human being and Society, Comparative studies on different models of Social Structures and their evolution

UNIT-II (11 hrs)

Political Development: Ideas of Political Systems as learnt from History, Different models of Governing system and their comparative study

UNIT-III(11 hrs)

Economic Development: Birth of Capitalism, Socialism, Marxism, Concept of development in pre-British, British and post British period- Barter, Jajmani, Idea of development in current context., E. F. Schumacher's idea of development, Buddhist economics. Gandhian idea of development. Swaraj and Decentralization.

DISCRETE MATHEMATICS

Subject Code- BMATH1-401	**L T P C 3 1 0 4**	**Duration – 60 hrs.**

COURSE OBJECTIVE

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives

CO2 For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference

CO3 For a given a mathematical problem, classify its algebraic structure

CO4 Evaluate Boolean functions and simplify expressions using the properties of Boolean Algebra

CO5 Develop the given problem as graph networks and solve with techniques of graph theory**.**

COURSE CONTENTS

UNIT-I (12 hrs)

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT-II (11 hrs)

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT-III (11 hrs)

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT-IV (11 hrs)

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

RECOMMENDED BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

SUGGESTED REFERENCE BOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It’s Application to Computer Science”, TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum’s Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

COMPUTER ORGANIZATION & ARCHITECTURE

Subject Code-	**L T P C**	**Duration – 45 hrs**
BITES1-401	**3 0 0 3**	

COURSE OBJECTIVE

To expose the students to the following:

1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

COURSE CONTENT

UNIT-I (11 hrs)

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look ahead adder etc. multiplication shift and add.

UNIT-II (12 hrs)

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches.

Memory system design: semiconductor memory technologies, memory organization.

UNIT-III (11 hrs)

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions.

UNIT-IV (11 hrs)

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping, replacement algorithms.

RECOMMENDED BOOKS:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

SUGGESTED REFERENCE BOOKS:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

COURSE OUTCOMES

CO1 Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

CO2 Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).

CO3 Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

CO4 Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.

CO5 Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

OPERATING SYSTEMS

Subject Code-	L T P C	Duration – 45 hrs
BITES1-402	3 1 0 4	

COURSE OBJECTIVE

To learn the fundamentals of Operating Systems.

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 Create processes and threads.

CO2 Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

CO3 For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4 Design and implement file management system and For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

UNIT-II (12 hrs)

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, **Scheduling criteria:** CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

UNIT-III (11 hrs)

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation - Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT-IV (11 hrs)

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

RECOMMENDED BOOKS

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

SUGGESTED REFERENCE BOOKS:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

OBJECT ORIENTED PROGRAMMING

Subject Code-	**L T P C**	**Duration – 36 hrs**
BITES1-403	**3 1 0 4**	

COURSE OBJECTIVE

To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System

COURSE OUTCOME

CO1 To introduce the basic concepts of object oriented programming language and its representation

CO2 To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.

CO3 To introduce polymorphism, interface design and overloading of operator.

CO4 To handle backup system using file, general purpose template and handling of raised exception during programming

COURSE CONTENT

UNIT-I (11 hrs)

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

UNIT-II (12 hrs)

This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,

Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance

UNIT-III (11 hrs)

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception.

UNIT-IV (11 hrs)

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates

Introduction: design patterns, Classifications

Introduction: model- view- controller pattern

RECOMMENDED BOOKS:

4. Robert Lafore, 'Object Oriented Programming in Turbo C++', 2nd Ed., The WAITE Group Press, **1994**.
5. Herbert shield, 'The complete reference C ++', 4th Ed., Tata McGraw Hill, **2003**.
6. Shukla, 'Object Oriented Programming in C++', Wiley India, 2008.
7. H M Deitel and P J Deitel, 'C++ How to Program', 2nd Ed., Prentice Hall, **1998**.
8. D Ravichandran, 'Programming with C++', 3rd Ed., Tata McGraw Hill, **2003**.
9. Bjarne Stroustrup, 'The C++ Programming Language', 4th Ed., Addison Wesley,**2013**.
10. R. S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House, **2016**.

OPERATING SYSTEMS LABORATORY

Subject Code- - BITES1-404	**L T P C 0 0 2 1**	**Duration – 30 hrs**

1. Installation Process of various operating systems
2. Virtualization, Installation of Virtual Machine Software and installation of Operating System on Virtual Machine
3. Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in linux, connecting processes with pipes, background processing, managing multiple processes. Manual help. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file. File related commands ws, sat, cut, grep.
4. Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks, report printing.

OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Subject Code- BITES1-405	**L T P C 0 0 4 2**	**Duration – 30 hrs**

PRACTICALS
1. Classes and Objects- Write a program that uses a class where the member functions are defined inside a class.
2. Classes and Objects- Write a program that uses a class where the member functions are defined outside a class.
3. Classes and Objects- Write a program to demonstrate the use of static data members.
4. Classes and Objects- Write a program to demonstrate the use of const data members.
5. Constructors and Destructors- Write a program to demonstrate the use of zero argument and parameterized constructors.
6. Constructors and Destructors- Write a program to demonstrate the use of explicit constructor.
7. Initializer Lists- Write a program to demonstrate the use of initializer list.
8. Operator Overloading- Write a program to demonstrate the overloading of increment and decrement operators.
9. Operator Overloading- Write a program to demonstrate the overloading of binary arithmetic operators.
10. Typecasting- Write a program to demonstrate the typecasting of basic type to class type.
11. Typecasting- Write a program to demonstrate the typecasting of class type to basic type.
12. Typecasting- Write a program to demonstrate the typecasting of class type to class type.
13. Inheritance- Write a program to demonstrate the multilevel inheritance

MANAGEMENT –I (ORGANIZATIONAL BEHAVIOR/FINANCE & ACCOUNTING)

Subject Code- MBADM1-101	**L T P C 3 0 0 3**	**Duration – 40hrs**

Course Objectives: The course aims to provide an understanding of basic concepts, theories and techniques in the field of human behaviour at the individual, group and organizational levels in the changing global scenario. The course must be taught using case study method.

UNIT-I (10 Hrs)

Organizational Behaviour: Concepts, Theories and organization aspects of OB, Contributing Disciplines to OB, challenges and opportunities for OB. Foundations of Individual Behaviour: Biographical Characteristics, Course, Theories of Course, Attitudes, Attitude Change, Values & Believes, Prejudices Personality: Determinants of Personality, Perception, Attribution Theory, Person's Perception.

UNIT-II (10 Hrs)

Motivation: Definition & Process, Early Theories of Motivation, Contemporary Theories of Motivation, Nature and process of Motivation, Application of Motivation Concept. Job Satisfaction: Nature & Significance of Job satisfaction. Leadership: Nature Significance & Theories; Leadership Effectiveness Model; Leadership Traits & Skills; Behavioural Styles in Leadership. Transactional Analysis, Life Position, Johari Window Model.

UNIT-III (10 Hrs)

Foundations of Group Behaviour: Nature & Concept of Group Formation, Stages of Group Formation, Theories of Group Formation. Teams, Difference between Group and Team Group Decision Making: Meaning & Nature, Decision Making Process; Decision Making Styles; Advantages & disadvantages of Decision Making; Techniques of Decision Making; Group Size & Decision Making.

UNIT-IV (10 Hrs)

Organizational Change & Development: Meaning & Definition, Change Agents, Change Models, Resistance to Change. Power and Politics in Organization: Nature & Concepts, Sources & Types of Power, Techniques of Politics. Stress Management: Meaning and Concept of Stress, Stress in Organizations

Recommended Books

1. Robbins, 'Organization Behavior', Pearson Education.
2. Luthans, Organization Behavior', Tata McGraw Hill.
3. Hersey, 'Management of Organizational Behavior', Prentice Hall India.
4. Aswathappa, 'Organization Behavior', Himalaya Publications.
5. L.M. Prasad, 'Organization Behavior', Sultan Chand & Sons
6. Parikh, Gupta, 'Organizational Behavior', Tata McGraw Hill

DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code-	**L T P C**	**Duration – 45 hrs**
BCSES1-504	**3 1 0 4**	

COURSE OBJECTIVE

To learn the fundamentals of Design and Analusis of Algorithms.

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

CO2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

CO3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

CO4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

CO5 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

CO6 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

CO7 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

COURSE CONTENT

UNIT-I (11 hrs)

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT-II (12 hrs)

Fundamental Algorithmic Strategies: Brute-Force, Greedy,Dynamic Programming, Branchand- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

UNIT-III (11 hrs)

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

UNIT-IV (11 hrs)

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

RECOMMENDED BOOKS

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

SUGGESTED REFERENCE BOOKS:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

DESIGN & ANALYSIS OF ALGORITHMS LABORATORY

Subject Code- -	**L T P C**	**Duration – 30 hrs**
BCSES1-505	**0 0 4 2**	

COURSE OBJECTIVE

To get a first-hand experience of implementing well-known algorithms in a high-level language. To be able to compare the practical performance of different algorithms for the same problem.

COURSE OUTCOMES

PRACTICALS

1. Code and analyze to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyze to find the median element in an array of integers.
3. Code and analyze to find the majority element in an array of integers.
4. Code and analyze to sort an array of integers using Heap sort.
5. Code and analyze to sort an array of integers using Merge sort.
6. Code and analyze to sort an array of integers using Quick sort.
7. Code and analyze Knapsack problem using dynamic programming
8. Code and analyze to find the shortest path for single source shortest path using dynamic programming.
9. Code and analyze to find the shortest path for All pair shortest path using dynamic programming.
10. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as to find the topological sort of a directed acyclic graph.
11. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as (i) to find connected components of an undirected graph, OR (ii) to check whether a given graph is bipartite.
12. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
13. Code and analyze to find all occurrences of a pattern P in a given string S using KMP Method
14. Code and analyze to compute the convex hull of a set of points in the plane.

Semester-3		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANE1-301	Fluid Mechanics	3	1	0	40	60	100	4
BANE1-302	Mathematics - III	3	1	0	40	60	100	4
BANE1-303	Introduction To Aeronautics	3	0	0	40	60	100	3
BANE1-304	Aerodynamics - I	3	0	0	40	60	100	3
BANE1-305	Strength of Materials - I	3	0	0	40	60	100	3
BANE1-306	Machine Drawing	1	0	4	40	60	100	3
BANE1-307	Workshop Training Of 4 Weeks duration After 2nd semester	0	0	0	60	40	100	2
BANE1-308	Strength of Materials Lab	0	0	2	60	40	100	1
BANE1-309	Fluid Mechanics Lab	0	0	2	60	40	100	1
Total		**16**	**2**	**8**	**420**	**480**	**900**	**24**

Total Contact Hours=26 **Total Marks=900** **Total Credits=24**

Semester-4		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANE1-410	Numerical Analysis	3	1	0	40	60	100	4
BANE1-411	Thermodynamics	3	1	0	40	60	100	4
BANE1-412	Aircraft Structures - I	3	1	0	40	60	100	4
BANE1-413	Aircraft materials and Processes	3	0	0	40	60	100	3
BANE1-414	Aircraft Propulsion - I	3	0	0	40	60	100	3
BANE1-415	Theory of Machines-1	3	0	0	40	60	100	3
BANE1-416	Aircraft propulsion and Material Processes lab	0	0	2	30	20	50	1
BANE1-417	Aircraft Structure - I Lab	0	0	2	30	20	50	1
Total		**18**	**3**	**4**	**300**	**400**	**700**	**23**

Total Contact Hours=25 **Total Marks=700** **Total Credits=23**

***NOTE:** During the summer vacation after 4th/ 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

Semester-5		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANE1-518	Aircraft Systems and Instrumentation	3	1	0	40	60	100	4
BANE1-519	Aerodynamics - II	3	1	0	40	60	100	4
BANE1-520	Aircraft Structures - II	3	1	0	40	60	100	4
BANE1-521	Aircraft Propulsion - II	3	0	0	40	60	100	3
BANE1-522	Aircraft Performance	3	0	0	40	60	100	3
BANE1-523	Aero Computing Lab	0	0	2	30	20	50	1
BANE1-524	Aircraft Systems Lab	0	0	2	30	20	50	1
BANE1-525	**Industrial Training of 6 weeks undergone after 4th semester(Training-II)**	-	-	-	60	40	100	3
Total		**15**	**3**	**4**	**320**	**380**	**700**	**23**

Total Contact Hours=22 **Total Marks=700** **Total Credits=23**

Semester-6		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANE1-626	Automatic Flight Control	3	1	0	40	60	100	4
BANE1-627	Aircraft Stability and Control	3	1	0	40	60	100	4
BANE1-628	Elements of Spacecraft Engineering	3	1	0	40	60	100	4
BANE1-629	Helicopter Engineering	3	0	0	40	60	100	3
BANE1-630	Elements of Avionics	3	0	0	40	60	100	3
BANE1-631	Wind Tunnel Techniques	3	0	0	40	60	100	3
BANE1-632	Aeromodelling and Design Lab	0	0	2	30	20	50	1
BANE1-633	Aircraft instrumentation and Measurement lab	0	0	2	30	20	50	1
Total		**18**	**3**	**4**	**300**	**400**	**700**	**23**

Total Contact Hours=25 **Total Marks=900** **Total Credits=23**

Semester-7		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BANE1-734	High Speed Aerodynamics	3	0	0	40	60	100	3
BANE1-735	Aeroelasticity	3	0	0	40	60	100	3
BANE1-736	Airplane Design I	3	0	0	40	60	100	3
BANE1-737	Theory of Elasticity	3	0	0	40	60	100	3
BANE1-738	Project-I	0	0	8	120	80	200	4
BANE1-739	**Training-III**	- -	-	-	60	40	100	4
	Department Elective-I*	3	0	0	40	60	100	3
BANE1-756	Principles of Management and Professional Ethics							
BANE1-757	Viscous Flow Theory							
BANE1-758	Aircraft Maintenance and Air Transportation							
Total		**15**	**0**	**8**	**380**	**420**	**800**	**23**

Total Contact Hours=23 **Total Marks=800** **Total Credits=23**

*One of the Departmental elective subjects to be selected by candidate

Semester-8		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
	Departmental Elective-II	3	1	0	40	60	100	4
BANE1-859	Boundary Layer Theory							
BANE1-860	Advanced Aerodynamics							
BANE1-861	Experimental Aerodynamics							
XXXX	Open Elective-III	3	0	0	40	60	100	3
XXXX	Open Elective--IV	3	0	0	40	60	100	3
BANE1-840	Project-II	0	0	8	60	40	100	4
Total		**9**	**1**	**8**	**180**	**220**	**400**	**14**

Total Contact Hours=18 **Total Marks=400** **Total Credits=14**

NOTE: Choose any one subject for open elective and if studied choose another from rest of them

3rd Semester

BANE1-301 Fluid Mechanics-I

L T P C

3 1 0 4

UNIT – I

1. **Fluid and their properties**: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; capillarity, vapour pressure, compressibility and bulk modulus; Newtonian and non-Newtonian fluids.
2. **Fluid Statics**: Concept of pressure, Pascal's law and its engineering applications, Hydrostatic paradox. Action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, metacentre height and its determination, periodic time of oscillation, pressure distribution in a liquid subjected to constant horizontal/ vertical acceleration, rotation of liquid in a cylindrical container.

UNIT – II

3. **Fluid Kinematics** : Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates.

   Rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net.
4. **Fluid Dynamics** : Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

UNIT – III

6. **Dimensional Analysis and Similitude**: Fundamental and derived units and dimensions, dimensional homogeneity. Rayleigh's and Buckingham's Pi method for dimensional analysis. Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies. Laminar and Turbulent Flows: Flow regimes and Reynlods number, critical velocity and critical Reynolds number, laminar flow in circular cross- section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

UNIT – IV

7. **Flow Measurement**: Manometers, pitot tubes, venturi meter and orifice meters, orifice, mouthpieces,

notches and weirs, rotameter.

Suggested Readings / Books:

- Fluid Mechanics and Fluid Power Engineering by D.S. Kumar : S.K. Kataria and Sons Publishers.
- Mechanics of Fluids by Massey BS; Van Nostrand Reinhold Co.
- Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Poitman
- Fluid Mechanics by Streetes VL and Wylie EB; Mcgraw Hill Book Co.

BANE1-302 MATHEMATICS-III

L T P C
3 1 0 4

UNIT – I

1. **Fourier Series** Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

2. **Laplace Transforms** Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT – II

4. **Special Functions** Power series solution of differential equations, Frobenius method, Legendre' equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation, Error function and its properties.

UNIT – III

5. **Partial Differential Equations** Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficient Applications: Wave equation and Heat conduction equation in one dimension. Two dimensional

Laplace equation, solution by the method of separation of variables. Laplacian in polar coordinates.

UNIT – IV

6. **Functions of Complex Variable** Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions; Conformal Mapping: Mapping of a complex function, conformal mapping, standard transforms, mapping of standard elementary transformations, complex potential, applications to fluid flow problems; Complex Integration : Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions, singular points, poles, residue,

   complex integration using the method of residues, evaluation of real integrals by contour integration.

Suggested Readings / Books:

- Advanced Engineering Mathematics by Kreyszing Erwin ; Wiley Eastern, New Delhi
- Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
- Numerical Solutions of Differential Equations by NK Jain ; Prentice Hall, Delhi.
- Differential Equations by Sharma and Gupta ; Krishna Prakashan Media (P) Ltd., Meerut.

BANE1-303 Introduction to Aeronautics

L T P C

3 0 0 3

UNIT – I

1. Introduction

History of aviation, History of space flight, History of Indian space experience, Pre Wright Brothers era, Wright Flyer, Conventional airplane, progress in airplane design and applications, Current status. Other kinds of heavier than air vehicles, helicopter, VSTOL machines. Symbology of Aerospace : US Deptt of defence Aerospace Vehicle Designation, Vehicle Type Symbol : G-H-Q-S-V-Z; Basic Mission Symbols : A-B-C-E-F-AL-O-P-Q-S-T-U-X; Modified Mission Symbols : A-C,D,E,F,H,K,L,M,O,P,Q,R,S,T,U,V,W; Rocket Symbols : B,M,N,R,S; Manufacturers of Aerospace Vehicle in India-Aircraft, Space Vehicles, Main Aircraft operators in India; Aircraft Certification : Type certification, Airworthiness, CAA, FAA, DGCA, ICAO, Aircraft registration & marking of aircraft registered in India VT-AAA-ZZZ,

VT HAA-HZZ, Introduction to Aircraft Communication System : Air Band Frequencies, Navigation-GPS, Instruments, Aircraft Flight Control System, Manual, Assisted, Stability Augmentation System,

utopilot, Fly by wire. Classification with examples : By flights regime; sub-Sonic, Supersonic, Hypersonic Flights By wing placement; High Wing, Low Wing, Mid Wing, Cruciform (X) Wing;

By Type : Aerostatic, Aerodynamic, FW, RW, Variable sweep, Mixed fixed-Rotary, surface effect vehicles. By Planforms : Rectangular, Elliptical, Delta, Double Delta, Ogive, By stall speed & wing span

: (I-VI) combination (A-III). System of Axes – Motion longitudinal (Roll axis), lateral (Pitch axis), vertical (Yaw axis) (x,y,z), velocity (u, v, w) and acceleration. Angles of rotation – Roll, Pitch, Yaw, Airfoil Nomenclature, Symmetric & Cambered Airfoil, Angle of Attack. Types of Missions ; Fly by, orbiter, atmospheric, lander, penetrator, observatory, Communicator, Aerospace mission of future.

Cockpit definition parts, seats, flight deck central column rudder pedal instrument panel, pedestal panel, side console, overhead panel, glass cockpit, joystick.

UNIT – II

2. Space Vehicles

Missile and its types, space vehicles and its types, reusable space vehicles, space shuttle ,satellites, types of satellites and their functions

3. Airplane Propulsion

Requirement of power to fly, balance of forces, various means of producing power for forward flight., piston engines ,jet propulsion-thrust equation, turbojet, turbofan, ramjet engines. Locations of such engines, Propellor and its use. Rocket engines.

UNIT – III

4. Airplane Structures & Materials

Structural arrangement of the Wright Flyer,. Structural details of landing gear, wing, fuselage and tail planes, functions of ribs, skin, spars, stringers, longerons. Monocoque and semi-monocoque structures,materials for main components

UNIT – IV

5. Control Systems & LEVEL FLIGHT

Various types of flaps, function of rudder, elevator, ailerons, flaprons, elevons, types of tail planes,condition for straight & level flight, flight path angle

Suggested Readings/ Books:

- Fundamentals of Flight Richard S. Shevel , Prentice Hall
- Introduction to flight- John D. Anderson
- Mechanics of flight by A.C. Kermode
- Aircraft Basic Science :Ralph D. Bent & James L. Mackinley
- Jet Aircraft Power Sysytem : Jack V.Casamassa & Ralph D.Bent

BANE1-304 Aerodynamics- I

L T P C

3 0 0 3

UNIT – I

1. **Introduction**

   Fluid statics, pascal's law,Continuum and free molecular flows, invisid and viscous flows, incompressible and compressible flows. Newtonian and Non-Newtonian flows. Pitot static tube,measurement of air-speed, pressure coefficient. Aerodynamic force and moments. Dimensional analysis, non-dimensional parameters, M, Re, Fr etc., flow similarity.

UNIT – II

2. **Description of Fluid Motion**

   Lagrangian and Eulerian methods, Description of properties in a moving fluid, local and material rate of change. Streamlines, Pathlines, Streaklines, Reynolds Transport theorem, Vorticity and circulation. Laws of vortex motion. Translation, rotation and rate of deformation of fluid particles.

3. **Equations of Fluid Motion**

   Equation of conservation of mass for control volume, special form of equation of conservation of mass, differential form of equation of conservation of mass Euler's and Navier-Stoke equations. Derivation of Bernaulli's equation for invisid and viscous flow fields. Momentum equation and angular momentum equation in integral form.

UNIT – III

4. **Invisid-Incompressible Flow**

   Condition on velocity for incompressible flow. Laplace's equations. Potential function, stream function. Basic elementary flows: Uniform flows, source flow, Doublet flow and Vortex flow. Superimposition of elementary flows. Non lifting and lifting flow over a circular cylinder, comparison with real flow over circular cylinder. Kutta-Jaukowski theorem, generation of lift.

5. **Introduction To Viscous Flow**

   Qualitative aspects of viscous flows, viscosity and thermal conductivity. Phenomenon of separation. Navier-Stokes equation; Viscous flow energy equation. Some exact solutions of Navier-Stokes equations: plane Poiseuille flow , Couette flow, Hagen-Poiseuille flow and Hele-Shaw flow

UNIT – IV

6. Introduction To Incompressible Boundary Layer

BL concept, BL properties, derivation of Prandtl's BL equations, Blasius solution, Karman's Integral equation. Turbulent BL over a plate, skin friction drag, BL control.

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Suggested Readings / Books:

- Fundamentals of Aerodynamics: John D.Anderson(Jr.) 2nd Ed.McGraw Hill
- Fluid Mechanics and its Applications: Gupta and Gupta Wiley Eastern ,1960
- Boundary Layer Theory: H.Schlichting 6th Ed. McGraw Hill ,1986
- Fluid Mechanics: Frank M.White 2nd Ed. McGraw Hill,1986
- Foundations of Fluid Mechanics: S.W.Yuan Prentice Hall

BANE1-305 Strength of Materials – I

L T P C
3 0 0 3

UNIT – I

1. **Simple stresses and strains** : Concept of stress and strain; St. Vernants principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stress and strains in bars subjected to axial loading. Modulus of elasticity, stress produced in compound bars subject to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound bars. Compound stress and strains, the two dimensional

system; stress at a point on a plane, principal stresses and principal planes; Mohr's circle of stress; ellipse of stress and their applications. Generalized Hook's Law, principal stresses related to principal strains

UNIT – II

2. **Bending moment and shear force diagrams**: S.F and B.M definitions. BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF and the point of contraflexure under the following loads:
   - **a.** Concentrated loads
   - **b.** Uniformity distributed loads over the whole span or part of span
   - **c.** Combination of concentrated loads (two or three) and uniformly distributed loads
   - **d.** Uniformity varying loads
   - **e.** Application of moments
   - **f.** Relation between rate of loading, shear force and bending moment
3. **Theory of bending stresses in beams due to bending**: assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel, I & T-sections,: Combined direct and bending stresses in aforementioned sections, composite / flitched beams.

UNIT – III

4. **Torsion:** Derivation of torsion equation and its assumptions. Applications of the equation to the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts principal stress and maximum shear stresses under combined loading of bending and torsion, analysis of close-coiled-helical springs.

5. **Thin cylinders and spheres** : Derivation of formulae and calculation of hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume; principal stresses in sphere and change in diameter and internal volume

UNIT – IV

7. **Columns and struts** : Columns and failure of columns : Euler's formuls; Rankine- Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.
8. **Slope and deflection** : Relationship between moment, slope and deflection, Moment area method; method of integration; Macaulay's method: Use of all these methods to calculate slope and deflection for the following :

a) Cantilevers

b) Simply supported beams with or without overhang

c) Under concentrated loads, uniformly distributed loads or combination of concentrated and uniformly distributed loads

Suggested Readings/ Books:

- Strength of Materials by Ferdinand P Singer and Andrew Pytel,Harper and Row H.
- Kogakusha Publishers, New York
- Mechanics of Materials by SI Version, end edition by Ferdinand P. Beer and E
- Russel Johnston (Jr); McGraw Hill, India
- Mechanics of Materials-SI Version 2nd Edition by EP Popov, Prentice Hall India
- Introduction to Solid Mechanics by D.H Shames, Prentice Hall Inc.
- Elements of strength of Materials by Timoshenko and Young
- Strength of Materials by DS Bedi; Khanna book Publishing Company, New Delhi.
- Strength of materials by R.S Lehri and A.S. Lehri, S.K Kataria and Sons.

BANE1-306 Machine Drawing

L T P C

1 0 4 3

UNIT – I

1. Principles of drawing, requirements of production drawing, sectioning and conventional representation, dimensioning, symbols of standard tolerances, machining symbols, Introduction and familiarization of the code IS:296.

UNIT – II

2. FASTENERS : Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints

UNIT – III

4. Assembly and Dis-assembly of the following manually and using computer aided drafting.

   a) Couplings: Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.

   b) Knuckle and cotter joints

   c) Pipe and Pipe fittings: flanged joints, spigot an socket joint, union joint, hydraulic an expansion joint

   d) IC Engine Parts : Piston, connecting rod

   e) Boiler Mountings : steam stop valve, feed check valve, safety valve, blow off cock.

   f) Bearings : swivel bearing, thrust bearing, plummer block, angular plumber block

   g) Miscellaneous : Screw Jack, Drill Press Vice, Crane hook.

Drafting of simple mechanical components on computer.

NOTE :

Drawing Practice is to be done as per IS:296 code.

First angle projection to be used. Drawings should contain bill of materials and should illustrate finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

Suggested Readings/ Books:

- Text-book of Machine Drawing by V Lakshmi Narayanan and Mathur
- Machine Drawing by PS Gill, BD Kataria and Sons, Ludhiana
- Machine Drawing by ND Bhatt, Charotar publications
- Machine Drawing by N Sidheshwar, Tata McGraw Hill

BANE1-308 Strength of Materials Lab

L T P C
0 0 2 1

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.
6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture
9. To perform Torsion test and close coiled helical spring in tension and compression and to determine modulus of rigidity/stiffness
10. Determination of Bucking loads of long columns with different end conditions.

BANE1-309 Fluid Mechanics –I Lab

L T P C
0 0 2 1

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturimeter/ orifice meter)
4. To determine the discharge coefficient for a Vee- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9. To determine the velocity distribution for pipeline flow with a pitot static probe

4th Semester

BANE1-410 Numerical Analysis

L T P C
3 1 0 4

1. **Errors:** Computer arithmetic, Errors in numerical calculations, Absolute, relative and percentage errors, Round off and truncation errors, Error propagation, Loss of significant digits, Errors in series approximation.
2. **Solution Of Equations:** Bisection method, Fixed point iteration and its convergence, Acceleration of convergence using Aitken's method; Regula-Falsi, Newton-Raphson, Generalized Newton's, Chebyshev's and Halley's methods.
3. **Interpolation:** Lagrange Interpolation, Newton's divided difference interpolation, Finite differences, Newton's and Gauss' difference formulae, Spline interpolation.
4. **Numerical Differentiation & Integration:** Differentiation using differences, Integration using Trapezoidal rule, Simpson's 1/3 rule, Newton-Cote's formula, Gaussian Quadrature.
5. **Solution Of Linear System Of Equations:** Direct methods - Gauss elimination, Partial pivoting, Complete pivoting, Gauss-Jordan and factorization methods, Solution of tridiagonal systems. Iterative methods-Gauss Siedal and Jacobi's methods, Convergence, Ill conditioning, Eigen values by iteration, Jacobi's methods
6. **Numerical Methods For Differential Equations:** Solution of first order differential equations using Euler's method, modified Euler's method and Runge-Kutta 4th order method, Predictor-Corrector methods (Adam's and Milne's method), Simultaneous differential equations of first order, Finite difference method.
7. **Numerical Methods For Partial Differential Equation:** Finite difference approximation to derivatives, solution to Laplace equation, Jacobi's method, Gauss-Siedel method.

Suggested Reading/Books:

- Introductory Methods of Numerical Analysis : S.S. Sastry, Prentice Hall India.
- Numerical Methods for Mathematics, Science and Engineering : Mathews, Prentice Hall.
- An Introduction to Numerical Analysis : Atkinson, John Wiley.

BANE1-411 Thermodynamics

L T P C
3 1 0 4

1. **Basic Concepts:** Macroscopic and Microscopic approach, Concept of Continuum, Thermodynamic System, Surrounding and Boundary, Thermodynamic Equilibrium, State, Path, Process, cycle, Quasi-static Process, Reversible and Irreversible Process, Working Substance. Thermodynamic Properties like Pressure, Volume and Temperature, Zeroeth Law of Thermodynamics. Temperature Scales, Concept of Heat and work in Thermodynamics.
2. **First Law Of Thermodynamics:** Joule's Paddle wheel Experiment; Mechanical Equivalent of Heat, First Law for a closed system undergoing a Cycle, First Law for a closed system undergoing a change of state. Different forms of stored Energy, Enthalpy, Energy of an isolated System, Perpetual Motion, Machine of First kind.
3. **First Law Applied To Flow Processes:** Flow Process and Control Volume, flow work, Steady and Unsteady Flow Process, Steady Flow Energy Equation, Throttling Process, Flow Work and Non-Flow work, Variable flow Processes, Limitation of First Law.
4. **Second Law Of Thermodynamics:** Qualitative Difference between Heat and Work, Thermal Reservoir, Statements of 2nd Law by Max.Planck and Claussius, Equivalence between two statements, Energy Analysis of Heat Engine, Refrigerator and Heat Pump Reversibility and Irreversibility, Causes of Irreversibility, Carnot Theorem, Carnot cycle, Absolute Thermodynamic Temperature, Efficiency of the Reversible Heat Engine, Equality of Ideal Gas Temperature and Kelvin Temperature.
5. **Entropy**: Classius Theorem, Classius Inequality and concept of Entropy, Entropy change in an Irreversible Process, Application of Entropy Principle, Entropy Transfer with Heat Flow, Entropy generation in closed and open system, Thermodynamics Equations relating properties of System, Reversible Adiabatic work in a Steady flow System. Entropy and direction, Entropy and disorder.
6. **Available Energy And Availability**: Available Energy referred to a cycle, Quality of work, Maximum work in Reversible Process, Useful work, Dead State, Availability, Second Law Efficiency.
7. **Gas Power Cycles**: Air Standard efficiency, Mean Effective Pressure, Otto, Diesel, Dual, Brayton, Stirling and Ericson Cycle, Comparison of cycles

8. **Properties Of Gases And Gas Mixture** : Equation of state of a gas, Properties of Mixture of gases, Internal Energy, Enthalpy and Specific heat of gas, mixtures, Entropy of gas Mixtures.
9. **Properties Of Pure Substances**: H-S, T-S, P-V, P-T, diagram for a Pure Substance, Properties of Pure substance with special reference to water, Steam and its formation, Wet Dry, Saturated and Superheated Steam, sensible, Latent heat, Dryness fraction and its determination, Separating and Throttling calorimeter Enthalpy, Entropy and Internal Energy of Steam. Use of Steam Table and Mollier Diagram, Basic Thermodynamic Processes of Steam in Closed and Open System and their representation on P-V and H-S chart.
10. **Vapour Power Cycle :** Carnot and Rankine Steam Power Cycle, Actual Vapour cycle Processes, Comparison of Carnot and Rankine cycle, Mean Temperature of Heat Addition, Reheat Cycle, Ideal Regenerative Cycle, Reheat Regenerative Cycle, Feed Water Heater, Characteristics of an Ideal working fluid in Vapour Power cycle.
11. **General Thermodynamic Relations**: Maxwell's Equation, Tds Equations, Ratio of specific heats, Joule Kelvin Effect, Classius-Clapeyron Equations, Gibb Phase Rule.

Suggested Reading/Books:

- Engineering Thermodynamics: P.K. Nag, McGraw Hill
- Engineering Thermodynamics : Gordon Rogers & Yon Machew
- Thermodynamics :Yunus Cengel and Mike Boles, McGraw Hill
- Thermodynamics : Arora, Tata McGraw Hill.

BANE1-412 Aircraft Structures –I

L T P C
3 1 0 4

1. Basic Elasticity: Equations of equilibrium, plane stress, stresses on inclined planes, principal stresses, Mohr's circle of stress, strain, compatibility equations, plane strain, principal strains, stress-strain relationship**.**

2. 2-D Problems In Elasticity: 2- D problems, stress functions, inverse and semi inverse method, St. Venant principle, bending of end-loaded cantilever, torsion of solid sections, Prandtl stress function solution. St. Venant warping function solution.

3. Structural Analysis Method

Energy Method, strain energy, complimentary energy, principle of virtual work and virtual displacement, principle of superposition, Maxwell reciprocal theorem.

4. Statically Determinate And Indeterminate Structures

Statically determinate and indeterminate trusses. Truss analysis with single and double redundancy, other structures with single redundancy, frames and rings, shear lag.

5. Loads On Structural Components

Functions of structural components, factor of safety, limit load,V-n diagram, a/c inertia loads, symmetric maneuver loads, steady pull out, banked turn, gust loads.

6. Bending, Shear And Torsion Of Open And Closed Beams Section

Direct stress distribution and deflection due to bending, shear of open section, shear centre, shear and torsion of closed section, torsion of open section, analysis of combined open and closed sections. .

7. Aircraft Joints And Fittings

Types of bolted or riveted joints, margin of safety, analysis of different types of fitting failures, standard parts, eccentrically loaded connection.

Suggested Reading/Books:

- Aircraft Structures for Engineering Students: T.H.G.Megson, Edward Arnold, Butterworth-Heinemann,
- Aircraft Structures: D.J.Peery, McGraw Hill
- Fundamentals of aircraft structural analysis: Howard D. Curtis, McGraw Hill
- Theory and Analysis of Flight Structures: RM Rivello, McGraw Hill

BANE1-413 AIRCRAFT MATERIALS AND PROCESSES

L T P C
3 0 0 3

1. INTRODUCTION

Properties of Flight Vehicle Materials, Importance of strength/weight ratio of materials for Aerospace Vehicles structures, Importance of temperature variations, factors affecting choice of material for different parts of airplane.

2. LIGHT METAL ALLOYS

Aluminum alloys, heat treatment, High strength and high corrosion alloys. Magnesium alloys and their properties, Heat treatment, Application of these alloys to Aerospace Vehicles.

3. AIRCRAFT STEELS

Classical of alloys steels, Effect of alloying elements, Carbon Steel V/S Alloys. Magnesium alloys and their properties, Heat treatment, Application to Aerospace Vehicle of these alloys.

4. HIGH STRENGTH AND HEAT RESISTANT ALLOYS

Classification of heat resistant materials, Iron, Nickel and Cobalt base alloys, Refractory materials, Ceramics, Titanium and its alloys, properties of Inconel Monal & K-Monal, Nimonic and Super Alloys; Application to Aerospace Vehicles

5. COMPOSTE MATERIALS

Introduction, Fibers, glass fibers, carbon fibers, Aramid fibres, Baron Fibres, Engineering ceramix. Matrix Materials – Their functions, various types , curing of resins.

6. METAL JOINING PROCESSES

Weldability, standard welding practices e.g. gas welding, resistance welding. Welding of light alloys, Riveting.

Suggested Reading/Books :

1. Workshop technology: WAJ Chapman, Replika Press Pvt. Ltd.
2. Aircraft Material and Processes: G F Titterton, Himalayan Books, New Delhi.
3. Advanced Composite materials: Lalit Gupta, Himalayan Books, New Delhi,

BANE1-414 AIRCRAFT PROPULSION -I

L T P C
3 0 0 3

1. CONDUCTION HEAT TRANSFER

Heat transfer process, heat conduction, thermal conductivity, general equations of heat conduction, Newton- Rikhman law, conduction problems.

2. CONVECTION AND RADIATION HEAT TRANSFER

Convection process, free convection heat transfer from vertical flat plate, planes, cylinder and sphere, free convection in enclosed space, effect of laminar and turbulent flow on convection process, combined free and forced convection. Thermal radiation and emissive power, Planck distributive law, radiation properties.

3. PROPELLERS

Ideal momentum theory, blade element theory, activity factor, airscrew coefficients, numerical problems on the performance of propellers, selection of propellers, fixed, variable and constant speed propellers, material for propellers, momentum theory applied to helicopter rotor.

4. AIRCRAFT PISTON ENGINES

The internal combustion engine process, brief history, G.I and C.I engines, 4-stroke and 2-stroke engines, air standard cycles, various types of arrangements for multi-cylinder aircraft engines, merit and operational efficiencies, cooling, lubricating and ignition systems, valve timing diagrams, I.H.P, B.H.P. and S.H.P., performance, effect of altitude, power required and power available, supercharging.

5. AIRCRAFT GAS TURBUNE ENGINES

Air standard Brayton cycle, actual gas turbine engine cycle, compressor and turbine efficiencies , compressor and turbine work, centrifugal and axial type of compressors, their compressive action, relative merits in operations, combustion chambers, simplex and duplex burners, expansion process, turbine materials for different components, engine intake and exhaust nozzles, afterburners, thrust augmentation, turboprop, turbo shaft and turbofan engines, multi shaft gas turbine engines, thrust equation, installed and uninstalled thrust.

Suggested Reading/Books :

1. Heat transfer: J.P.Holman, McGraw Hill.
2. I.C.Engines: L.C.Litchy**,** McGraw Hill.
3. Gas Turbine Theory: Cohen, Rogers and Saravanamuttu, Pearson Education .

4. Heat transfer: B.Gebhart,McGraw Hill.

5. Elements of Gas Turbine Propulsion: J.D. Mattingly, McGraw Hill.

BANE1-415 THEORY OF MACHINES-I

L T P C
3 0 0 3

UNIT – I

1. Basic Concept of Machines:

Link mechanism, kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider-crank-chain, double slider-crank-chain and their inversions, kinematic pairs, Graphical (relative velocity vector and instantaneous center methods) and Analytical methods for finding: Displacement, velocity, and acceleration of mechanisms (including Corliolis components).

UNIT – II

2. Lower Pairs:

Universal joint, calculation of maximum torque, steering mechanisms including Ackerman and Davis approximate steering mechanism, engine indicator, Pentograph, Straight line mechanisms.

3. Belts, Ropes and Chains :

Material, types of drives, idle pulley, intermediate or counter shaft pulley, angle and right angle drive, quarter turn drive, velocity ratio, crowning shaft pulley, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sided of belts, HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Use of gravity, idle, flat, V-belts and rope materials. Length of belt, rope and chain drives, type and cone type.

UNIT – III

4. Cams:

Types of cams and follower, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform acceleration and retardation, cycloidal). Analysis of follower motion for circular convex, tangent cam profiles. Calculation of pressure angle.

5. Friction Devices:

Concepts of frictions and wear related to bearing and clutches.Types of brakes, principle of function of brakes of various types. Braking of front and rear tyres of a vehicle, Problems to determine braking capacity, Types of dynamometers (absorption & transmission).

UNIT – IV

6. Flywheels:

Turning moment and crank effort diagrams for reciprocating machines, Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of flywheel mass and dimensions for engines and Punching Machines.

7. Governors:

Function, types and characteristics of governors, Watt, Porter and Proell governor. Hartnell and Willson-Hartnell, spring loaded governors, Simple numerical problems on these governors, Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power controlling force curve, effect of sleeve friction.

Suggested Reading/Books :

- Jagdish Lal, Theory of Mechanisms & Machines: Metropolitan Book Co. Pvt.Ltd, New Delhi.
- S. S. Rattan, Theory of Machines: Tata McGraw Hill, New Delhi
- Thomas Beven, Theory of Machines : Longman’s Green & Co., London
- W. G. Green,Theory of Machines : Blackie & Sons, London
- W. G. Green,Theory of Machines : Shigley, Mcgraw Hill , New York

BANE1-416 AIRCRAFT PROPULSION AND MATERIAL PROCESSES LAB

L T P C
0 0 2 1

Any five of the following :

1. To study the functioning of aircraft piston engines having various arrangements of cylinders .
2. To study the functioning of aircraft gas turbine engines .
3. Experiments on solid propellant test rig.
4. Experiments on continuous combustion test rig.
5. Heat treatment of steel alloys, study of microstructure before and after heat treatment.
6. Exercises in welding, riveting and spot welding.
7. Fabricating of fuselage and wing panels/parts.

BANE1-417 AIRCRAFT STRUCTURES – I LAB

L T P C
0 0 2 1

List of Practicals

1. Bending tests, Stresses and deflections of beams for various end conditions.
2. Compression tests on long and short columns, critical buckling loads, southwell plot.
3. Tests on riveted and bolted joints.
4. Combined bending and torsion of a hollow circular tube.
5. Shear centre of a channel section (open section).
6. Free vibration of a cantilever beam.
7. Shear centre of channel section (closed section).

5th Semester

BANE1-518 AIRCRAFT SYSTEMS AND INSTRUMENTATION

L T P C
3 1 0 4

UNIT – I

1. FLIGHT CONTROL SYSTEMS

Primary and secondary flight control, flight control linkage systems, push-pull control rod system, cable and pulley systems, high lift control systems, flight control actuation, linear actuator, mechanical actuator, mechanical screw-jack actuator, direct drive actuation, fly-by-wire actuator, electro-hydrostatic actuator, electro-mechanical actuator .

UNIT – II

2. ENGINE CONTROL SYSTEMS

Engine technology and principle of operation, fuel flow control, air flow control, control systems, control system parameters, input signals, output signals, engine starting, fuel control, ignition control, engine rotation, throttle levers, starting sequence, engine oil systems.

3. HYDRAULIC AND ENVIRONMENT CONTROL SYSTEMS

Hydraulic circuit design, hydraulic actuation, hydraulic fluid, fluid pressure and temperature, fluid flow rate, hydraulic piping and pumps, need for controlled environment, heat sources, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control, air cycle, refrigeration, humidity control, hypoxia, tolerance.

UNIT – III

4. PITOT STATIC INSTRUMENTS & SYSTEMS

Pitot static system, air speed indicator, altimeter, mach-meter, mach/airspeed indicator, vertical speed indicator.

5. GYROSCOPIC INSTRUMENTS

Gyroscope and its properties, gyro-horizon, turn and bank indicator, turn coordinator, direct reading magnetic compass, directional gyroscope.

UNIT – IV

6. NAVIGATIONAL INSTRUMENTS

Very high and ultra high frequency radio aids,VOR,TACAN,VORTAC,VHF direction finding, instrument landing system, microwave landing system.

Suggested Reading/Books :

- Aircraft systems: Ian Moir and Allan Seabridge
- Aircraft instruments: E H J Pallet

BANE1-519 Aerodynamics – II

L T P C
3 1 0 4

UNIT – II

1. CONFORMAL TRANSFORMATION

Complex potential function, Blasius theorem, principles of conformal transformation, Kutta - Juokowaski transformation of a circle into flat plate, airfoils & ellipses.

UNIT – II

2. INCOMPRESSIBLE FLOW OVER AIRFOILS

Glauert's thin airfoil theory, symmetrical airfoil, cambered airfoil, flapped airfoil, determination of mean camber line shapes for uniform & linear distribution of circulation. Description of flow about multi-element airfoils.

3. INCOMPRESSIBLE FLOW OVER FINITE WINGS

Downwash & induced drag, Biot-Savart's law and Helmholtz's theorem, Prandtl's classical lifting line theory, fundamental equations. Elliptic and general lift distribution over finite unswept wings, effect of aspect ratio, Drag polar ,Correlation of C_l distribution over other aspect ratios, Lifting Surface theory, Formation Flying, Ground effect.

UNIT – III

4. COMPUTATIONAL AERODYNAMICS OF AIRFOILS AND WINGS

Computation of flow field due to distribution of source doublet and line and horse shoe vortices, vortex lattice method, wing as a planar surface covered with HSVs. Panel methods: source ,doublet and vortex based panel methods for airfoils and wings of rectangular planform.Extension to elliptic and swept back planforms.

5. DELTA WING AERODYNAMICS

Polhamus theory, leading edge suction analogy, calculations of lift coefficient, flow field, aspect ratio effect, leading edge extension, HAA aerodynamics

UNIT – IV

6. COMPRESSIBLE SUBSONIC FLOWS OVER AIRFOILS

The derivation of velocity potential equation. Linearization , Prandtl-Glauert compressibility correction. Karman –Tsien correction, Critical Mach number, Whitcomb's area rule, Supercritical airfoil.

Suggested Reading/Books :

1. Fundamentals of Aerodynamics : John D.Anderson, McGraw Hill.
2. Aerodynamics for Engineers : Bertin and Smith, Prentice Hall.

BANE1-520 Aircraft Structures – II

L T P C
3 1 0 4

UNIT – I

1. ELASTICITY OF COLUMNS

Euler column, higher order differential equations for columns, energy approach, dynamic approach of predicting buckling loads, approximate methods for prediction of buckling loads, Effect of shear on buckling loads, Large deflection of columns, Columns with eccentricity in geometry, Open section columns, Torsional buckling of open section columns, Flexural torsional buckling of open section columns.

UNIT – II

2. STABILITY OF ELASTIC PLATES

Governing differential equation for stability of plates under uni-axial compressive loads, Energy equation for appropriate solution for bucking loads, Rayleigh Ritz technique, Galerkin technique, Buckling loads under biaxial compressive loads & shear loads, Finite difference equations for estimating buckling loads, Buckling of stiffened plates, Buckling of plates with different boundary conditions.

3. POST BUCKLING BEHAVIOUR OF PLATES

Concept of effective width, buckling behavior of plates, Elastic buckling of flat plates, Elastic buckling of curved rectangular plates.

UNIT – III

4. DESIGN OF WEBS IN SHEAR

Pure tension field beams, diagonal tension, semi tension field beams, curved tension field webs.

5. INTRODUCTION TO MATRIX METHODS IN STRUCTURAL ANALYSIS

Introduction of flexible and stiffness methods, choice of method, stiffness matrix for an elastic spring, analysis of pin jointed framework, Matrix analysis of space frames, stiffness matrix for uniform beams.

UNIT – IV

7. INTRODUCTION TO FEM METHOD IN STRUCTURAL ANALYSIS

Mathematical idealization of the structure, elements of discretization, application of FEM, stiffness method concept formulation, formulation procedure for element structural relationship, element shape function , from element to system formulation. Simple problems

Suggested Reading/Books :

- Aircraft Structures for Engineering Students : T.H.G.Megson, Elsevier.
- Structural Stability of Columns and Plates : NGR Iyengar, Affiliated East-West Press (Pvt) Ltd.
- Introduction to Structural Stability : C.Chajis, Prentice Hall Inc. Engle Wood Cliff.
- Aircraft Structures : David J.Perry, McGraw Hill.
- Theory and Analysis of Flight Structures : RM Rivello, McGraw Hill.
- Introduction to Finite Elements in Engineering: T.R Chandruplata and A.D Belagundu, PHI.

BANE1-521 Aircraft Propulsion – II

L T P C
3 0 0 3

UNIT – I

1. INTRODUCTION TO GAS DYNAMICS

Basics, simple flows, nozzle flow and design, nozzle operating characteristics for isentropic flow , shock waves in nozzle flow, Rayleigh flow and fanno flow effect of frictional duct length in subsonic and supersonic flow, numerical problems in 1-D flow. Scram jet, pulse jet and ram jet.

UNIT – II

2. INLETS AND NOZZLES

Subsonic inlets, pressure recovery, inlet sizing, supersonic inlets and mass flow characteristics, inlet design and sizing, exhaust nozzles, thrust reversing and thrust vectoring, nozzle coefficients, nozzle performance.

3. AXIAL FLOW COMPRESSOR

Euler's turbo machinery equations, axial flow compressor analysis, cascade theory, velocity diagrams, flow annulus area stage parameters, degree of reaction, axial flow compressor coefficients, stage p pressure ratio, repeating stage-repeating row-mean line design ,performance and design.

UNIT – III

4. AXIAL FLOW TURBINE

Introduction to turbine analysis, velocity diagrams, mean radius stage calculations, stage parameters, loading and flow coefficients, degree of reaction, axial flow turbine stage analysis, performance and design.

5. INTRODUCTION TO ROCKET PROPULSION

Rocket propulsion, early history of rocket flights, applications of rocket propulsion, definitions and fundamentals, solid rocket fundamentals, solid and liquid propellants in details.

UNIT – IV

6. SOLID ROCKET COMPONENTS AND MOTOR DESIGN

Motor case, nozzle, igniter hardware, rocket motor design, performance of rocket vehicles, space missions, rocket staging.

Suggested Reading/Books :

1. Elements of Gas Turbine Propulsion: J.D. Mattingly, McGraw Hill.
2. Rocket Propulsion Elements: George P. Sutton, Oscar Biblarz, John Wiley & Sons.
3. Gas Turbine Theory: Cohen, Rogers and Sarvanmatto, John Wiley

4 .Mechanics and Thermodynamics of Propulsion: P.G.Hill & Peterson, Addison- Wesley.

BANE1-522 Aircraft Performance

L T P C
3 0 0 3

UNIT – I

1. The Standard Atmosphere and Airflow

UNIT – II

3. Aerodynamic Drag

Cause of Drag, its effects, types of drag and affecting factors. Drag polar, compressibility drag, design for minimum drag, estimation of drag of complete airplane, Terminal Velocity.

3. Aerodynamic Characteristics

Force and Moments coefficients from dimensional analysis. Pressure distribution over 2-D airfoil, variation with angle of attack, center of pressure, aerodynamic center, problems connected with them. Lift, Drag and moment coefficients; Relations between lift and drag. Estimation of these characteristics from measured pressure distributions, variation of aerodynamic coefficients with Reynold's Number and Mach number. Effect of span, Aspect ratio, plan form, sweep, taper and twist on aerodynamic characteristics of a lifting surface. Delta wing Aerodynamics.

UNIT – III

4. High Lift Systems

Airfoil's maximum lift coefficient, leading and trailing edge devices, effect of sweep back. The deep stall. effect of Reynolds number, Propulsive lift, V/STOL configurations.

5. Airplane Performance in Steady Flight

Straight and Level flight, stalling speed; Variation of drag with flight. Speed conditions for minimum drag, minimum power conditions; Power at other speeds. Gliding flight, shallow and steep angles of glide; Sinking speed, minimum sinking speed, time of descent. Climbing flight at shallow angles, correction for steep angles, time to flight, maximum rate of climb.

UNIT – IV

6. Airplane Performance in Accelerated Flight

Take-off and landing, calculations of take-off ground run, take off distances. Minimum ground run, assisted take-off, calculation of landing ground run. Range and endurance and problems connected with them.

7. Maneuvers

Introductory comments on spins and stalls; turning flight, maneuvers in 3-D space.

Suggested Reading/Books :

1. Introduction to Flight: J D Anderson , Mc Graw Hill.

2. Fundamentals of Aerodynamics: J D Anderson, Mc Graw Hill.

3. Aerodynamics for Engineering Students: E L Houghton and N.B. Carruthers, Arnold Publisher.

BANE1-523 Aero Computing Lab

L T P C
0 0 2 1

Using any Softwares like PRO/E, CATIA, Solid W orks, ANSYS, MSC / Nastran

1. Modeling of various components using any modeling software
2. Static analysis on cantilever beam
3. Static analysis of forces in a simply supported beam
4. Static analysis- Plane truss
5. 2-D static stress analysis
6. 3-D static stress analysis
7. Stress distribution in a shrink fit
8. Natural frequencies of a spring mass system

BANE1-524 Aircraft Systems Lab

L T P C
0 0 2 1

Study of any five of the following aircraft systems :

1. Hydraulic system
2. Mechanical system
3. Pneumatic system
4. Electrical system
5. Fly-by-wire system
6. Fuel system

BANE1-525 Industrial Training

Industrial Training of 6 weeks undergone after 4th semester

6th Semester

BANE1-626 Automatic Flight control

L T P C
3 1 0 4

UNIT – I

1. INTRODUCTION

Open Loop and Closed Loop (Feed Back) control systems. Types of feedback control systems.

2. FEED BACK CONTROL SYSTEM

Transfer function of linear systems. Impulse response of linear systems, Block diagrams of feed back control systems, Multivariable systems, Block diagram algebra.

UNIT – II

3. ANALYSIS OF FEEDBACK CONTROL SYSTEMS

Typical test input signals, Time domain performance characteristics of feedback control systems. Effects of derivative and integral control. Steady State response of feedback control system-steady State error, Frequency response.

UNIT – III

4. SYSTEM STABILITY Routh-Hurwitz Criterion, the Root Locus Method.

UNIT – III

5. LONGITUDINAL AUTO-PILOTS

Longitudinal Auto Pilots: Brief description through Block diagrams and Root Locus of Displacement, Auto Pilot, Pitch Orientational Control System. Acceleration control system. Fly-By-Wire control system, Instrument Landing System.

UNIT – IV

6. LATERAL AUTO PILOTS

Introduction, Damping of the Dutch Roll, Methods of Obtaining coordination, Yaw orientational control system

Suggested Reading/Books :

1. Automatic Control of aircraft and Missiles : John H.Blackelock, John Wiley & Sons.
2. Airplane Performance Stability and Control: C.D. Perkins and R.E. Hage, John Wiley & Sons.
3. Dynamics of Flight: Stability and Control: Bernard Etkins, John Wiley & sons.
4. Flight Stability and Automatic Control: Robert C. Nelson, McGraw Hill.
5. Automatic Flight Control: EHJ Pallet, B.S. Professionals Books, Oxford.

6. Automatic Control Systems: Benjamin C.Kuo, Prentice Hall of India, New Delhi.

BANE1-627 Aircraft Stability and Control

L T P C
3 1 0 4

UNIT – I

1. Stick Fixed Static Longitudinal Stability

Introduction to stability of airplane, stick fixed longitudinal stability, effect of power, Neutral point, Centre of gravity limits. In flight measurement of stick fixed neutral point.

2. Control Surfaces and Aerodynamic Balancing

Control surface hinge moments, floating and restoring tendencies, different types of tabs used on airplanes. Frise Aileron, Spoiler Controls.

UNIT – II

3. Stick Free Static Longitudinal Stability

Effect of free elevator on airplane stability, Elevator Control force, stick force gradients, Neutral point, Controls free center of gravity limit. In flight measurement of stick free neutral point.

UNIT – III

4. Maneuvering Flight

Effect of acceleration on airplane balancing, Elevator angle per g, and stick force per g, Maneuver margins.

5. Directional Stability and Controls

Asymmetric flight, Weather cock stability, contribution of different parts of Airplane, Rudder Fixed and Rudder free static directional stability, rudder lock.

UNIT – IV

6. Lateral Stability and Control

Dihedral Effect. Contribution of different parts of airplane, controls in Roll, Aileron control power, cross coupling of lateral and directional effects.

7. Dynamic Stability

Introduction to dynamics, spring-mass system. Equations of motion without derivation, stability derivatives, Longitudinal Dynamic Stability, Lateral and Directional Dynamic Stability, analysis of different stability modes

Suggested Reading/Books:

1. Airplane Performance Stability and Control: Perkins and Hage, John Wiley.

2. Dynamics of Flight: Bernard Etkin, John Wiley.

3. Flight Stability and Automatic Control: Robert C. Nelson, McGraw Hill.

BANE1-628 Elements of Spacecraft Engineering

L T P C
3 1 0 4

UNIT – I

1. INTRODUCTION

Introduction to spacecraft, rockets and missiles, their basic functions and features , elements of rocket propulsion.

2. 2-D ROCKET MOTION IN VACUUM

Equations of motion, rocket motion in free space, Tsiolkovsky's equation, rocket parameters, multistage rockets, ideal velocity of multistage rocket.

UNIT – II

3. TWO BODY PROBLEM

Orbit equation, Kepler's laws, circular orbit, elliptical, hyperbolic orbit, orbital elements

4. LAUNCHING OF SATELLITE

Launch vehicle ascent trajectories, injection of satellite and its general aspects, dependance of orbital parameters on in-plane injection parameters

UNIT – III

5. THE EARTH SATELLITE OPERATIONS

The Hohmann transfer, inclination-change maneuver, launch to rendezvous, decay life time, earth oblateness effect, low thrust orbit transfer.

6. SATELLITE ALTITUDE DYNAMICS

Torque –Free axisymmetric rigid body, general torque free rigid body, semi-rigid space craft, altitude control: Spinning and Non spinning space craft. The Yo-Yo mechanism, gravity gradient satellite, the dual spin spacecraft.

UNIT – IV

7. BALLISTIC MISSILE TRAJETORIES

Introduction, boost phase, ballistic phase, trajectory geometry, re-entry trajectory

Suggested Reading/Books:

1. Space Flight Dynamics: William E. Wiesel , Mc Graw Hill.

2. Rocket Propulsion & Spaceflight Dynamics: J W Cornelisse, H F R Schoyer, K F Wakker, Pitman Publishing Ltd.

3. Rocket Propulsion Elements: G.P Sutton, John Wiley and Sons.

BANE1-629 Helicopter Engineering

L T P C
3 0 0 3

UNIT – I

1. ELEMENTARY BLADE MOTION

Historical development of helicopter and overview, Basic concepts, Introduction to hovering and forward flight theory, Rotor blade motion – flapping, feathering and lagging motion, Composite structures.

UNIT – II

2. AERODYNAMICS OF THE ROTOR IN MOTION

The actuator-disc theory, Working states of rotor, Optimum rotor, Efficiency of rotor, Ground effect on lifting rotor, The effect of finite number of blades, Induced velocity and induced power in forward flight – Mangler and Squire method, flight and wind tunnel test, The vortex wake, Aerofoil characteristics in forward flight.

UNIT – III

3. HELICOPTER TRIM AND PERFORMANCE IN MOTION

Blade forces and motion in forward flight, Force, torque and flapping coefficient, Helicopter trim analysis, Performance in forward flight.

4. DYNAMIC STABILITY AND CONTROL

Longitudinal and lateral stability, Equations of motion, Stability characteristics, Auto stabilization, Control response.

UNIT – IV

5. HELICOPTER VIBRATIONS

Exciting forces, Fuselage response, Vibration absorbers, Measurement of vibration in flight.

Suggested Reading/Books :

1. Helicopter Dynamics : ARS Bramwell, John Wiley and Sons.

2. Helicopter Engineering : Lalit Gupta, Himalayan Publishers

3. Principles of Helicopter Engineering: Jacob Shapiro, Mc Graw Hill.

4. Introduction to Helicopter and Tilt rotor flight simulation : M.E. Drier, AIAAA Education series.

BANE1-630 Elements of Avionics

L T P C
3 0 0 3

UNIT – I

1. AVIONICS TECHNOLOGY

Processors, Memory Devices, Digital Data Buses –MIL-STD-1553B, ARINC 429, ARINC 629, Fiber Optic Buses, LRU architecture for avionics packaging, software, environmental effects, difference in avionics architecture of commercial and military aircraft.

UNIT – II

2. SENSORS

Air Data Sensing – Use of pitot static probe, static probe to derive air data indications; Role of Air Data Computer (ADC), Magnetic Sensing – Magnetic Heading Reference System (MHRS), Inertial Sensing – Position Gyros, Rate Gyros, Accelerometers, Radar Sensing - Radar Altimeter (RADALT), Doppler Radar, Weather Radar.

UNIT – III

3. DISPLAY

Comparison of earlier flight deck (Electromechanical type instruments) to modern flight deck (glass fight deck), Cathode Ray Tube (CRT), Active Matrix Liquid Crystal Display (AMLCD), Head Down Display (HDD), Head Up Display (HUD),Helmet Mounted Display (HMD), Integrated Standby Instrument System (ISIS).

4. COMMUNICATION

HF, U/VHF, Satellite Communication , Air Traffic Control (ATC) Transponder, Traffic Collision & Avoidance System (TCAS), Identification of Friend & Foe (IFF).

UNIT – IV

5. NAVIGATION

Automatic Direction Finding, Very High Frequency Omni-Range (VOR), Distance Measuring Equipment (DME), Tactical Air Navigation (TACAN), VORTAC (VOR+TACAN) Satellite Navigation System-Global Positioning System (GPS), Differential GPS Instrument Landing System (ILS), Transponder Landing System (TLS), Microwave Landing System (MLS), Astronavigation.

6. AUTOMATIC FLIGHT CONTROL SYSTEM

Longitudinal, Lateral & Direction Autopilot.

Suggested Reading/Books :

1. Civil Avionics Systems: Ian Moir, Allan Seabridge, AIAA Education Series.
2. Aircraft System : Ian Moir & Allan Seabridge, John Wiley.
3. Aircraft Electricity & Electronics : T.K. Eismin, Macmillan.

BANE1-631 Wind Tunnel Techniques

L T P C
3 0 0 3

UNIT – I

1. Wind Tunnel as a Tool

Types of wind tunnels, special purpose wind tunnels.

2. Wind Tunnel Design

Test section, diffuser, fan section, fan design, return passage, cooling , The breather- vibration, test section flow quality, effuser design , wind tunnel construction , energy ratio, final form.

UNIT – II

3. Instrumentation and Calibration of Test Section

Measurement of pressure, velocity, turbulence, flow angularity, hot wire anemometry, laser velocitimeter, data acquisition, flow visualization techniques, wind tunnel calibration.

UNIT – III

4. Model Forces, Moment and Pressure Measurement

Wind tunnel balances- Internal & External balances, design of wind tunnel balances, Wake survey method.

5. Wind Tunnel Correction

Method of Images , boundary corrections, buoyancy corrections, wake blockage, solid blockage-(2-D & 3-D corrections).

UNIT – IV

6. Non-Aeronautical Uses of Wind Tunnel

Applications in wind engineering, Surface vehicle testing, testing of buildings for wind forces, pollution, other applications at low Reynolds numbers.

Suggested Reading/Books :

1. Low speed wind tunnel testing: W.E. Rae and A. Pope, John Wiley.
2. Measurement of Airflow: Pankhrust and Ower, Pergamon Press.

BANE1-632 Aeromodelling and Design Lab

L T P C
0 0 2 1

This laboratory Course is intended to bring out the talent in the students. It requires equal or even more work / thinking on the part of the instructor in-charge First formulate a simple problem known from the theory covered so far, work out a practical approach to demonstrate that there is yet another method to understand and demonstrate the problem and its solution. It could be a group task involving some fabrication work.

BANE1-633 Aircraft Instrumentation and Measurements Lab

L T P C
0 0 2 1

1. Study of various types of flight instruments.
2. Any four of the following experiments :

(a) Use of strain gauges
(b) Measurement of force, torque and power.
(c) Measurement of flow
(d) Measurement of pressure.
(e) Measurement of acoustics.
(f) Measurement of temperature.

7th Semester

BANE1-734 High Speed Aerodynamics

L T P C
3 0 0 3

UNIT – I

1. SHOCK WAVES

Introductory remarks, Point source in a compressible flow, Mach waves and shock waves. a)Normal shock waves: Equation of motion for a normal shock, Normal shock relations for a perfect gas, Stagnation conditions, RH relations, Propagating shock waves, weak shock, reflected shock wave, centered expansion waves, shock tube. Numerical examples b) Oblique shock waves: Introduction, Oblique shock relations, M-θ-β relations, Shock polar, Supersonic flow over wedge, Weak oblique shock, Supersonic compression, Detached shock, Numerical examples.

UNIT – II

2. EXPANSION WAVES

Supersonic expansion by turning, Prandtl-Meyer flow, Numerical problems. Simple and non-simple regions, Reflection and intersection of shocks and expansion waves, Mach reflections, Method of characteristics, Numerical examples.

3. LIFT AND DRAG IN SUPERSONIC FLOWS

Shock –Expansion theory, Flow field in supersonic flows, Numerical problems, Thin airfoil theory, Analytical determination of lift and drag coefficients on flat plate, Bi-convex, and diamond shaped sections in supersonic flows, Numerical problems, Supersonic leading and trailing edges.

UNIT – III

4. POTENTIAL EQUATION FOR COMPRESSIBLE FLOWS

Introduction, Crocco's theorem, Derivation of basic potential equation for compressible flows, Linearization of governing equation, Boundary conditions, Small perturbation theory, Application to wavy wall, Bodies of revolution.

5. AIRFOILS IN COMPRESSIBLE FLOW

Introduction, Linearized compressible flow, Airfoils in subsonic flow, Prandtl-Glauert transformation, Critical Mach number, Supercritical flows, Airfoils in transonic flow, Governing equations, Shock wave boundary layer interaction, Stability and control problems.

UNIT – IV

6. **MEASUREMENTS IN COMPRESSIBLE FLOWS**

Rayleigh's supersonic Pitot formula, Equipment used in supersonic flows, Supersonic wind tunnels, Heat transfer tunnels, Shock tunnels, Aero-ballistic ranges, Terminal ballistic range, Rocket sled facility, Special instrumentation for these types of tunnels. Suggested Readings / Books:

1. Modern compressible Flow: John D. Anderson, Mc Graw Hill.

2. Elements of Gas Dynamics: Lieppmann and Rosheko, John Wiley.

3. Experimental Methods in Hypersonic flows: J. Lucasiewisz, M Dekker.

4. Compressible Flows: S.M Yahya, New Age International Publisher.

BANE1-735 Aero elasticity

L T P C
3 0 0 3

UNIT – I

1. INTRODUCTION

Definition and historical background, Static and dynamic aeroelastic phenomenon, Integration of aerodynamic, elastic and inertia forces, Influence of aeroelastic phenomenon on aircraft design, Comparison of critical speeds.

UNIT – II

2. DIVERGENCE OF LIFTING SURFACE

The phenomenon of divergence, divergence of 2-D wing section, divergence of an idealized cantilever wing, Solution based on semi-rigid assumptions, Solution in generalized co-ordinates, Method of successive approximation, use of Numerical Methods.

UNIT – III

3. STEADY STATE AERO-ELASTICITY PROBLEMS IN GENERAL

Loss and reversal of aileron Control, 2-D case, aileron reversal general case, Lift distribution on a rigid and elastic wing, Effect on Static Longitudinal stability of airplane.

4. INTRODUCTION TO FLUTTER AND BUFFETING

The phenomenon of flutter, flutter of a cantilever wing, Approximate determination of critical speed by Galerkin's Method, Introduction to buffeting and stall flutter.

UNIT – IV

5. **NON-AERONAUTICAL PROBLEMS**

Some typical example in civil engineering, Flow around an oscillating circular cylinder, applications to H-shaped sections, Prevention of aero-elastic instabilities.

Suggested Readings / Books:

1. An Introduction to the Theory of Aeroelasticity: Y.C. Fung, Dover Publications.
2. Aeroelasticity: R.L Bisplinghoff, Holt Ashley, R.L Halfman Addison –Wesley Publishing Co. Reading Mass.
3. Aircraft Structures for Engineering Students: T.H.C Megson, Elsevier.

BANE1-736 Airplane Design

L T P C
3 0 0 3

UNIT – I

1. PRELIMINARIES

Aircraft design, requirements and specifications, Airworthiness requirements. Weight: It's importance. Aerodynamic and structural design considerations. Classifications of airplane, Concept of configuration, Features of special purpose airplanes. Unmanned aerial vehicles and their features.

2. AIR LOADS IN FLIGHT

Classical methods of estimating symmetrical maneuvering loads on a wing in flight, Basic flight loading conditions, Load factor, V-n diagram, Gust loads, estimation of gust loads, Structural effects, Use of panel methods to estimate air load distribution on a wing.

UNIT – II

3. AIRPLANE WEIGHT ESTIMATION

Estimation of airplane weight based on airplane type/mission and material used, Trends in wing loading, Iterative approach.

4. WING DESIGN CONSIDERATIONS

Factors influencing selection of airfoil and plan form, Span wise air loads variation with span and planform, stalling, Take-off and landing considerations, BM and SF, Design principles for the structure of all metal, Stressed skin wing (Civil & Military airplane), Estimation of wing drag, Effect of flaps.

UNIT – III

5. STRUCTURAL LAYOUT AND INTEGRATION

Structural layout of straight, tapered swept (fwd and aft) wings. fuselage, empennage, Engine locations, Cockpit and passenger cabin layout, Layout of flight and engine controls, Wing-fuselage jointing methods, All metal airplane considerations, Use of composite materials. Preparation of 3-views, CG location.

6. LANDING GEARS

Requirement of landing gears, Different arrangements, mechanism for retraction into fuselage and wing, Absorption of landing loads, calculations of loads.

7. AIRFRAME POWER PLANT INTEGRATION

Estimation of horizontal and vertical tail volume ratios, Number of engines, Location for inlets and their considerations, Revised CG location.

UNIT – IV

8. MODERN CONCEPTS IN AIRPLANE DESIGN

Super critical wing, Relaxed stability, Control configured vehicles.

9. COMPLETE DESIGN PROBLEM

Preparation of conceptual design of an airplane from given specifications. Use and analysis of existing designs for this purpose. Design of airframe for the specifications, Prediction of performance, Stability and control, Selection of engines from all considerations with all details, Freezing the design, Preparation of preliminary drawings including 3 views and layout.

Suggested Readings / Books:

1. Airplane Design- A Conceptual Approach: Daniel P Raymer, AIAA Education Series USA.
2. The Design of Airplane : D.Stinton, GRANADA,UK.
3. Fundamentals of Aircraft Design : L.M.Nikolai, Univ. of Dayton Ohio.
4. Aerodynamics for Engineers : Bertin and Smith, Prentice Hall.

BANE1-737 Theory of Elasticity

L T P C
3 0 0 3

UNIT – I

1. 2-D PROBLEMS IN RECTANGULAR COORDINATES

Solution by polynomials, Bending of cantilever loaded at end, Bending of beam by uniform load, Symmetrical stress distribution.

2. 2-D PROBLEMS IN POLAR COORDINATES

Pure bending of curved bars, Strain components in polar coordinates, General equations in polar coordinates, Displacements for symmetrical stress distributions, Rotating disks, Bending of curved bar by a force at the end, Effect of circular holes on stress distribution in plates.

UNIT – II

3. PHOTOELASTICITY

Photoelastic stress measurement, Circular polariscope, Photoelastic stress determination, determination of principal stresses, 3-D photoelasticity.

UNIT – III

4. 3-D STRESS-STRAIN ANALYSIS

Introduction, Stress ellipsoid and stress-director surface, Determination of principal stresses, Stress invariants, Determination of maximum shearing stresses, Homogeneous deformation, Strain at a point, Principal axes of strain, Rotation.

5. 3-D PROBLEMS OF ELASTICITY

Uniform stress, Stretching of prismatic bar, Twist of circular shafts, Pure bending of prismatic bars and plates.

UNIT – IV

6. TORSION

Torsion of straight bars, elliptic cross section and other elementary solutions, Membrane analogy, Torsion of bar with narrow rectangular cross section, Torsion of rectangular bars, Torsion of rolled profile sections, Torsion of hollow shafts, Torsion of thin tubes, Torsion of circular shafts of variable diameter.

Suggested Readings / Books:

1. Theory of Elasticity: S.P.Timoshenko & J.N. Goodier, McGraw Hill.

2. Aircraft structures for Engineering Students: T H G Megson, Elsevier.

3. Theoretical Elasticity: A.E.H. Love

BANE1-756 Principles of Management and Professional Ethics

L T P C
3 0 0 3

UNIT – I

1. MANAGEMENT FUNCTIONS & STRUCTURE

Management – Definition, Basic Function, Contribution of Taylor & Fayol, Types of structure – Line, staff, Functional, Committee, Project & Matrix, Structures, Departmentalization, Centralization, Decentralization, span of control, Management by Objectives, Management by Exception.

UNIT – II

2. MANAGEMENT OF ORGANISATION

Forms of Business/Industrial Ownership, Sole Trader, Partnership, Company, Performance Appraisal, Basic Principles, Pitfalls, Methods to Overcome, Industrial Safety, Causes of Accidents, Cost of Accident, How to minimize Accidents, Plant Layout & Maintenance – Need, Types & Managerial Aspects.

UNIT – III

3. ORGANISATIONAL BEHAVIOUR

OB – Definition, Nature & Scope, Contributing Disciplines, Importance of OB to Managers, Personality – Definition, Theories, Factors Influencing Personality, Motivation – Definition, Theories, Theory X & Y, Transactional Analysis, Morale & Job Satisfaction, Factors Influencing Job Satisfaction.

4. GROUP DYNAMICS

Group – Definition, Types, Determinants of Group Cohesiveness, Communication, Process, Barriers, Effective Communication, Leadership Theories, Factors Contributing to Effective Leadership, Role of Trade Unions in Organizations, Functions of Trade Union, Why Trade Union is required? Types of Trade Unions.

UNIT – IV

5. PROFESSIONAL ETHICS

Ethics in Workplace, Formulation of Ethics, Managerial Ethics, Managing Ethical Behaviour, Codes of Ethics, Encouraging Ethical Behaviour, Social Responsibility, Spirituality.

Suggested Readings / Books:

1. Management Theory and Practice: C.B. Gupta, Sultan Chand & Sons.
2. Organisational Behaviour: Dr. L.M. Prasad, Sultan Chand & Sons.
3. Principle & Practice of Management: Dr. L.M. Prasad, Sultan Chand & Sons.
4. Organisational Behaviour: Aswathappa, Himalaya Publishing House.
5. Principles of Management: Harold Koontz, Tata McGraw Hill.

BANE1-757 Viscous Flow Theory

L T P C
3 0 0 3

UNIT – I

1. **Outline of Fluid Motion with friction**
   Real and perfect fluid, Viscosity, Compressibility, The Hagen-Poiseuille flow through a pipe, Principle of Similarity: Reynolds and Mach number, Comparison between the theory of perfect fluids and experiments.

UNIT – II

2. **Derivation of the equations of motion of a compressible viscous fluid (Navier-Stokes equations)**
   Fundamental equations of motion and continuity applied to fluid flow, General stress system in a deformable body, Relation between stress and rate of deformation, Stokes's hypothesis, Bulk viscosity and thermodynamic pressure, Navier-Stokes equations.

3. Outlines of Boundary-layer theory

The Boundary-Layer concept, Separation and vortex formation, Turbulent flow in a pipe and in a boundary layer.

UNIT – III

4. Laminar Boundary Layer Flows

Boundary layer Flow, Boundary Layer Equations, Approximate Momentum Integral Theory, Boundary Layers within accelerating potential flow, Flow over non-Slender Planner Bodies, Rotational Boundary Layers.

UNIT – IV

5. Boundary-layer equations for two-dimensional flow; Boundary-Layer on a flat plate

Derivation of boundary-layer equations for flow along a flat plate, The separation of a boundary layer, A Remark on the integration of the boundary layer equations, Skin friction, The boundary layer along a plate.

Suggested Readings / Books:

1. Boundary-Layer Theory: Dr Hermann Schlichting, McGraw-Hill Book Company.
2. Fluid Mechanics: Frank M White, McGraw-Hill Companies.
3. Physical Fluid Dynamics: P.D. McCormack and Lawrence Crane, Academic Press.
4. Viscous Flow Theory vol.I – Laminar Flow: Shih-i-Pai, P.Van Nostrand and Co.

BANE1-758 Air craft Maintenance and Air Transportation

L T P C
3 0 0 3

UNIT – I

1. AIR TRAFFIC CONTROL

Principles of Air Navigation and Air Traffic Control, Overview of CNS & ATM, Separation standards, Radar and Non-radar separation, Wake turbulence longitudinal separation minima, Precision approaches for landing, Radar systems for ATC.

UNIT – II

2. AIRLINES

Introduction to airline industry and economics, Determination of operating costs, Airline route selection and scheduling, Planning of flight operations, Special topics in airline operations, Emergence of LCC.

3. AIRPORTS

Aircraft characteristics affecting airport design, Airport layouts and configurations, Geometric design of the airfield, Wind Rose Diagram, Geometric design of the airfield.

UNIT – III

4. CURRENT ISSUES AND TRENDS IN AIR TRANSPORTATION

Modeling & Simulation of ATC systems, Estimation of airway Capacity & Delay, Human factors and Controller Workload, Performance based Navigation, Free Flight, Conflict Detection and resolution, Environmental effects of Aviation, Modeling air transport systems.

5. MAINTENANCE SCHEDULES

Maintenance of aircraft, its components, systems and sub-systems. Types of maintenance schedules, Mandatory schedules, Inspection of aircraft and components: Types of Inspections, Various Aircraft Manuals, Service Letters, Service Bulleting, Advisory Circulars, Repair, Modifications, Alteration, Reconditioning, History Record Sheet.

UNIT – IV

6. MAINTENANCE OF STRUCTURE AND VARIOUS SYSTEMS

Maintenance of aircraft structure,Propeller, Power-plant, Undercarriage, Hydraulic system, Fuel system, Air-conditioning system.

7. Aircraft Assembly and Rigging

Aircraft Assembly, Rigging, Alignment of fixed surfaces and flight controls systems in details, Balancing, Inspection and Maintenance. Flight control system of Helicopter.

Suggested Readings / Books:

1. Aircraft Maintenance and Repair : Kroes et.al, GLENCOE.

2. Fundamentals of Air Traffic Control : Michael S. Nolan, Thomson Brooks, Cole, USA.

3. Airline Route Planning : John H. H. Grover, BSP Professional Books, Blackwell Scientific Publications, Oxford, UK.

4. Air Transportation : A Management Perspective: John G. Wensveen, Ashgate Publishing, Ltd., UK.

5. Aircarft Basic Science : Kroes et.al, GLENCOE

6. An Introduction to Airline Economics : William E. O'Connor, Greenwood Publishing Group

7. Planning and Design of Airports : Robert Horonjeff & Francis X. McKelvey, Mcgraw Hill Professional Publishing.

8. Air Transportation Systems Engineering : George L. Donohue, Andres G. Zellweger, Editors, American Institute of Aeronautics and Astronautics.

8th Semester

BANE1-859 BOUNDARY LAYER THEORY

L T P C
3 1 0 4

UNIT – I

1. **Review of Basic Concepts and Formulation of Equation:** Descriptors/Topics: Boundary layer thickness, Momentum thickness, Energy thickness, Shape Factor, separation equations of Motion and energy equation for compressible viscous fluid-derivation and discussion, boundary layer equation and their general properties.

UNIT – II

2. **Exact and Approximate Methods and Axially Symmetrical Body:** Descriptors/Topics: Flat plate at zero incidence, Flows with pressure gradient, von Karman and Polhausen Methods. Rotation near ground, Circular jet, Boundary layer on a body of revolution, flow in the entrance section of pipe.

UNIT – III

3. **Thermal Boundary Layer, Transition and Boundary Layer Control:** Descriptors/Topics: Heat transfer from heated surface. Incompressible and compressible laminar flow over a flat plate, Plate thermometer problem. Pipe flow and flow over a flat plate, Critical Reynolds number, Turbulent spots, Principles of theory of stability of Laminar flows, Sommer-field equation, factors affecting transition, Laminar airfoils.

   Methods of control, Fundamental equations and exact solution for a flat plate with uniform suction, Compressible Boundary Layers with suction, Approximate solution for a flat plate with uniform suction, compressible boundary layers with suction approximate solutions, theoretical and experimental results.

UNIT – IV

4. Turbulent Boundary Layer and pipe flows: Descriptors/Topics: Fundamentals of Turbulent flow, Mean motion and fluctuations, Reynolds, stresses, wind tunnel Turbulence, Prandtls mixing Length theory, Von Karman's similarity Hypothesis, Velocity distribution laws. Experimental results through smooth pipes, Relation between laws of friction and velocity distribution, Universal Resistance law for smooth pipe at large Reynolds number, Rough pipe and equivalent roughness.

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RECOMMENDED BOOKS

3. John D. Anderson (Jr.), 'Fundamentals of Aerodynamics', 2nd Edition., McGraw Hill.
4. Gupta and Gupta, 'Fluid Mechanics and its Applications', Wiley Eastern, **1960**
5. H. Schlichting, 'Boundary Layer Theory', 6th Edition., McGraw Hill, **1986.**
6. Frank M. White, 'Fluid Mechanics', 2nd Edition, McGraw Hill, **1986.**

BANE1-860 ADVANCED AERODYNAMICS

L T P C
3 1 0 4

UNIT – I

1. Elements of compressible flow: Compressible flow properties: Total Enthalpy, Total Temperature, Temperature and Pressure ratios as a function of Mach No., Mass Flow Parameter (MFP). Isentropic Area ratio (A/A*), Velocity-Area variations, Rayleigh Pitot tube formula, Flow in constant area duct with friction and heat transfer.

UNIT – II

2. Non-Linear Supersonic Flows: Numerical techniques, method of characteristics, supersonic nozzle design, finite difference method, time dependent technique for supersonic blunt bodies, numerical problems. Compressibility effects of aerodynamic characteristics of lift generating surfaces

UNIT – III

3. **Supersonic Analysis for configurations:** Governing equations and boundary conditions, consequences of linearity, conical flow method for rectangular, swept, delta and arrow wings, singularity distribution method, design nsideration for supersonic aircraft, aerodynamic interaction, supersonic analysis for complete configurations.

UNIT – IV

4. Supersonic Lift Theory and Hypersonic flow: Shock –Expansion theory, flow field in supersonic flows, numerical problems, thin airfoil theory, analytical determination of lift and drag coefficients on flat plate, bi-convex, and diamond shaped sections in supersonic flows, numerical problems, supersonic leading and trailing edges. Qualitative aspects, Newtonian theory, lift and drag of wings at hypersonic speeds, hypersonic shock wave relations, Mach no. independence, hypersonic and CFD, high L/D hypersonic configurations, Aerodynamic heating, ground test data and flight test data.

INSTRUCTIONAL STRATEGY

Visual aids like videos and presentations must be used in order to explain theoretical concepts in a better way, where applicable.

RECOMMENDED BOOKS

1. "Modern Compressible Flow with Historical Perspective", Anderson, J. D., 3rd edition., McGraw-Hill
2. "Aerodynamics", L.J.Clancy, 5th Ed. Himalayan Books
3. "Aerodynamics for Engineers", John J Bertin, 4th Ed, Pearson Publishers
4. "Gas Dynamics", Vol I , Zucrow, M J and J D Hoffman, John Wiley & sons
5. "Gas Dynamics (Fifth Edition)", Dr. E. Rathakrishnan, PHI Learning, Delhi, India, 2013.

BANE1-861 EXPERIMENTAL AERODYNAMICS

L T P C
3 1 0 4

UNIT – I

1. Introduction: Types of wind tunnels – Open and closed wind tunnels; wind tunnels with open and closed test sections; variable density wind tunnels; smoke tunnels; vertical wind tunnels; sub-sonic, super-sonic, trans-sonic wind tunnel; water tunnels. Wind tunnel calibration, Measurements techniques in wind tunnels: forces and moments, pressure, velocity, temperature, aero-acoustic measurements.

UNIT – II

2. Qualitative and Quantitative Measurements: Low speed flow visualization techniques, Schlieren, shadowgraph, interferometry, introduction to laser diagnostic techniques.

Measurement of temperature using thermocouples, resistance thermometers, temperature sensitive paints and liquid crystals, Steady and unsteady pressure measurements and various types of pressure probes and transducers, errors in pressure measurements, thermocouples, thermography, velocity measurement using hot wire anemometry , Laser Doppler Velocimetry and Particle Image Velocimetry

UNIT – III

3. Data Acquisition and Processing: Data acquisition and digital signal processing techniques, wind tunnel data acquisition, measurement of steady and unsteady pressure, velocity, temperature, turbulence intensity, calibration of force, pressure and acoustic sensors. Calibration of single and two wire probes.

Data validation techniques: verifying experimental data with theoretical and computational results.

UNIT – IV

4. Virtual Instrumentation: Introduction to VI (virtual instrumentation) and its typical applications, functional systems, graphical programming, data flow techniques, advantages of VI techniques. VI programming techniques; VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, string and file I/O, DAQ methods, code interface nodes.

INSTRUCTIONAL STRATEGY

In case of data acquisition and analysis, hands on experience in instruments and computational facilities should supplement classroom teaching.

RECOMMENDED BOOKS

- “Low speed wind tunnel testing”, Jewel B. Barlow, John Wiley & sons
- “Experimental Aerodynamics”, Henry Christensen, Pavian,Pitman Publishing

- "Wind Tunnels: Aerodynamics, Models & Experiments (Engineering Tools, Techniques and Tables)", Justin D. Pereira.
- "Virtual instrumentation using LabVIEW", Jerome Jovitha, PHI Learning Private Ltd.

RECOMMENDED BOOKS

6. "Modern Compressible Flow with Historical Perspective", Anderson, J. D., 3rd edition., McGraw-Hill
7. "Aerodynamics", L.J.Clancy, 5th Ed. Himalayan Books
8. "Aerodynamics for Engineers", John J Bertin, 4th Ed, Pearson Publishers
9. "Gas Dynamics", Vol I , Zucrow, M J and J D Hoffman, John Wiley & sons
10. "Gas Dynamics (Fifth Edition)", Dr. E. Rathakrishnan, PHI Learning, Delhi, India, 2013.

Open Elective-I

Open Elective-II

BANE1- 840 Project-II

B.Tech. Aeronautical Engineering (3rd SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMATH4-301	Applied Mathematics – III	2	0	0	40	60	100	2
BANES1-301	Basics of Aeronautics	3	0	0	40	60	100	3
BANES1-302	Aerodynamics	3	0	0	40	60	100	3
BANES1-303	Basics of Thermodynamics	3	1	0	40	60	100	4
BANES1-304	Strength of Materials	3	1	0	40	60	100	4
BANES1-305	Aerodynamics Lab.	0	0	2	60	40	100	1
BANES1-306	Strength of materials lab	0	0	2	60	40	100	1
BANES1-307	Training–1 : 4 weeks Summer Training (Manufacturing practices)	-	-	-	60	40	100	2
Total 5 Theory & 2 Lab. Courses		**14**	**2**	**4**	**380**	**420**	**800**	**20**

B.Tech. Aeronautical Engineering (4th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANES1-401	Aircraft performance	3	1	0	40	60	100	4
BANES1-402	Aircraft Structures	3	1	0	40	60	100	4
BANES1-403	Aircraft Propulsion	3	1	0	40	60	100	4
BANES1-404	Aircraft Systems and Instrumentation	3	0	0	40	60	100	3
BANES1-405	Aircraft Structures Lab.	0	0	2	60	40	100	1
BANES1-406	Aircraft Propulsion Lab.	0	0	2	60	40	100	1
	Management (Select any One)	3	0	0	40	60	100	3
BHSMC0-018	Introduction to Industrial Management							
BHSMC0-014	Fundamentals of Management for Engineers							
	Mandatory Course							
BMNCC0-002	Environmental Sciences	3	0	0	40	60	100	0
Total 6 Theory & 2 Lab. Courses		**15**	**3**	**04**	**360**	**440**	**800**	**20**

NOTE: Students will go on Industrial training after 4th Semester

B.Tech. Aeronautical Engineering (5th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANES1-501	Aircraft Structural analysis	3	1	0	40	60	100	4
BANES1-502	High Speed Aerodynamics	3	1	0	40	60	100	4
BANES1-503	Aircraft Materials and Processes	3	1	0	40	60	100	4
BANES1-504	Aircraft Structural analysis Lab	0	0	2	60	40	100	1
BANES1-505	Training-II	-	-	-	60	40	100	3
	Humanities (Select Any One)	3	0	0	40	60	100	3
BHSMC0-005	Effective Technical Communication							
BHSMC0-016	Organizational Behavior							
	Departmental Elective-I (Select One)	3	1	0	60	40	100	4
BANED1-511	Numerical Methods							
BANED1-512	Finite element Methods							
	Mandatory Courses* (Any One)	-	-	-				0
BMNCC0-001	Constitution of India							
BMNCC0-006	Essence of Indian Knowledge Tradition							
Total 6 Theory & 1 Lab. Courses		**15**	**4**	**02**	**340**	**360**	**700**	**23**

B.Tech. Aeronautical Engineering (6th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANES1-601	Computational Fluid Dynamics	3	0	0	40	60	100	3
BANES1-602	Helicopter Engineering	3	1	0	40	60	100	4
BANES1-603	Aircraft stability and control	3	1	0	40	60	100	4
BANES1-604	Computational Fluid Dynamics Lab	0	0	2	60	40	100	1
	Departmental Elective-II (Select One)	3	0	0	40	60	100	3
BANED1-611	Aircraft Maintenance							
BANED1-612	Automatic flight control							
BANED1-613	Aero engine Design							
	Departmental Elective-III (Select One)	4	0	0	60	40	100	4
BANED1-621	Vibration and Aero Elasticity							
BANED1-622	Optimization Techniques							
XXXX	Open Elective-I	3	0	0	40	60	100	3
Total 6 Theory & 1 Lab. Courses		**19**	**2**	**02**	**320**	**380**	**700**	**22**

B.Tech. Aeronautical Engineering (7th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BANES1-701	Avionics	3	0	0	40	60	100	3
BANES1-702	Aircraft design	3	1	0	40	60	100	4
BANES1-703	**Project-I	0	0	8	60	40	100	4
BANES1-704	*Training-III	-	-	-				3
	Departmental Elective-IV (Select One)	3	1	0	40	60	100	4
BANED1-711	Jet Propulsion							
BANED1-712	Rocket Propulsion							
BANED1-713	Rockets and Missiles							
	Departmental Elective-V (Select One)	3	0	0	40	60	100	3
BANED1-721	Air Transportation and Operation							
BANED1-722	Aircraft Composite Material							
BANED1-723	Aircraft Modelling and Simulation							
XXXX	**Open Elective-II**	3	0	0	40	60	100	3
Total 5Theory and 01 Lab		**12**	**2**	**08**	**260**	**340**	**600**	**24**

B.Tech. Aeronautical Engineering (8th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
	Departmental Elective-VI (Select One)							
BANED1-801	Boundary Layer Theory	3	1	0	40	60	100	4
BANED1-802	Advanced Aerodynamics							
BANED1-803	Experimental Aerodynamics							
BANED1-804	Project-II	0	0	08	60	40	100	4
XXXX	Open Elective-III	3	0	0	40	60	100	3
XXXX	Open Elective--IV	3	0	0	40	60	100	3
Total 3 Theory and 01 lab		**9**	**1**	**08**	**180**	**220**	**400**	**14**

NOTE: Choose any one subject from list of Open Elective subjects provided by MRSPTU, Bathinda.

BASICS OF AERONAUTICS

Subject Code – BANES1-301 **L T P Cr** **Duration:45 Hours**
3 0 0 3

COURSE OBJECTIVES

- To enable the student to understand prominent design features of Flight vehicle structures
- To enable the student to understand basic principles of flight along with historical developments.
- To enable the student to find basic flight performance and stability parameters of aircrafts.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Distinguish different components of aircrafts based on design features.
- Estimate aerodynamic performance of various Aerodynamic Shapes.
- Estimate basic flight parameters of aircrafts.
- Estimate power of propulsive devices of aircrafts.
- Distinguish different components of aircrafts navigation and communication systems.

DETAILED CONTENTS

UNIT –I (08 Hrs.)

1. **Basics of flight vehicles:** Classification of Flight Vehicles along with prominent design features, Importance of Strength/Weight Ratio, Loads on different parts of the Vehicle, detailed description of the Fuselage, Wing & Tail Surfaces, Wing Surfaces, Wing Fuselage Joining Methods, different types of Under Carriages, of Manned & Unmanned Space Vehicles Airplanes, Hovercraft, Helicopter & other V/STOL Machines along with examples. Historical Note: Very Early Flight vehicle Development, Sir George Caley, Otto Lilienthal, Percy Pilcher, Wilber and Orville Wright, The Aeronautical Triangle-Langley, the Wright and Glenn Curtiss.

UNIT-II (12 Hrs.)

2. **Airfoils, wings and other aerodynamic shapes:** Airfoil Nomenclature, Lift, Drag, and Moment, Airfoil Data, Infinite versus Finite wings, Pressure Coefficient, Lift coefficient from pressure coefficient, Compressibility Correction, Drag-Divergence Mach No., Wave Drag, Finite Wings, Calculation of Induced Drag, Change in the Lift Slope, Swept Wings, High Lift Flaps, Aerodynamics of cylinder and spheres, alternate explanation of Lift, Historical Note: Airfoils and Wings, The Wright Brothers, British and United States Airfoils(1910 to1920), 1920 to 1930, NACA series Digital Airfoils, Later Airfoils, Modern Airfoil , Finite Wings.

UNIT III (13 Hrs.)

3. **Basics of flight mechanics:** Equations of Motion, Thrust required for level Flight, Thrust available and Maximum velocity, Power required for level Flight, Power available and Maximum Velocity, Rate of Climb, Gliding Flight, Absolute and service Ceilings, Historical Note: Drag Reduction- Early Prediction of Airplane Performance.

   Definition of Stability and Control, Moments on the airplane, Criteria for Longitudinal Static Stability, Wing Contribution, tail Contribution, Static Stability equations, Neutral Point, Static Margin, Historical Note: Drag Reduction- Early Prediction of Airplane Performance, Wright Brothers versus the European philosophy on Stability and Control, The Development of Flight controls, Airplane Design-Evolution and Revolution.

UNIT-IV (12 Hrs.)

4. **Basics of aircraft propulsion:** Propeller, Reciprocating Engine, Jet Propulsion-The thrust Equations, Turbojet, Turbofan, Ramjet and Rocket Engine, Historical Note: Early Development of the Internal Combustion Engine for Aviation, Inventors of the Early Jet Engines, Early History of the Rocket Engine, Solid & liquid Propellant.

5. **Navigation & communication:** Different Navigation Methods, Dead Reckoning, Astronavigation, Ratio Aids, Positive Fixing, Related modern instruments. Instruments landing system, HF& VHF System, Simple Description of Communication Systems using Earth Station & Satellites.

INSTRUCTIONAL STRATEGY

Session Plan / course-material uploading, Visit to Aircraft Hanger, Class-room teaching associated with assignments, presentations, Videos, quiz, in-class tests, viva-voce and evaluation.

RECOMMENDED BOOKS

1 “Introduction to Flight”, J. D. Anderson, 8th Edition, 2015
2 “Flight without Formulae”, A. C. Kermode, Pitman Publishing; 4th revised edition, 197(
3 “Aerodynamics”, L. J. Clancy, Wiley & Sons, 1975

VIDEOS

1. “Aerodynamics: Airfoil Camber, Flaps, Slots-Slats & Drag”, Youtube Video
2 “How Airplanes Fly 1968 FAA Basic Aerodynamics ,“ Youtube Video
3 ”Jet Engines, How it works?” ,“ Youtube Video
4 “Basic Aerodynamics”-CG and Stability,” Youtube Video

AERODYNAMICS

Subject Code –BANES1-302 | **L T P Cr 3 0 0 3** | **Duration:45 Hours**

COURSE OBJECTIVES

- Differentiate between various types of fluid flow.
- Understand physical significance of Bernoulli's equation, momentum equation and Naiver-Stokes equations.
- Apply concepts of viscous flow to calculate laminar and turbulent boundary layer.

LEARNING OUTCOME

At the end of the course, the student will be able to:

- Classify flow in different categories on the basis of various parameters.
- Develop understanding of various significant non-dimensional numbers used in fluid dynamics.
- Evaluate aerodynamic properties of different planer bodies in inviscid flow theoretically.
- Develop governing equations of flow properties using different conservation principles.
- Find lift force over Joukowsky airfoils by Kutta-Joukowsky theorem.

DETAILED CONTENTS

UNIT – I (10 Hrs.)

1. **Introduction:** Dimensional analysis, units of measurements, similarity parameters, Buckingham-pi theorem, classifications of flow- Continuum and free molecular flows, inviscid and viscous flows, incompressible and compressible flows. Newtonian and Non-Newtonian flows. Streamlines, Pathlines, Streaklines, Pitot static tube, measurement of air-speed, pressure coefficient. Aerodynamic force and moments. Reynolds number.

UNIT – II (18 Hrs.)

2. **Kinematics and Dynamics of Fluid Flow:** Lagrangian and Eulerian methods, Description of properties in a moving fluid, Gradient of a scalar field , Divergence and Curl of a vector field, Line, Surface and Volume integrals and their relationship ,Finite control volume and molecular approach, Divergence of velocity.

   Equation of conservation of mass for control volume, special form of equation of conservation of mass, differential form of equation of conservation of mass, Euler's and Naiver-Stoke equations. Derivation of Bernoulli's equation for inviscid and viscous flow fields. Momentum equation in integral form. Application of momentum equation.

UNIT – III (10 Hrs.)

3. **Inviscid-Incompressible Flow:** Incompressible flow in a duct, Condition on velocity for incompressible flow. Laplace's equations. Vorticity and circulation, Potential function, stream function. Basic elementary flows: Uniform flows, source flow, Doublet flow and Vortex flow. Superimposition of elementary flows. Non-lifting and lifting flow over a circular cylinder, comparison with real flow over circular cylinder. Kutta-Joukowski theorem, generation of lift.

UNIT – IV (07 Hrs.)

4. **Viscous flow:** Boundary layer concept, boundary layer properties, derivation of Prandtl's boundary layer equations, Blasius solution, Karman's Integral equation. Turbulent boundary layer over a plate, skin friction drag, boundary layer control.

INSTRUCTIONAL STRATEGY

Videos and images may be referred to explain basic concepts in a better way.

RECOMMENDED BOOKS

1. "Fundamentals of Aerodynamics", John D.Anderson(Jr.), McGraw Hill
2. "Fluid Mechanics", Frank M.White 2nd Edition., McGraw Hill
3. "Aerodynamics for Engineering Students", E.L.Houghton and P.W.Carpenter, 4th Edition., CBS Publishers , India

BASIC OF THERMODYNAMICS

Subject Code – BANES1-303 | **L T P Cr** **3 1 0 4** | **Duration:45 Hours**

COURSE OBJECTIVES

- Explain thermodynamic terminology and concepts appropriately
- Define appropriate system boundaries for analyzing a variety of thermodynamic components and systems
- Determine and calculate the appropriate energy transfers and system properties to analyze closed system processes and cycles
- Determine and calculate the appropriate mass and energy transfers and properties to analyze steady-state control volume applications with any number of heat, work, or mass flows crossing the system boundary
- Determine and calculate appropriate mass and energy transfers and properties to analyze selected transient control volume applications
- Use tables, charts, equations, and software, in conjunction with appropriate property diagrams, to fix states of a pure substance and determine relationships among pressure, temperature, specific volume, internal energy, enthalpy and entropy

LEARNING OUTCOME

At the end of the course, the student will be able to:

- demonstrate that they can apply the principles of conservation of mass, conservation of energy, and the second law of thermodynamics to thermodynamic cycles.
- demonstrate the ability to analyze the performance of vapor and gas power cycles.
- demonstrate the ability to analyze the performance of vapor and gas refrigeration and heat pump cycles.
- Calculate states and performance parameters for vapor power cycles based on the Rankine cycle with superheat, reheat, and regeneration
- Use analytical techniques and/or computer tools (e.g. Matlab) to solve problems and display the results in graphical forms

UNIT – I (10 Hrs.)

Fundamental Concepts & Definitions:
Thermodynamic definition and scope, Microscopic and Macroscopic approaches.Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and controlsurface, examples. Thermodynamic properties; definition and units, intensive , extensive properties, specific properties,pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process,cyclic and non-cyclic;

processes;Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall,thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, internationalfixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gasthermometer, mercury in glass thermometer

Work and Heat:

Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, signconvention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions fordisplacement work in various processes through p-v diagrams. Shaft work; Electrical work.Other types of work.Heat;definition, units and sign convention. Problems

UNIT – II (12 Hrs.)

First Law of Thermodynamics:

Joules experiments, equivalence of heat and work. Statement of the First law ofthermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy,Extension of the First law to control volume; steady flow energy equation(SFEE), important applications.

Second Law of Thermodynamics:

limitations of first law of thermodynamics Devices converting heat to work; (a) in athermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir,Direct heat engine; schematic representation andefficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation,coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II,Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnotprinciples. Problems

Reversibility:

Definitions of a reversible process, reversible heat engine, importance and superiority of a reversible heatengine and irreversible processes; factors that make a process irreversible, reversible heat engines. Unresistedexpansion, remarks on Carnot’s engine, internal and external reversibility, Definition of the thermodynamic temperaturescale. Problems

Entropy:

Clasius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as aquantitative test for irreversibility, principle of increase in entropy, , calculation of entropy using Tds relations, entropyas a coordinate.

UNIT – III (12 Hrs.)

Availability, Irreversibility and General Thermodynamic relations.

Introduction, Availability (Exergy), Unavailable energy(anergy), Relation between increase in unavailable energy and increase in entropy.Maximum work, maximum usefulwork for a system and control volume, irreversibility, second law efficiency (effectiveness). Gibbs and

Helmholtzfunctions, Maxwell relations, Clapeyron equation, Joule Thomson coefficient, general relations for change in entropy,enthalpy , internal energy and specific heats.

Pure Substances:

P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture ofsaturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example.Enthalpy of change of phase (Latent heat).Dryness fraction (quality), T-S and H-S diagrams, representation of variousprocesses on these diagrams.Steam tables and its use.Throttling calorimeter, separating and throttling calorimeter.

UNIT – IV (11 Hrs.)

Ideal gases:

Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation ofproperties of perfect and ideal gases,Air- Water mixtures and related properties, Psychrometric properties, Construction and use of Psychrometric chart.

Real gases –

Introduction , Air water mixture and related properties, Van-der Waal\\'s Equation of state, Van-der Waal\\'sconstants in terms of critical properties, Redlich and Kwong equation of state Beattie-Bridgeman equation , Law ofcorresponding states, compressibility factor; compressibility chart.Difference between Ideal and real gases.

RECOMMENDED BOOKS

1. **An Introduction to Thermodynamics,** Y.V.C. Rao, University Press (India) Private Limited, Revised Edition, 2004).
2. **Thermodynamics: an Engineering Approach**, Y.A.Cengal and M.A.Boles, McGraw Hill (Fifth edition).
3. **Fundamentals of Classical Thermodynamics**, G.VanWylen, R.Sonntag and C.Borgnakke, John Willey & Sons (Fourth edition).

APPLIED MATHEMATICS-III

Subject Code - BMATH4-301 **L T P Cr** **Duration:45 Hours**
2 0 0 2

Transform Calculus

Module 8a: *Transform Calculus* -1 (10 hours)
Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials, Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem, Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Module 8b: *Transform Calculus*-2 (10 hours)
Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.

Discrete Mathematics

Module 9a: *Sets, relations and functions*: (8 hours)

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Module 9b: *Propositional Logic:* (6 hours)

Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem etc., Decision problems of propositional logic. Introduction to first order logic and first order theory.

Module 9c: *Partially ordered sets:* (6 hours)

Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices, Boolean and pseudo Boolean lattices.

Module 9d: *Algebraic Structures:* (6 hours)

Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Module 9e: *Introduction to Counting:*(6 hours)

Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

Module 9f: ***Introduction to Graphs:*** (8 hours)

Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.

Textbooks/References:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.
6. N. Deo, Graph Theory, Prentice Hall of India, 1974.
7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

STRENGTH OF MATERIALS

Subject Code – BANES1-304 **L T P Cr** **Duration:45 Hours**
3 1 0 4

COURSE OBJECTIVES

- This course will make the students understand the concept of stress and strain in different types of structure/ machine under different loading conditions.

- The course also covers the simple and compound stresses due to forces, stresses and deflection in beams due to bending, torsion in circular section, strain energy, different theories of failure, stress in thin cylinder thick cylinder and spheres due to external and internal pressure.

LEARNING OUTCOME

At the end of the subject, the student will be able to:

- Model and analyze the behaviour of structural and machine components subjected to various loading and support conditions based on principles of equilibrium and material constitutional relationships.
- Understand and apply the concept of stress and strain to analyze and design structural members and machine parts under axial load, shear load, bending moment and torsional moment.
- Solve practical problems through evaluating the relationship between stress and strain.
- Analyse composite beams and shafts
- Determine the deflections and deformations of loaded flexural members.
- Analyze a structural member and machine part when loaded beyond elastic limit (inelastic and plastic cases).

DETAILED CONTENTS

UNIT –I (12Hrs.)

1. Simple stresses and strains : Concept of stress and strain; St. Vernants principle, stress and strain diagram, Hooke’s law, Young’s modulus, Poisson ratio, stress at a point, stress and strains in bars subjected to axial loading. Modulus of elasticity, stress produced in compound bars subject to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound bars. Compound stress and strains, the two dimensional. system; stress at a point on a plane, principal stresses and principal planes; Mohr’s circle of stress; ellipse of stress and their applications. Generalized Hook's Law, principal stresses related to principal strains

UNIT –II (12 Hrs.)

2. Bending moment and shear force diagrams: S.F and B.M definitions. BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF and the point of contra-flexure under the following loads:

a) Concentrated loads
b) Uniformity distributed loads over the whole span or part of span
c) Combination of concentrated loads (two or three) and uniformly distributed loads
d) Uniformity varying loads
e) Application of moments
f) Relation between rate of loading, shear force and bending moment

3. Theory of bending stresses in beams due to bending: assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel, I & T-sections,: Combined direct and bending stresses in aforementioned sections, composite / flitched beams.

UNIT –III (12 Hrs.)

4. Torsion: Derivation of torsion equation and its assumptions. Applications of the equation to the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts principal stress and maximum shear stresses under combined loading of bending and torsion, analysis of close-coiled-helical springs.

5. Thin cylinders and spheres : Derivation of formulae and calculation of hoop stress, Longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume; principal stresses in sphere and change in diameter and internal volume

UNIT –IV (09 Hrs.)

6. Columns and struts : Columns and failure of columns : Euler's formulas; Rankine-Gordon's
formula, Johnson's empirical formula for axially loaded columns and their applications.

7. Slope and deflection: Relationship between moment, slope and deflection, Moment area method; method of integration; Macaulay's method: Use of all these methods to calculate slope and deflection for the following :

a) Cantilevers

b) Simply supported beams with or without overhang

c) Under concentrated loads, uniformly distributed loads or combination of concentrated and uniformly distributed loads

INSTRUCTIONAL STRATEGY

The course pedagogy will include lectures, numerical practice, seminars and presentations. It also includes discussion on real life problems related to design of mechanical components which includes all types of stresses. The teachers should demonstrate the following experiments to the students in the Strength of Materials Lab:-

Tensile Test (MS), Compression Test (CI), Brinell Hardness No., Izod Impact, Rockwell Hardness Tester, Spring Stiffness (Spring Compression Testing Machine), Torsion Testing

Machine.

RECOMMENDED BOOKS

1. Introduction to Solid Mechanics by D.H Shames, Prentice Hall Inc. 2010
2. Elements of strength of Materials by Timoshenko and Young 2010
3. Strength of Materials by DS Bedi; Khanna book Publishing Company, 2014
4. Strength of materials by R.S Lehri and A.S. Lehri, S.K Kataria and Sons. 2014
5. Strength of Materials by Ferdinand P Singer and Andrew Pytel,Harper and Row H. Kogakusha Publishers, New York
6. Mechanics of Materials by SI Version, end edition by Ferdinand P. Beer and E Russel Johnston (Jr); McGraw Hill, India
7. Mechanics of Materials-SI Version 2nd Edition by EP Popov, Prentice Hall India

AERODYNAMICS LAB

Subject Code – BANES1-305 **L T P Cr** **Duration:30 Hours**
0 0 2 1

COURSE OBJECTIVES

- Select appropriate experimental techniques to study the aerodynamic characteristics of any body.
- Interpret experimental result.

DETAILED CONTENTS

1. Visualization and plotting streamlines of flow field around Symmetric Airfoil and cambered airfoil at subsonic speed in smoke tunnel. Repeat the experiment for three different angles of attack.
   a. Negative angle of attack (say -5^{o})
   b. Zero lift angle of attack
   c. Positive angle of attack of small value, say 5^{o}
   d. Stall angle of attack (i.e. > 15^{o})
2. Identification and plotting different flow structure (wing tip vortices, downwash region, up-wash region, trailing edge wake) around finite wing using smoke at subsonic speed in wind tunnel.
3. Visualization of flow using smoke at subsonic speed around delta wing in wind tunnel.
4. Obtain vortex shedding frequency vs speed plot for Von-Karman vortex around circular non-rotating cylinder in smoke tunnel at subsonic speed.
5. Calculating rotational speed of cylinder for fixed incoming freestream velocity at which
   a. Two stagnation points are obtained
   b. One stagnation point is obtained
   c. No stagnation point is obtained on the surface of cylinder

   Use smoke tunnel for this experiment. Repeat this experiment for at least three different velocity.
6. Calculating angle of attack at which flow separates over the surface of aircraft using tufts in wind tunnel. Identify the regions over the aircraft surface where flow remains separated at relatively low angles of attack.
7. Visualization and plotting of flow separation process and wing tip vortices around 3D wing at different angle of attack using tufts in wind tunnel.
8. Plotting the flow field, using oil pattern, around airfoil at different angle of attack in wind tunnel.

RECOMMENDED BOOKS

1. "Low speed wind tunnel testing", Jewel B. Barlow, John Wiley & sons
2. "Experimental Aerodynamics", Henry Christensen, Pavian, Pitman Publishing
3. "Wind Tunnels: Aerodynamics, Models & Experiments (Engineering Tools, Techniques and Tables)", Justin D. Pereira.

MEANS OF ASSESSMENT

Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce.

STRENGTH OF MATERIALS LAB

Subject Code – BANES1-306 **L T P Cr** **Duration:30 Hours**
0 0 2 1

OBJECTIVES

To supplement the theoretical knowledge gained in Strength of Materials with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison

    a) Unhardened specimen
    b) Quenched Specimen and

11. Quenched and tempered specimen. Microscopic Examination of
    a) Hardened samples and
    b) Hardened and tempered samples.

MEANS OF ASSESSMENT

Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce.

*NOTE: Workshop Training will be imparted in the Institution at the end of 2nd semester for Four (04) weeks duration (Minimum 36 hours per week).students will learn manufacturing practices. Students will also undergo training of 3D CAD modeling software (SOLIDWORKS). Students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.

AIRCRAFT PERFORMANCE

Subject Code – BANES1-401 **L T P Cr** **Duration:45 Hours**
3 1 0 4

COURSE OBJECTIVES

- The course enables students to learn various concepts related to atmosphere, aerodynamic characteristics, performance parameters and energy methods.
- The course enables students to analyze and estimate performance parameters of different types of aircraft for steady and accelerated flights.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Analyze atmosphere and estimate atmospheric properties.
- Analyze drag for 2D and 3D cases for subsonic and supersonic aircrafts.
- Analyze aerodynamic characteristics of different types of aircrafts.
- Estimate performance parameters for steady flight.
- Estimate performance parameters for accelerated flight.
- Analyze maneuvers and Energy methods.

DETAILED CONTENTS

UNIT – I (8 Hrs.)

1. Atmosphere: Standard atmosphere, Relation between geo-potential and geometric altitudes, Pressure, temperature and density altitudes. Relations for isothermal and gradient atmospheric regions, Stability of atmosphere, Measurement of air-speed: Indicated airspeed, Calibrated airspeed, Equivalent airspeed and True airspeed, Airspeed indicator.

UNIT – II (16 Hrs.)

2. Drag: Drag, Causes of drag, Types of drag, Factors affecting drag. Drag polar, Compressibility drag, Design for minimum drag, Estimation of drag of complete airplane for subsonic and supersonic cases, Terminal velocity.

3. Aerodynamic characteristics: Force and Moment coefficients from dimensional analysis and their variation with angle of attack, Lift, Drag and moment coefficients, Relations between lift and drag, Aerodynamic center, Center of pressure, Pressure distribution over 2-D airfoil, Estimation of aerodynamic characteristics from measured pressure distribution, Variation of aerodynamic coefficients with Reynold's Number and Mach number, Effect of span, aspect ratio, plan form, sweep, taper and twist on aerodynamic characteristics of a lifting surface, Delta wing aerodynamics.

UNIT – III (12 Hrs.)

4. High lift devices: Maximum lift coefficient of airfoils, Leading and trailing edge devices, Deep stall, Propulsive lift, V/STOL configurations.

5. Aircraft performance in steady flight: Straight and Level flight, Variation of drag with flight speed, Minimum drag conditions, Variation of power with flight speed, Minimum power conditions, Gliding flight, Shallow and steep angles of glide, Sinking speed, Minimum sinking speed, Time of descent, Climbing flight at shallow angles, Correction for steep angles, Time to flight, Maximum rate of climb.

UNIT – IV (09 Hrs.)

6. Aircraft performance in accelerated flight: Take-off and landing, Calculation of take-off ground run and take off distances, Minimum ground run, Assisted take-off, Calculation of landing ground run and landing distances, Range and endurance, Numerical problems.

7. Maneuvers and energy method: Maneuvering performance, Introductory comments on spins and stalls, Analysis of Spin, Various types of stalling behavior of wings, Turning flight, Maneuvers in 3-D space, Karman's method of JATO, Energy method of performance calculations

INSTRUCTIONAL STRATEGY

The course consists of conceptual and numerical contents for which a combination of LCD projector and black/white boards can be used as teaching aids.

RECOMMENDED BOOKS

1. Aircraft Performance and Design: J. D. Anderson Jr., TATA McGraw-Hill, 2010.
2. Aerodynamics for Engineering Students: E.L. Houghton and N.B. Carruthers, Butterworth Heinemann, 1982.
3. Introduction to Flight: J. D. Anderson Jr., TATA McGraw-Hill, 8^{th} Edition, 2015.

AIRCRAFT STRUCTURES

Subject Code – BANES1-402 **L T P Cr** **Duration:45 Hours**
3 1 0 4

COURSE OBJECTIVES

- To enable the student to explain basic principles of elasticity.
- The student should be able to calculate loads acting on the aircraft.
- The student should also be able to do stress analysis of statically determinate and indeterminate structures by matrix method and Finite Element methods.
- To enable the student to find buckling loads of columns and plates

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Perform stress analysis of beams, columns and trusses by applying various methods.
- Calculate deflection of structures by various methods..
- Perform stress analysis of statically determinate and indeterminate structures.
- Estimate loads acting on an aircraft.
- Estimate buckling loads of columns and plates.

DETAILED CONTENTS

UNIT –I (8 Hrs.)

1. **Basics of elasticity:** Equations of equilibrium, plane stress, stresses on inclined planes, principal stresses ,compatibility equations ,plane strain ,principal strains, stress-strain relationship**,** numerical problems, temperature effects, experimental measurement of surface strains,2- D problems, stress functions, St. Venant's principle, bending of end loaded cantilever.

UNIT-II (16 Hrs.)

2. **Statically determinate and indeterminate structures:** Statically determinate and indeterminate trusses. Truss analysis by method of joints, Truss analysis with single and double redundancy, other structures with single redundancy, shear center, principle of superposition, Maxwell reciprocal theorem, numerical problems.

3. **Matrix methods:** Introduction to flexible and stiffness methods, choice of method ,stiffness matrix for elastic springs, analysis of pin jointed framework, stiffness matrix for uniform beams. Finite Element Method for continuum structures

UNIT-III (14 Hrs.)

4 **Elastic buckling of columns and plates:** Buckling load of Euler columns with different end conditions, beam columns, effect of initial imperfections, pure bending of thin plates, plates subjected to bending and twisting, plates subjected to distributed transverse loads, numerical problems.

5 **Loads on aircraft:** Pure translation, inertia forces on rotating bodies, load factors for translational acceleration, load factors for angular acceleration, numerical problems.

UNIT IV (7 Hrs.)

6. **Analysis of aircraft components:** Loads on structural components, functions of structural components, fabrication of structural components, connections, V-n diagram, Gust loads, crack propagation, stress concentration factor, crack tip plasticity, crack propagation rates

INSTRUCTIONAL STRATEGY

Aircraft Structures being fundamental course, teachers are expected to lay emphasis explain the basic concepts, principles and their applications to aircraft structures. For this purpose teachers are expected to give simple problems and provide tutorial exercises. The teachers are expected to show the actual parts of aircraft wing and fuselage.

RECOMMENDED BOOKS:

1 "Aircraft Structures for Engineering Students", T.H.G.Megson ,4th Edition,Elsevier Ltd., 2012

2 "Aircraft structures", D.J.Peery and J.J.Azhar, 2nd Edition., McGraw Hill, 1996

3 "Structural stability of Columns and Plates", N G R Iyengar, John Wiley & sons, 1988

Ocw.mit.edu/courses/aeronautics-and-astronautics

AIRCRAFT PROPULSION

Subject Code – BANES1-403 **L T P Cr** **Duration:45 Hours**
3 1 0 4

COURSE OBJECTIVES

- The basic knowledge and governing laws of various modes of heat transfer, aero- and thermodynamic aspects of propulsive devices, such as, propellers, piston type and turbine type aero engines, their performance parameters and the essential knowledge of fuel combustion, standard ratings of aviation fuels and propellants used in rocket engines.

- With this basic knowledge, the student can move on to studying the advance propulsion systems.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Define governing laws of various IC Engines, cycles and modes of heat transfer; thermodynamic aspects of aerospace propulsion systems and their performance parameters
- Describe fuel combustion and flame-stability.
- Examine and analyze compressors and turbines.
- Estimate performance of various types of engines

DETAILED CONTENT

UNIT I: (13 Hrs.)

1. **Heat Transfer and Propellers:** Heat transfer process, Heat conduction, thermal conductivity, general equations of heat conduction with source, conduction problems in 1D and 2D with and without source; Convective heat transfer fundamentals, Introduction to radiative heat transfer, Coupled heat transfer problems.

   Ideal momentum theory and blade element theory and their relative merits, numerical problems on the performance of propellers using propeller charts, selection of propellers, fixed, variable and constant speed propellers, prop-fan, material for propellers, shrouded propellers helicopter rotor in hovering performance.

UNIT II: (12 Hrs.)

2. **Aircraft Piston Engines**: Brief historical sketch of S.I. and C.I. engines, 4-stroke and 2-stroke engines, thermodynamics of engine analysis, combustion process, air standard cycles, various type of arrangements or multi-cylinder aircraft engines, their merits and operational efficiencies, intake and exhaust manifolds, cooling and lubrication systems,

valve timing and arrangements, I.H.P., B.H.P and F.H.P, engine performance, effect of altitude, power required and power available, supercharging, preliminary design of aircraft piston engine.

UNIT III: (10 Hrs.)

3. **Fuels and Combustion:** Liquid fuels, hydrocarbons, gasoline, starting mixtures and temperatures, vapor lock, other liquid fuels and blends, combustion knock and knock rating, carburetion and fuel injection, ignition of the charge, ignition system, and gas turbine fuels, solid and liquid propellants

UNIT IV: (10 Hrs.)

4. **Aircraft Gas Turbine Engines:** Air-standard Brayton cycle, actual gas turbine engine cycle, compressor and turbine efficiencies, compressor work and turbine work, centrifugal and axial type of compressor, their comparative action, relative merits in operations, combustion chambers: various arrangements, simplex and duplex burners.

INSTRUCTIONAL STRATEGY

Session plan/course-material uploading, class-room teaching associated with assignments, quiz, viva-voce and evaluation.

RECOMMENDED BOOKS

1. Holman J.P., "Heat Transfer", 2nd Edition, McGraw Hill.
2. Gebhart B., "Heat Transfer", 2nd Edition, McGraw Hill.
3. Dommasch, Sherby and Connolly, "Airplane Aerodynamics", Pitman.
4. Litchy L.C., "I C. Engines", McGraw Hill.
5. Mattingly J.D., "Elements of Gas Turbine Propulsion", McGraw Hill 1st Ed.1997.
6. Cohen Rogers and Sarvanmattoo, "Gas Turbine Theory", John Wiley.
7. P. G. Hill and C. R. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison Wesley, 1970.
8. J.L Kereebrock, "Aircraft Propulsion System Technology and Design", MIT Press, 1991.

AIRCRAFT SYSTEMS AND INSTRUMENTATION

Subject Code – BANES1-404	L T P Cr	Duration:45 Hours
	3 0 0 3	

COURSE OBJECTIVES

- To enable the student to describe control systems of aircraft.
- The student should be able to describe working principle of Flight instruments
- The student should be able to apply the knowledge of digital system to covert and acquire data from various subsystems.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Illustrate various types of aircraft control systems mechanisms.
- Design Hydraulic and Pneumatic Systems for aircraft subsystems.
- Use Gyroscope and Accelerometer for effective navigation and guidance of aircraft.
- Explain the role of cockpit instruments and system of aircraft.
- Use digital system to confined and acquire data from various subsystems.

UNIT –I (10 Hrs)

1. **Flight control systems:** Conventional Systems, Power assisted and Fully Powered Flight Controls, Power Actuated Systems, Engine Control Systems, Push Pull Rod System, Flexible Push Full Rod System, Components, Modern Control Systems, Digital Fly by Wire Systems, Auto Pilot System, Active Control Technology.

2. **Communication and navigation system:** Introduction to Communication and navigation system of aircraft, Instrument Landing Systems, VOR, CCV Case Studies.

UNIT –II (10 Hrs.)

3. **Aircraft systems:** Hydraulic Systems: Study of Typical Workable System components, Hydraulic System Controllers, Modes of Operation, Pneumatic Systems: Advantages, Working Principles, Typical Air Pressure System, Brake System, Typical Pneumatic Power SystemComponents, Landing Gear Systems: Classification, Shock Absorbers, Retraction Mechanism.

UNIT –III (13 Hrs.)

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4. **Engine systems:** Fuel Systems for Piston and Jet Engines, Components of Multi Engines, Lubricating Systems for Piston and Jet Engines, Engine Starting and Ignition Systems, Typical examples for Piston and Jet Engines.

5. **Auxiliary system:** Basic Air Cycle Systems, Vapor Cycle Systems, Boot-Strap Air Cycle System, Pressurization system, Oxygen Systems, Fire Protection Systems, Deicing and Anti Icing Systems.

UNIT –IV (12 Hrs)

6. **Gyroscopic instruments:** Gyroscope and its properties, gyro system, Vertical gyroscope-Horizon, Direction gyro-direction indicator, Rate gyro-rate of turn and slip indicator, acceleration and turning errors.

7. **Measurements and instrumentation:** Pressure measurement, temperature measurement, fuel quantity measurement, engine power and control instruments-measurement of RPM, manifold pressure, torque, exhaust gas temperature, EPR, fuel flow, engine vibration, monitoring. Data acquisition and Handling systems: Introduction-signal conditioners-Instrumentation amplifiers-filters. Data conversion -multiplexers-A/D-D/A conversion. Telemetry-Airborne and ground system-PC based telemetry system. Introduction to telemetry flight data testing. Application of telemetry in UAVs and Satellites.

INSTRUCTIONAL STRATEGY

Session Plan/course-material uploading, Aircraft Hanger Visit, Class-room teaching associated with assignments, presentations, Videos of animation of aircraft systems and Flight Instruments working, quiz, in-class tests, viva-voce and evaluation.

RECOMMENDED BOOKS

1 Electrical and Electronics measurements and instruments. Author, A.K. Shawney, 2010

2 Aircraft flight instrumentation by Pallett, 1988

3 Advanced Aircraft Systems by David A. Lombardo, 1993

Airframe and Powerplant MECHANICS (Airframe Book), FAA, 1976

Note: Select any one subject for Management-I

MANAGEMENT –I (Introduction to Industrial Management)

SubjectCode-BHSMC0-018	**L T P Cr** **3 0 0 3**	**Duration – 45 hrs**

MANAGEMENT –I (Fundamentals of Management for Engineers)

SubjectCode-BHSMC0-014	**L T P Cr** **3 0 0 3**	**Duration – 45 hrs**

ENVIRONMENTAL SCIENCES

Subject Code- BMNCC0-002	**L T P Cr** **3 0 0 0**	**Duration – 45 hrs**

AIRCRAFT STRUCTURES LAB

Subject Code – BANES1-405	**L T P Cr** **0 0 2 1**	**Duration:30 Hours**

COURSE OBJECTIVE

The aircraft structures Lab with enable the student to conduct experiments, so that they are able to understand the theoretical concepts and principles in a better way.

DETAILED CONTENTS

1 Prove Maxwell Reciprocal theorem for a simply supported beam

2 Prove Maxwell Reciprocal theorem for a cantilever beam

3 To determine/calculate shear centre of a channel section

4 Determine/calculate shear centre of a Z section

5 To Determine/calculate shear centre of a rectangular section

6 Find direct strain in a simply supported beam by strain gauges

7 Determine/calculate direct strain in a cantilever by strain gauges

8 Stress analysis of a truss by using software

9 Stress analysis of initially bent column by using software

10 Stress analysis of a pinned column by using software

11 Stress analysis of a column with both ends fixed by using software

MEANS OF ASSESSMENT

Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce.

AIRCRAFT PROPULSION LAB

Subject Code – BANES1-406	**L T P Cr**	**Duration:30 Hours**
	0 0 2 1	

COURSE OBJECTIVE

- At the end of this course, the student should be able to perform experiments to measure different aircraft engine parameters.

DETAILED CONTENTS

1. Study the functioning of aircraft piston engines having various arrangements of cylinders.
2. Study of Jet Engine.
3. Experiments on Continuous Combustion test rig.
4. Conduct Morse test on given multi cylinder engine.
5. Conduct dynamometer test and retardation test
6. Performance test on reciprocating air compressor.

MEANS OF ASSESSMENT

Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce.

* **NOTE**: During the summer vacation after 4th/ 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

Semester III (Second Year)
Branch/Course Civil Engineering

Subject Code	Course Title	Hours per week			Credits
		L	T	P	
BECEE0-001	Basic Electronics	1	0	2	2
BCIES1-301	Computer-aided Civil Engineering Drawing	1	0	2	2
BCIES1-302	Energy Science & Engineering	2	0	0	2
BCIES1-303	Surveying	2	0	4	4
BMECE0-001	Engineering Mechanics	3	1	0	4
BMATH4-301	Mathematics-III (Transform & Discrete Mathematics)	2	0	0	2
BHSMC0-005	Humanities-I (Effective Technical Communication)	3	0	0	3
BHSMC0-021	Introduction to Civil Engineering	3	0	0	3
Total		17	1	8	22

Semester IV (Second Year)
Branch/Course Civil Engineering

Code	Course Title	Hours per week			Credits
		L	T	P	
BMECE0-002	Mechanical Engineering	2	1	0	3
BCIES1-401	Instrumentation & Sensor Technologies for Civil Engineering Applications	2	0	2	3
BCIES1-402	Engineering Geology	2	0	2	3
BCIES1-403	Disaster Preparedness & Planning	2	0	0	2
BCIES1-404	Introduction to Fluid Mechanics	2	0	2	3
BCIES1-405	Introduction to Solid Mechanics	2	0	2	3
BCIES1-406	Geomatics Engineering	2	0	2	3
BCIES1-407	Materials, Testing & Evaluation	2	0	2	3
BHSMC0-022	Civil Engineering - Societal & Global Impact	2	0	0	2
BMNCC0-005	Organizational Behaviour	3	0	0	0
Total		21	0	12	26

BASIC ELECTRONICS

Subject Code: BECEE0-001 L T P C
1 0 2 2

The objective of this Course is to provide the students with an introductory and broad treatment of the field of *Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in Civil Engineering applications.* Lab should be taken concurrently. This course emphasizes more on the laboratory/practical use of the knowledge gained from the course lectures.

What Will I Learn?

a) Know broadly the concepts and functionalities of the electronic devices, tools and instruments
b) Understand use, general specifications and deploy abilities of the electronic devices, and assemblies
c) Confidence in handling and usage of electronic devices, tools and instruments in engineering applications

Proposed Syllabus (All modules to provide only broad overview)

Module1: *Diodes and Applications* covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;

Module 2: *Transistor Characteristics* covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

Module 3: *Transistor Amplifiers and Oscillators* covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

Module 4: *Operational Amplifiers and Applications* covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;

Practicals:

Module 1: Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;

Module 2: Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);

Module 3: Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;

Module 4: Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators; Module 5: Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;

Module 6: Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations using 4-bit/8-bit Shift Register ICs; Functionality of Up-Down / Decade Counter ICs; (15 Sessions)

Text/Reference Books:

1. David. A. Bell (2003), *Laboratory Manual for Electronic Devices and Circuits*, Prentice Hall, India
2. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India
3. Thomas L. Floyd and R. P. Jain (2009), *Digital Fundamentals* by Pearson Education,
4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), *Basic Electronics – A Text-Lab. Manual,* TMH
5. R. T. Paynter (2009), *Introductory Electronic Devices & Circuits, Conventional Flow Version,* Pearson

COMPUTER AIDED CIVIL ENGINEERING DRAWING

Subject Code: BCIES1-301 L T P C
1 0 2 2

The students will be able to

a) Develop Parametric design and the conventions of formal engineering drawing
b) Produce and interpret 2D & 3D drawings
c) Communicate a design idea/concept graphically/ visually
d) Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
e) Get a Detailed study of an engineering artifact

Proposed Syllabus (No. of lectures shown within brackets)

Module 1: *INTRODUCTION***;** Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.(2)

Module 2: *SYMBOLS AND SIGN CONVENTIONS*: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards (2)

Module 3: *MASONRY BONDS:* English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall (1)

Module 4: *BUILDING DRAWING*: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings, Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity (7)

Module 5: *PICTORIAL VIEW*: Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM) (3)

Total 15 sessions

It may be advisable to conduct Theory sessions along with Lab demonstrations.

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows. 09
2. Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility. 06
3. RCC framed structures 09
4. Reinforcement drawings for typical slabs, beams, columns and spread footings. 09
5. Industrial buildings - North light roof structures - Trusses 06

6. Perspective view of one and two storey buildings 06

Text/Reference Books:

1. Subhash C Sharma & Gurucharan Singh (2005), “Civil Engineering Drawing”, Standard Publishers
2. Ajeet Singh (2002), “Working with AUTOCAD 2000 with updates on AUTOCAD 200I”, Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham Tickoo Swapna D (2009), “AUTOCAD for Engineers and Designers”, Pearson Education,
4. Venugopal (2007), “Engineering Drawing and Graphics + AUTOCAD”, New Age International Pvt. Ltd.,
5. Balagopal and Prabhu (1987), “Building Drawing and Detailing”, Spades publishing KDR building, Calicut,
6. (Corresponding set of) CAD Software Theory and User Manuals.
7. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
8. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,

Goals & Outcomes:

The course should enable the students to

i) To develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually as well as understand another person’s designs,
ii) and to get exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice
iii) Develop Parametric design and the conventions of formal engineering drawing
iv) Produce and interpret 2D & 3D drawings
v) Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
vi) Do a detailed study of an engineering artefact
vii) Develop drawings for conventional structures using practical norms.

ENGINEERING MECHANICS

Subject Code: BMECE0-001 L T P C
3 1 0 4

The objective of this Course is to provide an introductory treatment of *Engineering Mechanics* to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently

What Will I Learn?

a) Confidently tackle equilibrium equations, moments and inertia problems
b) Master calculator/computing basic skills to use to advantage in solving mechanics problems.
c) Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

Proposed Syllabus

Module 1***:*** *Introduction to Engineering Mechanics covering,* Force Systems, Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

Module 2***:*** *Friction covering,* Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Module 3***:*** *Basic Structural Analysis covering,* Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Module 4***:*** *Centroid and Centre of Gravity covering,* Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Module 5***:*** *Virtual Work and Energy Method-* Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency, Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium, Applications of energy method for equilibrium, Stability of equilibrium.

Module 6***:*** *Review of particle dynamics-* Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates), Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Module 7:*Introduction to Kinetics of Rigid Bodies covering,* Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems;

D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Module 8:*Mechanical Vibrations covering,* Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;

Tutorials *from the above modules covering*, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack

<u>Text/Reference Books:</u>

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publication.

Upon successful completion of the course, student should be able to:

- Use scalar and vector analytical techniques for analysing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of maths and physics to solve real-world problems
- Understand measurement error, and propagation of error in processed data
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy;
- Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution;
- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy; and
- Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

ENERGY SCIENCE & ENGINEERING

Subject Code: BCIES1-302 L T P C
2 0 0 2

The objective of this Course is to provide *an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear. Energy conservation methods will be emphasized* from Civil Engineering perspective. The knowledge acquired lays a good foundation for design of various civil engineering systems/ projects dealing with these energy generation paradigms in an efficient manner.

Proposed Syllabus

Module 1*: Introduction to Energy Science:* Scientific principles and historical interpretation to *place ener*gy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

Module 2: *Energy Sources:* Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

Module 3: *Energy & Environment:* Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy

Module 4: *Civil Engineering Projects connected with the Energy Sources:* Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems

Module 5: *Engineering for Energy conservation:* Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); *LEED ratings;* Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability, Energy Audit of Facilities and optimization of energy consumption.

S. No.	Module	No. of Lectures	Tutorial- to be derived for each module; typical examples given below.
1	Introduction to Energy Science	3	Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption and Carbon Footprint
2	Energy Sources	4	Compile a world map showing alternative Energy source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil Platform. Compile a map of India showing exiting Potential and utilized potential for hydro power. List the pros and cons for Thermal, hydro, nuclear and solar Power projects.
3	Energy & Environment	5	Study the functioning of an Electro Static Precipitator in a thermal power plant; study the uses of coarse and fine Fly Ash from thermal power plants. Compile the safety provisions in design and construction of a reactor containment building
4	Civil Engg projects connected with Energy Sources	10	Compile a process diagram for a typical underground hydro power project; Collect details of a model solar chimney project; collect details of a wave energy project at Vizhinjam; Collect details of the Kalpasar (Tidal energy) project
5	Engineering for Energy Conservation	8	Draw a typical geometrical orientation of a house in your area to avoid sun's radiation in the bed room in the evening; Identify typical examples of Indian buildings having various LEED ratings; List various building Materials with their embodied energy content. Do an Energy Audit of your Departmental Building in the College.
	TOTAL	**30**	**30**

Text/Reference Books:

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
6. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
7. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
8. Related papers published in international journals.

SURVEYING

Subject Code: BCIES1-303

L	T	P	C
2	0	4	4

Unit - I

Definition, principles of surveying, different types of surveys, topographical map, scale of map, Measurement of distances with chain and tape, direct & indirect ranging, offsets.

Instruments used in traversing, bearings, meridians, declination, dip of magnetic needle, bearing of lines from included angles, local attraction, closing error and its removal.

Unit-II

Principle of plane table survey, setting up the plane table and methods of plane tabling, Setting up a dumpy level, booking and reducing the levels by rise & fall method and height of instrument method, correction due to curvature and refraction, characteristics of contours, methods of contouring, uses of contour maps.

Unit – III

Temporary and permanent adjustments of theodolite, measurement of horizontal and vertical angles, closed & open traverse, consecutive and independent co-ordinates, advantages and disadvantages of traversing, Latitudes and Departures, closing error, Bowditch & Transit Rules, Gales traverse table, Different cases of omitted measurements.

Determination of tachometer constants, Measurement of horizontal & vertical distances with tachometer

Unit – IV

Selection of stations and base line for geodetic survey, corrections for base line, satellite station and reduction to centre. Elements of curves, different methods of setting out of curves, transition curve.

Recommended Books:

1. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, 'Surveying', Vol. I, II, Laxmi Publications,
2. S.K. Duggal, Tata McGraw Hill. Vol-I
3. R. Agor, 'Surveying', Khanna Publishers**.**
4. S.S. Bhavikatti, 'Surveying & Levelling Vol. I, II.
5. Narinder Singh, 'Surveying', Tata McGraw Hill.
6. N.N. Basak, 'Surveying and leveling', Tata McGraw Hill, New Delhi.

Practicals:

1. Measurement of distance, ranging a line.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of levelling, height of instrument, rise & fall methods.
4. Measurement of horizontal and vertical angle by theodolite.
5. Determination of tachometric constants and determination of reduced levels by tachometric observations.
6. Plane table survey, different methods of plotting, two point & three point problem.
7. Determination of height of an inaccessible object.
8. Setting out a transition curve, setting out of circular curves in the field using different methods.
9. Introduction of Total Station.

METHAMATICS-III (Transform & Discrete Mathematics)

Subject Code: BMATH4-301 L T P C
2 0 0 2

Transform Calculus

Module 8a: ***Transform Calculus*** **-1** (10 hours)
Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials, Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem, Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Module 8b: ***Transform Calculus*****-2** (10 hours)
Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.

Discrete Mathematics

Module 9a: ***Sets, relations and functions*****:** (8 hours)

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Module 9b: ***Propositional Logic:*** (6 hours)

Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem etc., Decision problems of propositional logic. Introduction to first order logic and first order theory.

Module 9c: ***Partially ordered sets:*** (6 hours)

Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices, Boolean and pseudo Boolean lattices.

Module 9d: ***Algebraic Structures:*** (6 hours)

Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations-ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Module 9e: ***Introduction to Counting:***(6 hours)

Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

Module 9f: ***Introduction to Graphs:*** (8 hours)

Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.

Textbooks/References:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.
6. N. Deo, Graph Theory, Prentice Hall of India, 1974.
7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

HUMANITIES-I (Effective Technical Communication)

Subject Code: BHSMC0-005 L T P C
3 0 0 3

Module 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Module 2: Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Module 3: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Module 4: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Module 5: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

INTRODUCTION TO CIVIL ENGINEERING

Subject Code: BHSMC0-021 L T P C
3 0 0 3

When the students enter the college to pursue a degree in Civil Engineering and as well pursue a career in Civil Engineering after graduation, they need to understand the breadth and depth available in this field for possible engagement. When many alternative disciplines of engineering appear to offer apparently more glamourous avenues for advancement, the Civil Engineering student should realize the solid foundations available in this mother of all engineering disciplines. The students should understand the enormous possibilities available for creative and innovative works in this all pervasive field of engineering.

This course is designed to address the following:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- To motivate the student to pursue a career in one of the many areas of Civil Enineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Proposed Syllabus

What is Civil Engineering/ Infrastructure, History of Civil Engineering, Overview of ancient & modern civil engineering marvels, current national planning for civil engineering/ infrastructure projects, scope of work involved in various branches of Civil Engineering – Architecture & Town planning, Surveying & Geomatics, Structural Engineering, Construction Management, Construction materials, Hydrology and Water Resources Engineering, Hydraulic Engineering, Environmental Engineering &Sustainability, Pavement Engineering and construction, Traffic & Transportation Engineering and Management, Geotechnical Engineering, Ocean Engineering, Building Energy Efficiency, Basics of Contract Management, Professional Ethics, Avenues for entrepreneurial working, Creativity Innovativeness in Civil Engineering,

Modules

1. **Basic Understanding**: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career

2. **History of Civil engineering**: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers

3. **Overview of National Planning for Construction and Infrastructure Development**; Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;

4. **Fundamentals of Architecture & Town Planning**: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities

5. **Fundamentals of Building Materials**: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes

6. **Basics of Construction Management & Contracts Management**: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management

7. **Environmental Engineering & Sustainability**: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;

8. **Geotechnical Engineering**: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling

9. **Hydraulics, Hydrology &Water Resources Engineering**: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects

10. **Ocean Engineering**: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures

11. **Power Plant Structures**: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects

12. **Structural Engineering**: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis;

13. **Surveying & Geomatics**: Traditional surveying techniques, Total Stations, Development

    of Digital Terrain Models; GPS, LIDAR;

14. **Traffic &Transportation Engineering**: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in

    integrated transport development in India: road, rail, port and harbour and airport sector;

    PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.

15. **Repairs & Rehabilitation of Structures:** Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.

16. **Computational Methods, IT, IoT in Civil Engineering:** Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,…GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM.

17. **Industrial lectures**: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning;
18. **Basics of Professionalism**: Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction.

ORGANISATION OF COURSE (3-0-0)

S. No.	Module [No of Lectures within brackets]	Tutorials
1	Basic Understanding (1)	Develop a matrix of various disciplines and possible roles for engineers in each
2	History of Civil engineering (1)	Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each
3	Overview of National planning for Construction and Infrastructure Development (1)	Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area
4	Architecture & Town Planning (1)	Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City
5	Building Materials (2)	Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report
6	Construction Management, Contracts management (2)	Identify 5 typical construction methods and list their advantages/ positive features
7	Environmental Engineering & Sustainability (2)	Environmental Engineering & Sustainability: Sustainability principles, Sustainable built environment, water treatment systems, good practices of wastewater management. examples of Solid and hazardous waste management, Air pollution and control
8	Geotechnical Engineering (2)	List top five tunnel projects in India and their features; collect and study geotechnical investigation report of any one Metro Rail (underground) project; Visit a construction site and make a site visit report
9	Hydraulics, Hydrology &Water Resources Engineering (1)	Identify three river interlinking projects and their features; visit a Hydraulics Lab and make a report
10	Ocean Engineering, Ports & Harbours (1)	Identify 5 typical ports in India and list the structures available in them; Visit a related/similar facility, if possible in nearby place and make a report
11	Power Plant Structures (1)	Collect the typical layout for a large thermal power plant and a large hydro power plant and identify all the structures and systems falling in them.
12	Structural Engineering (3)	Identify 5 unique features for typical buildings, bridges, tall structures and large span structures; Visit Structures Testing Lab/facility and make a report
13	Surveying & Geomatics (1)	Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other

14	Traffic & transportation (1)	Investments in transport infrastructure; Developments and challenges; Intelligent Transport
		Systems; Smart Cities, Urban Transport; Road Safety; Sustainable and resilient highway design principles; Plan a sustainable transport system for a city; Identify key features/components in the planning and design of a green field highway/airport/port/railway and the cost – Economics.
15	Repairs & rehabilitation of Structures (1)	Collect the history of a major rehabilitation project and list the interesting features
16	Computational Methods, IT, IoT in Civil Engineering (2)	Visit an AutoCad lab and prepare a report; Identify ten interesting software systems used in Civil Engg and their key features
17	Industrial lectures (2)	For each case study list the interesting features
18	Basics of Professionalism (3)	List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting projects and their positive features; Write 400 word reports on one ancient monument and a modern marvel of civil engineering
	TOTAL NO LECTURES =30	**15**

Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R.(1979), Law of Contract, Oxford University Press
9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.
11. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
14. Bare text (2005), Right to Information Act
15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
17. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
18. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd
19. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application

20. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
21. Engineering Ethics, National Institute for Engineering Ethics, USA
22. www.ieindia.org
23. Engineering ethics: concepts and cases –C. E. Harris, M.S. Pritchard, M.J.Rabins
24. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS
25. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
26. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractslaw1.html
27. Contract &Agreements , http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
28. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
29. Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
30. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html
32. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf

Goals & Outcomes:

Introduction to what constitutes Civil Engineering

- Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering.
- Highlighting the depth of engagement possible within each of these areas.
- Exploration of the various possibilities of a career in this field.
- Understanding the vast interfaces this field has with the society at large. Providing inspiration for doing creative and innovative work
- Showcasing the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration
- Highlighting possibilities for taking up entrepreneurial activities in this field.
- Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering.

MECHANICAL ENGINEERING

Subject Code: BMECE0-002

L	T	P	C
2	1	0	3

Module 1: Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

Module 2: First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow

Module 3: Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. Energy a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, energy change of a system, energy transfer by heat, work, and mass, the decrease of exergy principle and energy destruction, energy balance: closed systems and control volumes energy balance.

Module 4: Properties Of Pure Substance- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes.

Module 5: Power Cycles- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, an overview of reciprocating engines, air standard assumptions, gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles.

Module 6: Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient.

Module 7: Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables. Refrigeration cycles, including refrigerators and heat pumps, the ideal reversed Carnot vapour-compression refrigeration cycle, actual vapor-compression refrigeration cycles, heat pump systems, gas refrigeration cycles, and absorption refrigeration systems.

Text/Reference Books:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, Thermodynamics – An Engineering Approach *Tata McGraw Hill, New* Delhi.
3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
6. Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for Engineers, McGraw-Hill.

Upon successful completion of the course, student will have:

- Ability to apply mathematics, science, and engineering
- Ability to design and conduct experiments, as well as to analyze and interpret data
- Ability to identify, formulate, and solve engineering problems
- Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
- Ability to comprehend the thermodynamics and their corresponding processes that influence the behaviour and response of structural components
- Ability to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) and thermodynamics to model, analyze, design, and realize physical systems, components, or processes

INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS

Subject Code: BCIES1-401

L	T	P	C
2	0	2	3

The objective of this Course is to understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making. This course introduces theoretical and practical principles of design of sensor systems. Topics include: transducer characteristics for acoustic, current, temperature, pressure, electric, magnetic, gravity, salinity, concentration of contaminants, velocity, heat flow, and optical devices; limitations on these devices imposed by building/structure/pavement environments; signal conditioning and recording; noise, sensitivity, and sampling limitations; and standards. Lectures will cover the principles of state-of-the-art systems being used in physical infrastructure/bridges/buildings/pavements, etc. For lab work, the course will allow students to prepare, deploy and analyze observations from standard instruments. Laboratory experiments shall be used on application of concepts introduced in the lectures.

Providing principle knowledge, practical training and measurement best practice for a range of temperature, pressure, electrical, velocity, acceleration and vibration systems

Proposed Syllabus

Module 1*:* *Fundamentals of Measurement, Sensing and Instrumentation covering* definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations;

Module 2*:* *Sensor Installation and Operation covering to:* i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

Module 3*:* *Data Analysis and Interpretation covering* a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

Module 4*:* *Frequency Domain Signal Processing and Analysis covering* Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

Tutorials *from the above modules* demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report

Practicals:

Instrumentation of typical civil engineering members/structures/structural elements Use of different sensors, strain gauges, inclinometers,

Performance characteristics

Errors during the measurement process

Calibration of measuring sensors and instruments

Measurement, noise and signal processing

Analog Signal processing

Digital Signal Processing

Demonstration & use of sensor technologies

Text/Reference Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
4. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

What will I learn?

Understand the principles of operation and characteristics of instrumentation and integrated sensor systems

Understand right use of sensors and instruments for differing applications along with limitations

Recognize and apply measurement best practice and identify ways to improve measurement and evaluation

Troubleshoot and solve problems in instrumentation and measurement systems

To instill and encourage a questioning culture

Outcomes:

To analyze the errors during measurements

To specify the requirements in the calibration of sensors and instruments

To describe the noise added during measurements and transmission

To describe the measurement of electrical variables

To describe the requirements during the transmission of measured signals

To construct Instrumentation/Computer Networks

To suggest proper sensor technologies for specific applications

To design and set up measurement systems and do the studies

ENGINEERING GEOLOGY

Subject Code: BCIES1-402

L	T	P	C
2	0	2	3

The objective of this Course is to focus on the core activities of engineering geologists – site characterization and geologic hazard identification and mitigation. Through lectures, labs, and case study examination student will learn to couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.

Engineering geology is an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation. Engineering geologists are applied geoscientists with an awareness of engineering principles and practice—they are not engineers.

Proposed Syllabus:

Module 1: Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

Module 2: Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

Module 3: Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.

Module 4: Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

Module 5: Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. . Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

Module 6: Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description.

Module 7: Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.

Module 8: Rock Mechanics- Sub surface 9nvestigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

Practicals:

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite;

   Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole

   group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrolody): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. Identification of symbols in maps.

Text/Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2^{nd} Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

What will I learn?

Students will be able to:

Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site.

Calculate the bulk properties of rocks and unconsolidated sediments such as density, void ratio, water contents, and unit weights.

Evaluate rock-mass quality and perform a kinematic analysis.

Apply the factor of safety equation to solve planar rock slide and toppling problems. Perform a grain-size analysis, determine plastic and liquid limits, and classify soils using the Unified Soil Classification System.

Calculate soil consolidation magnitudes and rates under induced stress conditions. Determine soil strength parameters from in situ tests.

Apply the method of slices and factor of safety equation to solve rotational slide problems.

Outcomes:

Students will understand:

i) Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice
ii) The fundamentals of the engineering properties of Earth materials and fluids.
iii) Rock mass characterization and the mechanics of planar rock slides and topples.
iv) Soil characterization and the Unified Soil Classification System.
v) The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

DISASTER PREPAREDNESS & PLANNING

Subject Code: BCIES1-403

L	T	P	C
2	0	0	2

The overall aim of this course is to provide broad understanding about the basic concepts of Disaster Management with preparedness as a Civil Engineer. Further, the course introduces the various natural hazards that can pose risk to property, lives, and livestock, etc. and understanding of the social responsibility as an engineer towards preparedness as well as mitigating the damages.

The objectives of the course are i) To Understand basic concepts in Disaster Management ii) To Understand Definitions and Terminologies used in Disaster Management iii) To Understand Types and Categories of Disasters iv). To Understand the Challenges posed by Disasters vi) To understand Impacts of Disasters Key Skills

Proposed Syllabus

Module 1: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks-severity, frequency and details, capacity, impact, prevention, mitigation).

Module 2: Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Module 3: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Module 4: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Module 5: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

INTRODUCTION TO FLUID MECHANICS

Subject Code: BCIES1-404 L T P C
2 0 2 3

The objective of this course is to introduce the concepts of fluid mechanics useful in Civil Engineering applications. The course provides a first level exposure to the students to fluid statics, kinematics and dynamics. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems. A training to analyse engineering problems involving fluids – such as those dealing with pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river and groundwater flow - with a mechanistic perspective is essential for the civil engineering students. The topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

Module 1: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Module 2: Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Module 3: Fluid Kinematics- Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Module 4: Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber *Number and Euler Number; Buckingham's* π-Theorem.

<u>Lab Experiments</u>

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualization -Ideal Flow
10. Length of establishment of flow

11. Velocity distribution in pipes
12. Laminar Flow

Text/Reference Books:

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

At the end of the course, the student will be able to:

Understand the broad principles of fluid statics, kinematics and dynamics
Understand definitions of the basic terms used in fluid mechanics
Understand classifications of fluid flow
Be able to apply the continuity, momentum and energy principles
Be able to apply dimensional analysis

INTRODUCTION TO SOLID MECHANICS

Subject Code: BCIES1-405

L	T	P	C
2	0	2	3

The objective of this Course is to introduce to continuum mechanics and material modelling of engineering materials based on first energy principles: deformation and strain; momentum balance, stress and stress states; elasticity and elasticity bounds; plasticity and yield design. The overarching theme is a unified mechanistic language using thermodynamics, which allows understanding, modelling and design of a large range of engineering materials. The subject of mechanics of materials involves analytical methods for determining the strength, stiffness (deformation characteristics), and stability of the various members in a structural system. The behaviour of a member depends not only on the fundamental laws that govern the equilibrium of forces, but also on the mechanical characteristics of the material. These mechanical characteristics come from the laboratory, where materials are tested under accurately known forces and their behaviour is carefully observed and measured. For this reason, mechanics of materials is a blended science of experiment and Newtonian postulates of analytical mechanics.

Proposed Syllabus

Module1: *Simple Stresses and Strains*- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience Gradual, sudden, impact and shock loadings – simple applications.

Module 2: Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

Module 3: Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Module 4: *Flexural Stresses-Theory of simple bending* – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Module 5: *Shear Stresses- Derivation of formula* – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Module 6: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Module 7: Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

Module 8: Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

List of Experiments:

- Tension test
- Bending tests on simply supported beam and Cantilever beam.
- Compression test on concrete
- Impact test
- Shear test
- Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation,
- Determination of torsion and deflection,
- Measurement of forces on supports in statically determinate beam,
- Determination of shear forces in beams,
- Determination of bending moments in beams,
- Measurement of deflections in statically determinate beam,
- Measurement of strain in a bar
- Bend test steel bar;
- Yield/tensile strength of steel bar;

Text/Reference Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
5. Laboratory Manual of Testing Materials - William Kendrick Hall
6. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

Outcomes:

On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;
- Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods;
- Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams;and
- Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

GEOMATICS ENGINEERING

Subject Code: BCIES1-406

L	T	P	C
2	0	2	3

Unit I: Photogrammetry

Introduction, Basic Principles, Photo-Theodolite, Elevation of a Point by Photographic Measurement, Aerial Camera, Vertical Photograph, Tilted Photograph, Scale, Crab and Drift, Flight Planning for Aerial Photography, Ground Control for Photogrammetry, Photomaps and Mosaics, Stereoscopic Vision, Stereoscopic parallax, Stereoscopic Plotting Instruments, Applications.

Unit II: Remote Sensing

Introduction, Basic Principles, Electromagnetic (EM) Energy Spectrum, EM Radiations and the Atmosphere, Interaction of EM radiations with Earth's Surface, Types of remote sensing systems, Remote Sensing Observation Platforms, Satellites and their characteristics – Geostationary and sun-synchronous, Meteorological satellites, Sensors, Types and their characteristics, Across track and Along track scanning, Applications of Remote Sensing.

Unit III: Geographical Information System (GIS)

Definition, GIS Objectives, Hardware and software requirements for GIS, Components of GIS, Coordinate System and Projections in GIS, Data structure and formats, Spatial data models – Raster and Vector, Data inputting in GIS, Data base design - editing and topology creation in GIS, Linkage between spatial and non-spatial data, Spatial data analysis – significance and type, Attribute Query, Spatial Query, Vector based spatial data analysis, Raster based spatial data analysis, Errors in GIS, GIS Applications, Introduction to GIS Software Packages.

Unit IV: Global Positioning System (GPS)

Introduction, Fundamental concepts, GPS system elements and signals, GPS measurements and accuracy of GPS, GPS Satellites, Co-ordinate systems - Geoids, Ellipsoid and Datum, Spheroid, National Reference Systems, Worldwide Reference Ellipsoid, WGS 84, Differential-GPS, Classification of GPS receivers, GPS Applications.

List of Text Books:

1. Arora, K.R., 2007: Surveying Vol-III, Standard Book House.
2. Campbell, J.B.2002: Introduction to Remote Sensing. Taylor Publications.
3. Chang.T.K. 2002: Geographic Information Systems, Tata McGrawHill.
4. Joseph George, 2003: Fundamentals of Remote Sensing. Universities Press.
5. Punmia, B.C., Jain A.K., 2005: Higher Surveying, Luxmi Publications.
6. Duggal S.K Higher surveying vol-III,Tata McGrawHill.

List of Reference Books:

1. Heywood.I, Cornelius S, Crver Steve. 2003: An Introduction to Geographical Information Systems, Pearson Education.
2. 2.Sabbins, F.F., 1985: Remote Sensing Principles and Interpretation. W.H.Freeman and Company.
3. Kaplan, E.D., Understanding GPS : Principles and Application; Artec House.

MATERIALS, TESTING & EVALUATION

Subject Code: BCIES1-407

L	T	P	C
2	0	2	3

The objective of this Course is to deal with an experimental determination and evaluation of mechanical characteristics and advanced behavior of metallic and non-metallic structural materials. The course deals with explanation of deformation and fracture behavior of structural materials. The main goal of this course is to provide students with all information concerning principle, way of measurement, as well as practical application of mechanical characteristics.

Make measurements of behavior of various materials used in Civil Engineering. Provide physical observations to complement concepts learnt Introduce experimental procedures and common measurement instruments, equipment, devices. Exposure to a variety of established material testing procedures and techniques Different methods of evaluation and inferences drawn from observations

The course reviews also the current testing technology and examines force applications systems, force measurement, strain measurement, important instrument considerations, equipment for environmental testing, and computers applications for materials testing provide an introductory treatment of *basic skills in material engineering towards (i) selecting material for the design, and (ii) evaluating the mechanical and structural properties of material, as well as the knowledge necessary for a civil engineer.* The knowledge acquired lays a good foundation for analysis and design of various civil engineering structures/systems in a reliable manner.

What will I learn?

Different materials used in civil engineering applications

Planning an experimental program, selecting the test configuration, selecting the test specimens and collecting raw data

Documenting the experimental program including the test procedures, collected data, method of interpretation and final results

Operating the laboratory equipment including the electronic instrumentation, the test apparatus and the data collection system

Measuring physical properties of common structural and geotechnical construction materials

Interpreting the laboratory data including conversion of the measurements into engineering values and derivation of material properties (strength and stiffness) from the engineering values

Observing various modes of failure in compression, tension, and shear

Observing various types of material behavior under similar loading conditions

Proposed Syllabus

Module 1: *Introduction to Engineering Materials covering,* Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

Module 2: *Introduction to Material Testing covering,* What is the "Material Engineering"?; Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

Module 3: *Standard Testing & Evaluation Procedures covering,* Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep.

Tutorials *from the above modules covering*, understanding i) Tests & testing of bricks, ii) Tests & testing of sand, iii) Tests & testing of concrete, iv) Tests & testing of soils, v) Tests & testing of bitumen & bituminous mixes, vi) Tests & testing of polymers and polymer based materials, vii) Tests & testing of metals & viii) Tests & testing of other special materials, composites and cementitious materials, Explanation of mechanical behavior of these materials.

Practicals:

- Gradation of coarse and fine aggregates
- Different corresponding tests and need/application of these tests in design and quality control
- Tensile Strength of materials & concrete composites
- Compressive strength test on aggregates
- Tension I - Elastic Behaviour of metals & materials
- Tension II - Failure of Common Materials
- Direct Shear - Frictional Behaviour
- Concrete I - Early Age Properties
- Concrete II - Compression and Indirect Tension
- Compression – Directionality
- Soil Classification
- Consolidation and Strength Tests
- Tension III - Heat Treatment
- Torsion test
- Hardness tests (Brinnel's and Rockwell)
- Tests on closely coiled and open coiled springs
- Theories of Failure and Corroboration with Experiments
- Tests on unmodified bitumen and modified binders with polymers
- Bituminous Mix Design and Tests on bituminous mixes - Marshall method
- Concrete Mix Design as per BIS

Text/Reference Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition

6. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post 2000)
7. Related papers published in international journals

Measurable Outcomes:

One should be able to:

Calibrate electronic sensors

Operate a data acquisition system

Operate various types of testing machines

Configure a testing machine to measure tension or compression behavior

Compute engineering values (e.g. stress or strain) from laboratory measures

Analyze a stress versus strain curve for modulus, yield strength and other related attributes

Identify modes of failure

Write a technical laboratory report

CIVIL ENGINEERING – SOCIETAL & GLOBAL IMPACT

Subject Code: BHSMC0-002

L	T	P	C
2	0	0	2

The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realise the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.

The course covers:

- Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
- Awareness of the impact of Civil Engineering for the various specific fields of human endeavour
- Need to think innovatively to ensure Sustainability

Module 1: Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;

Module 2: Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering

Module 3: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;

Module 4: Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Module 5: Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

Module 6: Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

ORGANISATION OF COURSE (2-0-0)

S. No.	Module	No of Lectures	Details
1	Introduction	3	
2	Understanding the Importance of Civil Engineering	3	
3	Infrastructure	8	
4	Environment	7	
5	Built Environment	5	
6	Civil Engineering Projects	4	
	TOTAL	**30**	

Text/Reference Books:

1. *Ž iga* Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.

10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
12. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
13. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
14. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
15. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

What the student will learn? To develop an understanding of:

- The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
- The extent of Infrastructure, its requirements for energy and how they are met: past, present and future
- The Sustainability of the Environment, including its Aesthetics,
- The potentials of Civil Engineering for Employment creation and its Contribution to the GDP
- The Built Environment and factors impacting the Quality of Life
- The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.
- Applying professional and responsible judgement and take a leadership role;

MANAGEMENT-I (Organizational Behaviour)

Subject Code: BMNCC0-005	L T P C
	3 0 0 0

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

. **UNIT-I:**

1. The Multidisciplinary Nature of Environmental Studies:
Definition, scope and importance, Need for public awareness.
2. **Natural Resources**

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

(g) Role of an individual in conservation of natural resources.

(h) Equitable use of resources for sustainable lifestyles.

UNIT-II:

Environmental Pollution: Definition

(a) Causes, effects and control measures of:

i) Air pollution
ii) Water pollution
iii) Soil pollution
iv) Marine pollution
v) Noise pollution
vi) Thermal pollution
vii) Nuclear pollution

(b) **Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes.

(c) Role of an individual in prevention of pollution.

(d) Pollution Case Studies.

(e) Disaster management: floods, earthquake, cyclone and landslides.

UNIT-III:
Social Issues and the Environment
(a) From unsustainable to sustainable development
(b) Urban problems and related to energy
(c) Water conservation, rain water harvesting, Watershed Management
(d) Resettlement and rehabilitation of people; its problems and concerns, Case studies.
(e) Environmental ethics: Issues and possible solutions
(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.
(g) Wasteland reclamation
(h) Consumerism and waste products
(i) Environmental Protection Act
(j) Air (Prevention and Control of Pollution) Act
(k) Water (Prevention and control of Pollution) Act
(l) Wildlife Protection Act
(m) Forest Conservation Act
(n) Issues involved in enforcement of environmental legislation

UNIT-IV:
Human Population and the Environment
(a) Population growth, variation among nations
(b) Population explosion – Family Welfare Programmes
(c) Environment and human health
(d) Human Rights
(e) Value Education
(f) HIV/AIDS
(g) Women and Child Welfare
(h) Role of Information Technology in Environment and Human Health
(i) Case Studies

Environment Science:
We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around US. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.
(a) Awareness Activities:
i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts.
(b) Actual Activities:
i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess

vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

Semester III [Second year]

Branch/Course: B Tech Electrical Engineering

Sr. No.	**Course Code**	**Course Title**	**Hours per week**			**Marks**			**Credits**
			L	**T**	**P**	**Int**	**Ext**	**Total**	
1.	BELES1-301	Electrical Circuit Analysis	3	1	0	40	60	100	4
2.	BELES1-302	Analog Electronic Circuits	3	0	0	40	60	100	3
3.	BELES1-303	Analog Electronic Circuit Lab	0	0	2	60	40	100	1
4.	BELES1-304	Electrical Machines – I	3	1	0	40	60	100	4
5.	BELES1-305	Electrical Machines Lab- I	0	0	2	60	40	100	1
6.	BELES1-306	Electromagnetic Fields	3	1	0	40	60	100	4
7.	BELES1-307	Institutional Training	0	0	--	60	40	100	2
8.	BMECE0-001	Engineering Mechanics	3	1	0	40	60	100	4
9.	BMNCC0-002	Environment Science	2	0	0	100	--	100	0
		Total	**17**	**4**	**4**			**800**	**23**

#Workshop training will be imparted in the institution at the end of 2nd semester for four weeks duration (Minimum 30 hours Per week). Industrial tour will also form a part of this training.

Semester IV [Second year]

Branch/Course: B Tech Electrical Engineering

Sr. No.	Course Code	Course Title	Hours per week			Marks			Credits
			L	T	P	Int.	Ext.	Total	
1.	BELES1-401	Digital Electronics	3	0	0	40	60	100	3
2.	BELES1-402	Digital Electronics Lab	0	0	2	60	40	100	1
3.	BELES1-403	Electrical Machines – II	3	1	0	40	60	100	4
4.	BELES1-404	Electrical Machines–II Lab	0	0	2	60	40	100	1
5.	BELES1-405	Power Electronics	3	0	0	40	60	100	3
6.	BELES1-406	Power Electronics Lab	0	0	2	60	40	100	1
7.	BELES1-407	Signals and Systems	3	1	0	40	60	100	4
8.	BMATH3-301	Mathematics-III (Probability & Statistics)	3	1	0	40	60	100	4
10.	BMNCC0-001	Constitution of India	2	0	0	100	--	100	0
		Total	17	3	6			900	21

#After 4th semester, student will go for 6-Week Institutional/Industrial Training in which he/she should cover at least one of the software; such as: MATLAB/LabVIEW/C/C++/Automation/AutoCAD (Electrical)/Data Analysis using Excel or the upcoming advanced software which may be useful for Electrical Engineering.

ELECTRICAL CIRCUIT ANALYSIS

Sub Code: BELES1-301	L	T	P	C	Duration: 42 Hrs.
	3	1	0	4	

UNIT 1

Network Theorems (10 Hours)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

UNIT 2

Solution of First and Second order networks (8 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

UNIT 3

Sinusoidal steady state analysis (8 Hours)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNIT 4

Electrical Circuit Analysis Using Laplace Transforms (8 Hours)

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances.

UNIT 5

Two Port Network and Network Functions (6 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis', TMH, 2005.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1) Apply network theorems for the analysis of electrical circuits.
2) Obtain the transient and steady-state response of electrical circuits.
3) Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
4) Analyse two port circuit behaviour.

ANALOG ELECTRONIC CIRCUITS

Sub Code: BELES1-302	L	T	P	C	Duration: 40 Hrs.
	3	0	0	3	

UNIT 1

Diode circuits (4 Hours)

Introduction to Semiconductors and their classifications, P-N junction diode, I-V characteristics of a PN diode, PN diode as half-wave and full-wave rectifiers, Clamping and clipping device, Zener diode, Zener diode as voltage regulator.

BJT Circuits (8 Hours)

Bipolar Junction Transistor (BJT) and its operation, Various BJT configurations and I-V characteristics, Biasing techniques and bias stability, BJT as a switch, BJT as an amplifier: Small-signal model,Current mirror; Common-emitter, Common-base and Common-collector amplifiers; Small signal equivalent circuits, High-frequency equivalent circuits.

UNIT 2

Field Effect Transistor Circuits (8 Hours)

Field Effect Transistor and its operation, various configurations and I-V characteristics, Biasing techniques, FET as a switch and as an amplifier, MOS capacitor, C-V characteristics.

MOSFET structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier: Small-signal model and biasing circuits, Common-source, Common-gate and Common-drain amplifiers; Small signal equivalent circuits - gain, input and output impedances, trans-conductance, High frequency equivalent circuit.

UNIT 3

Operational Amplifiers (8 Hours)

Differential amplifier; Basic structure and principle of operation, Ideal op-amp, Non-idealities in an op-amp such as; Output offset voltage, Input bias current, Input offset current, Slew rate, Gain bandwidth product, calculation of differential gain, common mode gain, CMRR and ICMR, OP- AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

UNIT 4

Applications of OP-AMP (12 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, Integrator and Differentiator, Summing amplifier,Differential amplifier, Instrumentation amplifier,Active filters: Low pass, high pass, band pass and band stop, design guidelines, Voltage regulator, Oscillators (Wein bridge and phase shift).

Hysteresis comparator, Zero crossing detector, Schmitt trigger and its applications, Square-wave and triangular-wave generators, Precision rectifier, Peak detector, Monoshot vibrator.

Text/References:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford UniversityPress, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the characteristics of transistors.
2. Design and analyse various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

ANALOG ELECTRONIC CIRCUITS LAB

Sub Code: BELES1-303	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

EXPERIMENTS

1. To draw V-I characteristics of PN junction diode.
2. To draw V-I characteristics of Zener diode.
3. To analyse the response of Zener diode as regulator.
4. To study the response of clamping and clipping circuits.
5. To analyse the response of half wave, full wave and Bridge rectifiers.
6. To study and compare various biasing techniques for transistors.
7. To plot the input and output characteristics of CE configuration.
8. To plot the input and output characteristics of CB configuration.
9. To plot the input and output characteristics of CC configuration.
10. To plot the characteristics of JFET.
11. To plot the characteristics of MOSFET.
12. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
13. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
14. Study of OP-AMP as inverting amplifier.
15. Use OP-AMP as a differentiator.
16. Use of OP-AMP as an integrator circuit.
17. OP-AMP as square wave/triangular wave generator.

    Note: At least ten experiments should be performed in semester.

ELECTRICAL MACHINES – I

Sub Code: BELES1-304	**L**	**T**	**P**	**C**	**Duration: 40 Hrs.**
	3	**1**	**0**	**4**	

UNIT 1

Magnetic Fields and Magnetic Circuits (8 Hours)

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air

Influence of highly permeable materials on the magnetic flux lines, B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit.

UNIT 2

DC Machines (10 Hours)

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.

Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT 3

DC machine - motoring and generation (8 Hours)

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series.
Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed.
V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors.
Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

UNIT 4

Transformers (14 Hours)
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers,

Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Text / References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of magnetic circuits.
2. Understand the operation of dc machines.
3. Analyse the differences in operation of different dc machine configurations.
4. Analyse single phase and three phase transformers circuits.

ELECTRICAL MACHINES LAB - I

Sub Code: BELES1-305	L	T	P	C
	0	0	2	1

EXPERIMENTS

1. To study three point and four point starters of DC shunt motor.
2. To obtain torque and speed characteristics of a D.C. motor.
3. To obtain external characteristics of D.C. shunt generators.
4. To obtain external characteristics of D.C. series generators.
5. Speed control of a dc shunt motor by varying armature circuit and field circuit methods.
6. To calculate the power rating of DC machines.
7. To determine losses and efficiency of DC machines.
8. To check the transformation ratio and polarity of single phase transformer.
9. To perform open and short circuit test onsingle phase transformer and to determine its efficiency
10. To perform load test on a single phase transformer and to determine voltage regulation.
11. To perform parallel operation on single phase transformers.

Note: At least ten experiments should be performed in semester.

Course Objectives

1. To understand the characteristics of D.C. Machines.
2. To understand speed control methods and testing methods.
3. To determine efficiency and voltage regulation of transformers.

Course Outcomes

1. To acquire skills to operate all types of dc machines.
2. Ability to analyse the speed control methods and efficiency of DC machines.
3. To be able to compute efficiency and voltage regulation of transformers.

ELECTROMAGNETIC FIELDS

Sub Code: BELES1-306	L	T	P	C	Duration: 42 Hrs.
	3	1	0	4	

UNIT 1

Review of Vector Calculus (6 hours)

Vector algebra, addition, subtraction, Components of vectors, Scalar and vector multiplications, Triple products, Three orthogonal coordinate systems (rectangular, cylindrical and spherical), Vector calculus, differentiation, Partial differentiation, Integration, Vector operator del, Gradient, Divergence and curl; Integral theorems of vectors, Conversion of a vector from one coordinate system to another.

UNIT 2

Static Electric Field (6 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, surface and volume charge distributions. Gauss law and its applications. Absolute electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic energy and energy density.

Conductors, Dielectrics and Capacitance (6 Hours)

Current and current density, Ohms law in point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

UNIT3

Static Magnetic Fields (6 Hours)

Biot-Savart Law, Ampere law, Magnetic flux and magnetic flux density, Scalar and vector magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Magnetic Forces, Materials and Inductance (6 Hours)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, Inductances and mutual inductances.

UNIT4

Time Varying Fields and Maxwell's Equations (6 Hours)

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional electromotive forces. Boundary conditions.

Electromagnetic Waves (6 Hours)

Derivation of wave equation, Uniform plane waves, Maxwell's equation in phasor form, Wave equation in phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
5. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Course Outcomes:

At the end of the course, students will demonstrate the ability

1. To understand the basic laws of electromagnetism.
2. To obtain the electric and magnetic fields for simple configurations under static conditions.
3. To analyse time varying electric and magnetic fields.
4. To understand Maxwell's equation in different forms and different media.

5. To understand the propagation of EM waves.

ENGINEERING MECHANICS

Sub Code: BMECE0-001	**L**	**T**	**P**	**C**	**Duration: 42 Hrs.**
(To be finalized by DAA)	**3**	**1**	**0**	**4**	

UNIT 1

Introduction to Vectors and Tensors and Co-ordinate systems (5 hours)

Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.

Three-dimensional Rotation (4 hours)

Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.

UNIT2

Kinematics of Rigid Body (6 hours)

Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two- and three-dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.

Kinetics of Rigid Bodies (6 hours)

Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

UNIT3

Free Body Diagram (2 hour)

Free body diagrams; Examples on modelling of typical supports and joints and their kinematic and kinetic constraints.

General Motion (9 hours)

General planar motions, General 3-D motions, Free precession, Gyroscopes, Rolling coin.

UNIT4

Bending Moment (5 hours)

Transverse loading on beams, shear force and bending moment in beams, Analysis of cantilevers, Simply supported beams and overhanging beams, Relationships between loading, shear force and bending moment, Shear force and bending moment diagrams.

Torsional Motion (2 hours)

Torsion of circular shafts, Derivation of torsion equation, Stress and deformation in circular and hollow shafts.

Friction (3 hours)

Concept of friction; Laws of coulomb friction; Angle of repose; Coefficient of friction.

Text / References:

1. J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.
2. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.
3. R. K. Bansal, "Engineering Mechanics", Laxmi Publications, Third Edition, 2012

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the concepts of co-ordinate systems.
2. Analyse the three-dimensional motion.
3. Understand the concepts of rigid bodies.
4. Analyse the free-body diagrams of different arrangements.
5. Analyse torsional motion and bending moment.

Environmental Sciences (Mandatory Non-Credited course)

Branch – Electrical Engg.	L T P C
Sub. Code-BMNCC0-002	2 0 0 0

Course Objectives:
1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

. **UNIT-I:**

1. The Multidisciplinary Nature of Environmental Studies:
Definition, scope and importance, Need for public awareness.
2. **Natural Resources**
Renewable and Non-renewable Resources: Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification
(g) Role of an individual in conservation of natural resources.
(h) Equitable use of resources for sustainable lifestyles.

UNIT-II:
Environmental Pollution: Definition
(a) Causes, effects and control measures of:
i) Air pollution
ii) Water pollution
iii) Soil pollution
iv) Marine pollution
v) Noise pollution
vi) Thermal pollution
vii) Nuclear pollution

(b) **Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes.
(c) Role of an individual in prevention of pollution.
(d) Pollution Case Studies.
(e) Disaster management: floods, earthquake, cyclone and landslides.

UNIT-III:
Social Issues and the Environment
(a) From unsustainable to sustainable development
(b) Urban problems and related to energy
(c) Water conservation, rain water harvesting, Watershed Management
(d) Resettlement and rehabilitation of people; its problems and concerns, Case studies.
(e) Environmental ethics: Issues and possible solutions
(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.
(g) Wasteland reclamation
(h) Consumerism and waste products

(i) Environmental Protection Act
(j) Air (Prevention and Control of Pollution) Act
(k) Water (Prevention and control of Pollution) Act
(l) Wildlife Protection Act
(m) Forest Conservation Act
(n) Issues involved in enforcement of environmental legislation

UNIT-IV:
Human Population and the Environment
(a) Population growth, variation among nations
(b) Population explosion – Family Welfare Programmes
(c) Environment and human health
(d) Human Rights
(e) Value Education
(f) HIV/AIDS
(g) Women and Child Welfare
(h) Role of Information Technology in Environment and Human Health
(i) Case Studies

Environmental Science related activities:
We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around US. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.
(a) Awareness Activities:
i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts.
(b) Actual Activities:
i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

DIGITAL ELECTRONICS

Sub Code: BELES1-401	**L**	**T**	**P**	**C**	**Duration: 40 Hrs.**
(To be finalized by DAA)	**3**	**0**	**0**	**3**	

UNIT 1

Fundamentals of Digital Systems and Logic families (7Hours)

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates

Number systems-binary, signed binary, octal and hexadecimal number, binaryarithmetic,one's and two's complements arithmetic, codes, error detecting and correctingcodes.

UNIT 2

Combinational digitalcircuits (10 Hours)

Standard representation for logic functions,simplification oflogicfunctions using K-map, minimization of logical functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, Carry look ahead adder,Serialadder, Arithmetic and Logic unit (ALU), elementary ALU design, popular MSI chips, Digital comparator,Paritychecker/generator, Code converters, Priority encoders, Decoders/drivers for display devices.

UNIT 3

Sequential circuits and systems (10 Hours)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K and D and Tflipflops,Applicationsofflipflops, Shiftregisters,Applicationsofshiftregisters,Serialtoparallelconverter,Paralleltoserialconverter.

Ringcounter,Sequencegenerator,Ripple(Asynchronous) counters, Synchronous counters, Counters design using flipflops,specialcounter IC's, Asynchronous sequential counters, applications ofcounters.

UNIT 4

Semiconductor memories and Programmable logic devices (6 Hours)

Memory organization and operation, Expanding memory size, Classification andcharacteristicsof memories, Sequential memory, Read only memory (ROM), Read and write memory(RAM), Content addressable memory (CAM), Charge de-coupled device memory (CCD), Commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, Complex programmable logic devices (CPLDS), Field programmable gate array (FPGA).

Analog-to-Digital (A/D) and Digital-to-Analog (D/A) Converters (7Hours)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter,specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit,Analog to digital converters: quantization and encoding, parallel comparator A/Dconverter,successive approximation A/D converter, counting A/Dconverter, Dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, Example of A/D converter ICs.

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Malvino and Leach, “Digital Principles and Applications”, TMH, 4th Ed.1991

CourseOutcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

DIGITAL ELECTRONICS LAB

	L	T	P	C
Sub Code: BELES1-402	**L**	**T**	**P**	**C**
(To be finalized by DAA)	**0**	**0**	**2**	**1**

EXPERIMENTS

1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universal gates.
2. To design Half Adder using Logic gates on bread board.
3. To design Full Adder using Logic gates on bread board.
4. To design Half Subtractor using Logic gates on bread board.
5. To design Full Subtractor using Logic gates on bread board.
6. To design 4-Bit Binary-to-Gray Code Converter on bread board.
7. To design 4-Bit Gray-to-Binary Code Converter on bread board.

8. To study and design 4-Bit magnitude comparator using logic gates on bread board.
9. Design and verification of Truth-table of multiplexer.
10. Realization of Half adder and Full adder using MUX.
11. Design and verification of Truth-table of Demultiplexer.
12. Realization of half subtractor and full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. To Study different shift registers: SIPO, SISO, PIPO, and PISO.

Note: At least ten experiments should be performed in semester.

Course Objectives

1. To give students a practical knowledge about various types of gates and varify their truth tables.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students knowledge of working of different combinational and sequential circuits.

ELECTRICAL MACHINES –II

	L	T	P	C	
Sub Code: BELES1-403	**L**	**T**	**P**	**C**	**Duration: 42 Hrs.**
(To be finalized by DAA)	**3**	**1**	**0**	**4**	

UNIT 1

Fundamentals of AC machine windings (8 Hours)

Physical arrangement of windings in stator and cylindrical rotor; Slots for windings; Single-turn coil - active portion and overhang; Full-pitch coils, Concentrated winding, Distributed winding, Winding axis, 3D visualization of the above winding types.

Air-gap MMF distribution with fixed current through winding,Concentrated and distributed winding, Sinusoidally distributed winding, Winding distribution factor.

UNIT 2

Pulsating and revolving magnetic fields (6 Hours)

Constant magnetic field, Magnetic field produced by a single winding - fixed current and alternating current, Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), Revolving magnetic field.

UNIT 3

Three-phase induction machines (10 Hours)

Construction, Types (squirrel cage and slip-ring), Torque-slip characteristics, Starting and maximum torque. Equivalent circuit. Phasor diagram, Losses and efficiency.

Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors.

Generator operation. Self-excitation. Doubly-fed induction machines.

Single-phase induction motors (6 Hours)

Constructional features, Double revolving field theory, Equivalent circuit, Determination of parameters. Split-phase, Starting methods and applications.

UNIT 4

Synchronous machines (12 Hours)

Constructional features, Cylindrical rotor synchronous machine - Generated EMF, Equivalent circuit and phasor diagram, Armature reaction, Synchronous impedance, Voltage regulation. Operating characteristics of synchronous machines, V-curves.

Salient pole machine - Two reaction theory, Analysis of phasor diagram, Power angle characteristics. Parallel operation of alternators - Synchronization and Load division.

Text/References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
5. A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.
6. P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of rotating magnetic fields.
2. Understand the operation of ac machines.
3. Analyse performance characteristics of ac machines.

ELECTRICAL MACHINES LAB – II

Sub Code: BELES1-404 **L T P C**

(To be finalized by DAA) **0 0 2 1**

EXPERIMENTS

1. To perform load-test on three-phase induction motor and to plot speed-torque characteristics.
2. To perform no-load and blocked rotor test on three-phase induction motor to obtain equivalent circuit parameters and to draw circle diagram.
3. To study the speed control of three-phase induction motor by Kramer's method.
4. To study the speed control of three-phase induction motor by cascading of two induction motors.
5. To study star- delta starters and
   a) To draw electrical connection diagram.
   b) To start the three-phase induction motor using it.
   c) To reverse the direction of three-phase induction motor.
6. To start a three-phase slip ring induction motor by inserting different levels of resistance in the rotor circuits and to plot speed- torque characteristics.
7. To perform no-load and blocked rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
8. To perform load test on single-phase induction motor and plot speed-torque characteristics.
9. To perform no load and short circuit test on three-phase alternator and draw open and short circuit characteristics.
10. To find voltage regulation of an alternator by zero power factor (ZPF) method.
11. To study effect of variation of field current upon the stator current and power factor of synchronous motor running at no load and draw V and inverted V curves of motor.
12. To synchronise two 3-phase alternators using dark lamp method, and two-bright & one dark lamp method.
13. To start a synchronous motor using appropriate method.

Note: At least ten experiments should be performed in the semester.

Course Objectives:

1. To plot speed-torque characteristics of three-phase and single-phase induction motors.
2. To obtain equivalent circuit parameters of three-phase and single-phase induction motors.
3. To study speed control of induction motors using different techniques.

4. To plot characteristics of a three-phase alternator and a synchronous motor.

5. To synchronise two 3-phase alternators by different methods

Course Outcomes:

Students will be able to

1. Obtain equivalent circuit parameters of single-phase and three- phase Induction motors.

2. Control speed of Induction motors by different methods.

3. Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor.

4. Find out voltage regulation of an alternator by different tests.

5. Synchronise two or more 3-phase alternators.

POWER ELECTRONICS

	L	T	P	C	
Sub Code: BELES1-405	**L**	**T**	**P**	**C**	**Duration: 40 Hrs.**
(To be finalized by DAA)	**3**	**0**	**0**	**3**	

UNIT 1

Power Switching Devices (12Hours)

Power Diode, MOSFET, Insulated gate bipolar transistor(IGBT): V-I characteristics, Gate drive circuits for MOSFET and IGBT.

Introduction to Thyristor family,Silicon controlled rectifier (SCR), Static and dynamic Characteristics,Turn-on methods, Firing circuits for thyristors; Commutation circuits for thyristors.

Uni-junction transistor (UJT): Construction, V-I characteristics and use in firing circuit

UNIT 2

Thyristor Rectifiers (AC – DC converters) (8Hours)

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load;

Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT 3

Choppers (DC-DC converters) (5Hours)

Elementary chopper with an active switch and diode, Duty ratio and average voltage, Buck converter: analysis and waveforms at steady state, duty ratio control of output voltage, Boost converter: analysis and waveforms at steady state,duty ratio and average output voltage.

AC Voltage Controllers and Cycloconverters (AC - AC converters) (5 Hours)

Single phase AC voltage controllers using thyristors, phase control and integral cycle control, Single phase cyclo-converters, applications.

UNIT 4

Voltage Source Inverters (DC – AC converters) (10Hours)

Single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and uni-polar sinusoidal modulation, modulation index and output voltage.

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

Text/References:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. Bimbhra P.S., Power Electronics, Khanna Publishers, 2004.
6. P. C. Sen,Power Electronics, Tata McGraw-Hill Company Limited, New Delhi, 1992.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits.
3. Analyse the operation of DC-DC choppers.
4. Analyse the operation of voltage source inverters.

POWER ELECTRONICS LAB

	L	T	P	C
Sub Code: BELES1-406	**L**	**T**	**P**	**C**
(To be finalized by DAA)	**0**	**0**	**2**	**1**

EXPERIMENTS

1. To obtain V-I characteristics of SCR and measure latching and holding currents.
2. To plot V-I Characteristics of UJT.
3. To obtain triggering pulses for SCR by using UJT as relaxation oscillator.
4. To obtain triggering wave forms for SCR using R and RC firing circuits.
5. To obtain output voltage waveforms of single phase half wave controlled rectifier for R-L load.
6. To obtain output voltage wave forms for single phase full-wave controlled rectifiers with resistive and inductive loads.
7. To simulate three phase bridge rectifier and draw load voltage and load current waveform for resistive and inductive loads.
8. To study different types of chopper circuits and obtain waveforms for at least one of them.
9. To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveforms for different types of loads.
10. To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
11. To study single phase cycloconverter.
12. To study speed control of induction motor using thyristor.
13. To study speed control of DC motor using thyristor.

Note: At least ten experiments should be performed in the semester.

Recommended Books

1. K.R. Varmah, K. John Ginnes, Abraham Chikku, 'Power Electronics, Design, Testing and Simulation, Laboratory Manual', 1st Edn., CBS Publishers & Distributors Pvt. Ltd., **2017**.

2. O.P. Arora, 'Power Electronics Laboratory, Theory, Practice and Organization', Narosa Publishing House, **2007.**

Course Objectives:

1. To obtain the characteristics of SCR and UJT and to obtain triggering pulses for them.
2. To verify the performance of various converter circuits by measuring the currents and voltages at different points in the circuit and to display their waveforms.
3. To control speed of motors by using thyristors.

Course Outcomes:

1. Students will be able to verify the characteristics of SCR and UJT and triggering pulses for them.
2. They will be able to visualize and analyse the performance of various converter circuits.
3. They will be able to control the speed of motors using thyristors.

SIGNALS & SYSTEMS

Sub Code: BELES1-407 (To be finalized by DAA)	L	T	P	C	Duration: 40 Hrs.
	3	1	0	4	

UNIT 1

Introduction to Signals and Systems (8 hours)

Signals and systemsin electrical engineering and science, Signal properties: Periodicity, absolute integrability, determinism and stochastic character.

Some special signals of importance: Unit step, Unit impulse, Sinusoid, Complex exponential, Special time-limited signals; Continuous and discrete time signals, Continuous and discrete amplitude signals.

System properties: Linearity, additivity and homogeneity, Shift-invariance, causality, stability, realizability, Examples.

UNIT 2

Continuous and Discrete-time Linear Time invariant (LTI) systems (10 hours)

Impulse response and step response, Convolution, Input-output behaviour with aperiodic convergent inputs, Cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations.

UNIT 3

Fourier and Z- Transforms (14 hours)

Fourier series representation of periodic signals, Waveform symmetries, Calculation of Fourier coefficients. Fourier Transform, Convolution/multiplication and their effect in the frequency domain, Magnitude and phase response, Fourier domain duality.

The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem, The Z-Transform for discrete time signals and systems, System functions, Poles and zeros of systems and sequences, Z-domain analysis.

UNIT 4

Sampling and Reconstruction (8 hours)

The Sampling Theorem and its implications. Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects.

Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of continuous time and discrete time systems.
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.

MATHEMATICS - III
(Probability and Statistics)

	L	T	P	C	
Sub Code: BMATH3-301	L	T	P	C	Duration: 40 Hrs.
(To be finalized by DAA)	3	1	0	4	

UNIT 1

Basic Probability (12 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

UNIT 2

Continuous Probability Distributions (4 hours)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions (4 hours)

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT 3

Basic Statistics (8 hours)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT 4

Applied Statistics (8 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Small Samples (4 hours)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / References:

1) E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
2) P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
3) S. Ross, “A First Course in Probability”, Pearson Education India, 2002.
4) W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.
5) N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.
6) B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.
7) T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001 **L T P C** **Duration: 24 Hrs**

2 0 0 0

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

8)
9)
10)

PROPOSED STUDY SCHEME by BoS ELECTRONICS ENGINEERING
B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING
3rd-8th SEMESTER
As on 03.04.2019

3rd SEMESTER

Sr.No.	Course Code	Course Title	L	T	P	Marks			Credits
						Int	Ext	Total	
1	BECES1S1-301	Electronic Devices & Circuits	3	1	0	40	60	100	4
2	BECES1S1-302	Digital Electronic Circuits& Design	3	1	0	40	60	100	4
3	BECES1S1-303	Signals and Systems	3	1	0	40	60	100	4
4	BECES1S1-304	Network Theory: Analysis & Synthesis	3	1	0	40	60	100	4
5	BECES1S1-305	Electronic Devices & Circuits Lab	0	0	2	60	40	100	1
6	BECES1S1-306	Digital Electronic Circuit & Design Lab	0	0	2	60	40	100	1
7	BMATH3-301	Mathematics-III*	3	1	0	40	60	100	4
8	BECES1S1-307	Training-I	-	-	-	60	40	100	3
		TOTAL	**15**	**5**	**4**	**380**	**420**	**800**	**25**

** Framed and Approved by Deptt. of Applied Mathematics, MRSPTU, BTI*

4th SEMESTER

Sr.No.	Course Code	Course Title	Contact Hours			Marks			Credits
			L	T	P	Int	Ext	Total	
1	BECES1S1-401	Analog and Digital Communication	3	1	0	40	60	100	4
2	BECES1S1-402	Analog Electronic Circuits	3	1	0	40	60	100	4
3	BECES1S1-403	Electromagnetic Theory & Applications	3	1	0	40	60	100	4
4	BECES1S1-404	Analog and Digital Communication Lab	0	0	2	60	40	100	1
5	BECES1S1-405	Analog Electronic Circuits Lab	0	0	2	60	40	100	1
6	BMECE0-001	Engineering Mechanics*	3	1	0	40	60	100	4
7	BMNCC0-001	Constitution of India	2	0	0	-	-	-	--
		TOTAL	**14**	**4**	**4**	**280**	**320**	**600**	**18**

** Framed and Approved by Deptt. of Mechanical Engg, GZSCCET, MRSPTU, BTI*

There will be 4-week Internship after 4th semester.

5th SEMESTER

Sr.No.	Course Code	Course Title	Contact Hours			Marks			Credits
			L	T	P	Int	Ext	Total	
1	BECES1S1-501	Microprocessors & Microcontrollers	3	1	0	40	60	100	4
2	BECES1S1-502	Information Theory & Coding	3	1	0	40	60	100	4
3	BECES1S1-503	Control Systems & Applications	3	1	0	40	60	100	4
4	BECES1S1-504	Control Systems Lab	0	0	2	60	40	100	1
5	BECES1S1-505	Microprocessors & Microcontrollers Lab	0	0	2	60	40	100	1
6	BECES1S1-506	Training-II	-	-	-	60	40	100	4
7	BECES1D1-5XX	Program Elective – 1	3	0	0	40	60	100	3
8	XXXXX	Open Elective-1	3	0	0	40	60	100	3
		TOTAL	**15**	**3**	**4**	**380**	**420**	**800**	**24**

6th SEMESTER

Sr.No.	Course Code	Course Title	Contact Hours			Marks			Credits
			L	T	P	Int	Ext	Total	
1	BECES1S1-601	Digital Signal Processing	3	1	0	40	60	100	4
2	BECES1S1-602	Computer Communication Networks	3	1	0	40	60	100	4
3	BECES1S1-603	Digital Signal Processing Lab	0	0	2	60	40	100	1
4	BECES1S1-604	Computer Communication Networks Lab	0	0	2	40	60	100	1
5	BECES1S1-605	Electronic Measurement	1	0	2	40	60	100	1
6	BECES1S1-606	Mini Project/Electronic Design workshop	0	0	4	60	40	100	2
7	BECES1D1-6XX	Program Elective – 2	3	0	0	60	40	100	3

8	XXXXX	OE-2	3	0	0	60	40	100	3
9	BHSMC0-0XX	Universal Human Values-II/Law & Engineering/ Human Relation at Work/Engineering Economics & Industrial Management	3	0	0	40	60	100	3
		TOTAL	**16**	**2**	**10**	**440**	**460**	**900**	**22**

(ECEL◆: Course to be selected from the list of Program Electives)

There will be 4-week Internship after 6th semester.

7th SEMESTER

Sr.No.	Course Code	Course Title	Contact Hours			Marks			Credits
			L	T	P	Int	Ext	Total	
1	BECES1D1-7XX	Program Elective -3	3	0	0	40	60	100	3
2	BECES1D1-7XX	Program Elective -4	3	0	0	40	60	100	3
3	BECES1D1-7XX	Program Elective -5	3	0	0	40	60	100	3
4	XXXXXXX	OE-3	3	0	0	40	60	100	3
5	BECES1S1-701	Project Stage-I	0	0	4	60	40	100	2
6	BMNCC0-1002	**Environment Science (MC)**	2	0	0	--	--	--	--
7	BECES1S1-702	Training-III	--	--	--	60	40	100	4
		TOTAL	**14**	**0**	**4**	**280**	**320**	**600**	**18**

(ECEL◆: Course to be selected from the list of Program Electives)

8th SEMESTER

Sr.No.	Course Code	Course Title	Contact Hours			Marks			Credits
			L	T	P	Int	Ext	Total	
1	BECES1D1-8XX	Program Elective -6	3	0	0	40	60	100	3
2	BECES1D1-8XX	Program Elective -7	3	0	0	40	60	100	3
3	XXXXX	OE-4	3	0	0	40	60	100	3
4	BECES1S1-801	Project Stage-II	0	0	10	120	80	200	5
5	BMNCC0-006	**Essence of Indian Knowledge Tradition**	2	0	0	--	--	--	--
		TOTAL	**11**	**0**	**10**	**240**	**260**	**500**	**14**

(ECEL◆: Course to be selected from the list of Program Electives)

Note ***(Applicable for 2019 Batch onwards)*****:** As per AICTE Activity Point Programme, a candidate has to earn 100 activity points (for Lateral Entry – 75 activity points) in addition to the required Academic Grades before he/she appears in his/her final examinations.

Program Elective Courses

Sr. No.	Course Code	Course Title	Hrs. /Week L: T:P	Credits
5th Semester				
1	BECES1D1-501	Antennas and Wave Propagation	3:0:0	3
2	BECES1D1-502	Introduction to MEMS	3:0:0	3
3	BECES1D1-503	Bio-Medical Electronics	3:0:0	3
4	BECES1D1-504	Computer Architecture	3:0:0	3
5	BECES1D1-505	Nano Electronics	3:0:0	3
6	BECES1D1-506	VHDL Design	3:0:0	3
6th Semester				
1	BECES1D1-601	Microwave Theory and Techniques	3:0:0	3
2	BECES1D1-602	Speech and Audio Processing	3:0:0	3
3	BECES1D1-603	Power Electronics	3:0:0	3
4	BECES1D1-604	Embedded systems	3:0:0	3
5	BECES1D1-605	Probability Theory and Stochastic Processes	3:0:0	3
6	BECES1D1-606	Android based Operating Systems	3:0:0	3
7	BECES1D1-607	Industrial Automation	3:0:0	3
7th Semester				

1	BECES1D1-701	Fiber Optic Communications	3:0:0	3
2	BECES1D1-702	Mobile Communication and Networks	3:0:0	3
3	BECES1D1-703	Information Theory and Coding	3:0:0	3
4	BECES1D1-704	Digital Image & Video Processing	3:0:0	3
5	BECES1D1-705	Mixed Signal Design	3:0:0	3
6	BECES1D1-706	Wavelets	3:0:0	3
7	BECES1D1-707	CMOS Design	3:0:0	3
8	BECES1D1-708	High Speed Electronics	3:0:0	3
9	BECES1D1-709	Neural Network & Fuzzy Logic	3:0:0	3
8th Semester				
1	BECES1D1-801	Wireless Sensor Networks	3:0:0	3
2	BECES1D1-802	Satellite Communication	3:0:0	3
3	BECES1D1-803	Error correcting codes	3:0:0	3
4	BECES1D1-804	Scientific computing	3:0:0	3
5	BECES1D1-805	Adaptive Signal Processing	3:0:0	3
6	BECES1D1-806	Artificial Intelligence	3:0:0	3
7	BECES1D1-807	Internet of Things	3:0:0	3
8	BECES1D1-808	Machine Learning	3:0:0	3
9	BECES1D1-809	Data Mining & Big Data	3:0:0	3

Subject Code: BECES1-301 **L T P C** **Duration: 48 Hrs**
3 1 0 4

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various electronic devices, their circuits & behavior under various conditions.

1. To make aware the students about the various electronic devices and their circuits.
2. To impart knowledge of BJTs and FETs.
3. To provide the students detailed concepts of MOSFETs and CMOSFETs.
4. To analyze low and high frequency transistor models.

Course Outcomes:

At the end of this course student will be able to:

1. Understand the principles of semiconductor physics
2. Understand the concepts of junction diodes and their applications.
3. Understandandutilizethemathematicalmodelsofsemiconductorjunctionsand MOS transistors for circuits and systems
4. Analyze BJT characteristics and determine their behavior under low and high frequencies.
5. Analyze various concepts of FETs and their characteristics.
6. Design low and high frequency models and observe and their various characteristics.

UNIT-I (12 Hrs)

Semiconductors: Introduction to Semiconductors and their classification, Energy bands in intrinsic and extrinsic semiconductors, Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, Generation and recombination of carriers.

Semiconductors Diodes: P-N junction diode, diode resistance and capacitance, I-V characteristics, small signal switching models, Avalanche/Zener breakdown, Applications of PN diode: rectifier, clipper and clamper, Zener diode, Schottky diode, LED, photodiode and solar cell

UNIT-II (12 Hrs)

Bipolar Junction Transistor: BJT and its operation, Ebers-Moll Model, Various BJT configurations and their I-V characteristics, Biasing techniques and bias stability, BJT as a switch and as an amplifier.

Field Effect Transistor: JFET and its operation, various configurations and I-V characteristics, Biasing techniques, FET as a switch and as an amplifier, MOS capacitor, C-V characteristics, MOSFETs; their operation and characteristics, biasing and small signal models of MOS transistor, CMOS devices and CMOS inverter.

UNIT-III (12 Hrs)

Low & High Frequency Transistor Models: Small signal low frequency BJT hybrid Model, Analysis of transistor amplifier in CB, CE and CC configuration using h-parameters, small signal low frequency analysis of FET/MOSFET, Need of high frequency BJT model, high frequency T model, hybrid-pi model, hybrid-pi conductances in terms of low frequency h parameters.

UNIT-IV (12 Hrs)

Integrated Circuit Fabrication Process: Fundamentals of IC fabrication, photolithography, etching, oxidation, diffusion, ion implantation, chemical vapor deposition, sputtering, twin-tub CMOS process. Monolithic IC-Fabrication: Resistor, PN junction Diode and BJTs.

Text/Reference Books:

1. G.Streetman,and S.K.Banerjee,“SolidStateElectronicDevices,”7thedition,Pearson,2014.
2. D.Neamen,D.Biswas"SemiconductorPhysicsandDevices,"McGraw-HillEducation
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
4. C.T.Sah,“Fundamentalsofsolidstateelectronics,”WorldScientificPublishingCo.Inc,1991.
5. Y.TsividisandM.Colin,“OperationandModelingoftheMOSTransistor,”Oxford Univ. Press, 2011.
6. J. Luo, “Integrated Modelling of Chemical Mechanical Planarization for sub-micron IC Fabrication”, Springer.

DIGITAL ELECTRONIC CIRCUITS & DESIGN

Subject Code: BECES1-302	L T P C 3 1 0 4	Duration: 48 Hrs

Course Objectives:

1. To provide knowledge about basics of digital electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
4. Design & analyze synchronous sequential logic circuits

UNIT-I (12 Hrs)

Fundamentals of Digital Electronics:- Digital/Analog signal, Concept of Number System, logic gates, Universal gates and their specifications**.**

Boolean Algebra: Boolean Algebra- De-Morgan's Theorem, Principle of Duality, Boolean expression Boolean function, Minimization of Boolean expressions– using Karnaugh map Sum of Products (SOP), Product of Sums (POS), QM method, Canonical terms, Minterm, Maxterm.

UNIT-II (12 Hrs)

Logic families: TTL, MOS, CMOS, ECL and their characteristics.

Combinational Circuits: Design procedure – Adders, Subtractors, Serial adder/ Subtractor, Parallel adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/ Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic circuits using MUX.

UNIT-III (12 Hrs)

Sequential Circuits: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Conversion of one Flip-Flop to another. Shift registers and their types, Design of universal Shift Register, Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter, Ring Counters, Design of Synchronous counters.

Semiconductor Memories: Basic memory cell, RAM, ROM, PROM, EPROM, EEROM, PLD, PLA, FPGA, Logic implementation using Programmable Devices.

UNIT-IV (12 Hrs)

Finite State Machines: State diagram, state table, Excitation table, Transition and output table, state Reduction and Assignment. Design of sequential Circuits:- Finite State machine, Capabilities and limitations of FSM, Mathematical Representation of synchronous sequential machine, Mealy Model and Moore Model. Algorithmic State Machines:- Introduction, Components of ASM charts, salient features of ASM Charts, Introductory examples of ASM charts, ASM for Binary Multiplier, ASM for weighing Machine, Hazards in sequential circuits.

Text/Reference Books:

1. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill.
2. Malvino & Leach, 'Digital Principles and Applications', McGraw Hill.
3. Taub & Schilling, 'Digital Integrated Electronics', Tata McGraw Hill.
4. DIGITAL DESIGN – Third Edition , M.Morris Mano, Pearson Education/PHI.
5. Digital Principles and Design – Donald D.Givone, Tata McGraw Hill, Edition.
6. John F Wakerly, "Digital Design Principles and Practices 3/e", Pearson Education.

SIGNALS AND SYSTEMS

Subject Code: BECES1-303 **L T P C** **Duration: 48 Hrs**
3 1 0 4

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To make the students aware about the signal transmission through linear networks.
3. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
4. To impart them knowledge of various types of noises.

Course Outcomes:

Upon the completion of the course, students will be able to:

1. Analyze the properties of signals & systems and representation in time and frequency domain.
2. Classify systems based on their properties and determine the response of LSI system.
3. Apply random signal theory and understand various types of noise.
4. Understand the process of sampling and reconstruction.

UNIT-I(12 Hrs)

Classification of Signals and Systems: Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals, System properties: linearity, additivity and homogeneity, shift-invariance, causality, stability, realizability.

Fourier Representation: The notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, Convolution theorem and its graphical interpretation, Parseval's Theorem, idea of signal space and orthogonal bases.

UNIT-II (12 Hrs)

Linear Shift-invariant (LSI) Systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems, System representation through differential equations and difference equations, Periodic and semi-periodic inputs to an LSI system,

Introduction to Noise: Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure.

UNIT-III (12 Hrs)

Random Signal Theory: Introduction to Probability Theory, Joint and Conditional Probability, Random Events, Probability Mass Function, Statistical Averages. Probability Density Functions (PDF) and Statistical Averages, mean, moments and expectations, standard deviation and variance, Probability models: Uniform, Gaussian, Binomial, Examples of PDF, Transformation of Random Variables, Random Processes, Stationary and Ergodicity, Auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

UNIT-IV (12 Hrs)

Sampling and Reconstruction: Sampling Theorem and its implications- Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on, Aliasing and its effects, Relation between continuous and discrete time systems.

Concept of State-space analysis: State-space analysis and multi-input, multi-output representation, the state-transition matrix and its role.

Text/Reference Books:

1. *A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.*
2. *R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.*
3. *A. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.*
4. *B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.*
5. *Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.*
6. *Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.*
7. *Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons (SEA) Private Limited, c1995.*
8. *M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw Hill Edition, 2003.*
9. *I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2001.*
10. *Ashok Ambardar, "Analog and Digital Signal Processing", Second Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), c1999.*

NETWORK THEORY: ANALYSIS & SYNTHESIS

Subject Code: BECES1-304 **L T P C** **Duration: 48 Hrs**
3 1 0 4

Course Objectives:

1. To introduce nodal, mesh analysis and network theorems for network analysis.
2. To give knowledge of Trigonometric, exponential Fourier series and Laplace transforms along with its properties.
3. To provide overview of network functions and network synthesis techniques.
4. To familiarize with the classifications of filters and their design.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.
6. Students will be able to design analog filters.

UNIT-I (12 Hrs)

Fundamentals of Network Analysis: Node and Mesh analysis, Matrix approach of network containing voltage and current sources and reactances, Source transformation and duality.

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Compensation and Tallegen's theorem as applied to A.C. circuits.

UNIT-II (12 Hrs)

Trigonometric and Exponential Fourier Series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra.

Laplace Transforms and Properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT-III (12 Hrs)

Network Functions: Transient behaviour, concept of complex frequency, Driving points and transfer functions, poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two port network and interconnections, Behaviour of series and parallel resonant circuits.

UNIT-IV (12 Hrs)

Network Synthesis: Fundamental concepts of network synthesis, Hurwitz Polynomials, Properties of RC, RL & LC networks, Foster and Cauer forms of realization.

Network Filters: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Design of constant-K, m-derived and Composite filters.

Text/Reference Books:

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi,1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
4. Chakrabarti A., "Network Analysis and Synthesis" DhanpatRai& Co.

ELECTRONIC DEVICES & CIRCUITS LAB

Subject Code: BECES1-305 **L T P C** **Duration: 24 Hrs**
0 0 2 1

Course Objectives:

1. Able to understand and identification of various electronic components.
2. To understand and plot characteristics of various semiconductor devices.
3. To understand the applications of Transistors as amplifier in various configurations.

Course Outcomes:

1. An ability to understand all types of electronics devices and circuits
2. An ability to conduct experiments, as well as to analyze and interpret various data sheets.

LIST OF EXPERIMENTS

1. To study I-V characteristics of PN junction diode and Zener diode.
2. To perform & analyze the use of PN junction diode as clipper and clamper.
3. To observe and calculate the characteristics/behavior of Half/Full wave rectifier.
4. To perform & analyze the use of Zener diode as voltage regulator.
5. Design of clipper circuit using diode and other components.
6. To plot the input and output characteristics of BJT in CE configuration.
7. To plot the input and output characteristics of BJT in CB/CC configuration.
8. To demonstrate use of BJT as amplifier in a CE configuration.
9. To demonstrate use of a BJT in a CC amplifier circuit configuration.
10. To plot the input and output characteristics of JFET in CG/CD/CS configurations.
11. To perform an experiment to observe the working of JFET as an amplifier.
12. Study and verification of the DC Superposition/Thevenin theorem
13. Study of simple capacitive filters (T & π).
14. Design of constant K filters.
15. Design of m- derived filters.

Note: At least 10 experiments are required to be performed.

DIGITAL ELECTRONIC CIRCUITS & DESIGN LAB

Subject Code: BECES1-306	**L T P C** **0 0 2 1**	**Duration: 24 Hrs**

Course Objectives:

1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students a knowledge about integrated circuits of different combinational and sequential circuits.

Course Outcomes:

1. An ability to test and verify working and truth tables of combinational and sequential circuits.
2. Working knowledge of different converters.
3. To perform multiplexer and demultiplexer.

LIST OF EXPERIMENTS

1. Verification of the truth tables of TTL gates, e.g., 7400, 7402, 7404, 7408, 7432 and 7486.
2. Realization of logic functions with the help of universal gates-NAND Gate
3. Realization of logic functions with the help of universal gates-NOR Gate
4. Design and verification of Half/Full Adder circuit(s) using Logic gates.
5. Design and verification of Half/Full Subtractor circuit(s) using Logic gates.
6. Design and implementation of parity generator/checker using basic gates and MSI devices.
7. Design and verification of 1-bit magnitude comparator using logic gates.
8. Verification of truth-table of multiplexer.
9. Verification of truth-table of demultiplexer.
10. Verification of truth-tables of RS and D flip flops.
11. Verification of truth-tables of JK and T flip flops.
12. To study and verify the Flip-flop conversion.
13. Design of 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
14. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. Study of shift right, SIPO, SISO, PIPO, PISO and Shift left operations of shift registers using ICs.

Note: At least 10 experiments are required to be performed.

MATHEMATICS-III

Subject Code: BMATH3-301	**L T P C** **3 1 0 4**	**Duration: 48 Hrs**

UNIT-I (12 Hrs)

Fourier Series & Fourier Transform: Definition of Periodic functions, Euler's formula, Even and odd functions, half range expansions, Fourier series of different wave forms, Fourier transform, Dirichlet's conditions, Fourier integral formula (without proof), properties of Fourier transform, inversion formula, convolution, Parseval's equality; Fourier transform of generalized functions, application of transforms to heat wave and Laplace equation.

UNIT-II (12 Hrs)

Partial Differential Equations: Definition of PDE, origin of first-order PDE; determination of integral surfaces of linear first order partial differential equations passing through a given curve; surfaces orthogonal to given system of surfaces; non-linear PDE of first order, Cauchy's method of characteristic; compatible system of first order PDE; Charpit's method of solution.

UNIT-III (12 Hrs)

Solution to Linear Partial Differential Equations: Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method, Separation of variables in a PDE; wave and heat equations in one dimensional form, Elementary solutions of Laplace equations.

UNIT-IV (12 Hrs)

Propositional Logic: Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc., Decision problems of propositional logic, Introduction to first order logic and first order theory.

Partially Ordered Sets: Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices, Boolean and pseudo Boolean lattices.

References Books:

1. Kreyszing, E., Advanced Engineering Mathematics, 8th edition, John Wiley, New Delhi.
2. Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
4. Advanced Engineering Mathematics, O'Neil, Cengage Learning.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.

7. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
8. C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, Tata McGraw Hill, 2000.

ANALOG AND DIGITAL COMMUNICATION

Subject Code: BECES1-401 **L T P C** **Duration: 48 Hrs**
3 1 0 4

Course Objectives:

1. To provide students the understanding about the concept of analog and digital modulation techniques.
2. To provide the detailed knowledge about AM transmission and AM reception.
3. To impart the knowledge about FM transmission and FM reception.
4. To learn design of useful circuits required in communication system.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Analyze the behavior of a communication system in presence of noise.
3. Investigate pulsed modulation system and analyze their system performance.

Analyze different digital modulation schemes and can compute the bit error performance

UNIT-I (12 Hrs)

Amplitude Modulation and Demodulation: DSB, SSB and VSB modulations, Basic Principles of AM Generation: Square law Diode Modulation, Suppressed Carrier AM Generation, Ring Modulator, Balanced Modulator, Tuned Radio Frequency (TRF) Receiver, Basic Elements of Super-heterodyne receiver, Envelope or Diode Detector, AGC, Applications, Noise in Amplitude modulation systems.

UNIT-II (12 Hrs)

Angle Modulation and Demodulation: Representation of FM and PM signals, Spectral characteristics of angle modulated signals, Generation of FM by Direct Methods, Indirect Generation of FM: The Armstrong Method, FM Stereo Transmission, Slope Detector, Foster Seeley or Phase Discriminator, Indirect methods of FM Demodulation: FM Detector using PLL and Stereo FM Multiplex Reception, Noise in Frequency modulation systems, Pre-emphasis and De-emphasis, Threshold effects in angle modulation.

UNIT-III (12 Hrs)

Pulse Modulation: Pulse Amplitude and Pulse code modulation (PCM), Noise considerations in PCM, Differential pulse code modulation, Delta modulation, Comparison of PCM and DM.

Baseband Transmission and Detection: Various line coding formats, Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion, Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms-Probability of Error evaluations.

UNIT-IV (12 Hrs)

Digital Modulation Schemes: Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Synchronization and Carrier Recovery for Digital modulation, Digital Modulation tradeoffs

Passband Detection: Optimum demodulation of digital signals over band-limited channels-Maximum likelihood sequence detection (Viterbi receiver), Equalization Techniques.

Text/Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

ANALOG ELECTRONIC CIRCUITS

Subject Code: BECES1-402	L T P C 3 1 0 4	Duration: 48 Hrs

Course Objectives:

1. To understand the characteristics of various power amplifiers.
2. To understand various sources of oscillations.
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.
5. To understand various Applications of Op amp.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

UNIT-I (12 Hrs)

Amplifiers: Review of small signal low frequency BJT models and their analysis, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier.

Feedback Amplifiers: Concept of negative feedback, Feedback topologies, effect of feedback on gain, bandwidth, input/output impedances etc., practical circuits, concept of stability.

Oscillators: Concept of positive feedback, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.) their operation and conditions for sustained oscillations, crystal oscillator.

UNIT-II (12 Hrs)

Power Amplifiers: Frequency response of single stage amplifiers, Multistage amplifiers, cascade and cascade amplifiers, Different coupling schemes for multi stage amplifiers, different classes of operation(Class A, B,AB, C etc.),their power efficiency and linearity issues. Push-pull amplifier, cross over distortion, transistor phase inverter, complementary symmetry push-pull amplifier.

UNIT-III (12 Hrs)

Differential Amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

OP-AMP Applications: Review of inverting and non inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, Active filters: Low pass, high pass, band pass and band stop, design guidelines.

UNIT-IV (12 Hrs)

Multivibrators: Collector/Emitter Coupled- Astable, Mono-stable multivibrators and Fixed/Self biased Bistable mutlivibrators, Triggering methods of Monostable and Bistable multivibrators.

Converter Circuits Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to- digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millmanand A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder'sCollege11
5. Publishing,EditionIV
6. Paul R. Gray and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, JohnWiley, 3rdEdition

ELECTROMAGNETIC THEORY & APPLICATIONS

Subject Code: BECES1-403 | **L T P C 3 1 0 4** | **Duration: 48 Hrs**

Course Objective:

1. To introduce students with different coordinate systems.
2. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
3. To expose the students to the ideas of electromagnetic waves and structure of transmission lines.

Course Outcome:

After the completion of this course the students shall be able to:

1. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
2. Understand the concepts of magnetic field and magnetic field intensity.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4. Understand transmission lines and use of smith chart in electromagnetic engineering problems.

UNIT-I (06 Hrs)

Introduction: The Electromagnetic model, vector algebra: vector addition, subtraction and product, orthogonal coordinate system and their transformations, vector calculus: del operator, gradient, divergence and curl operations and their physical significance, Divergence and Stokes's Theorem and their physical significance, Null Identities, Helmholtz's Equation

UNIT-II (18 Hrs)

Electrostatic Fields: Fundamental Postulates of Electrostatic in free space, Coloumb' s law, Gauss's law and its applications, Electric potential, Electric flux density and dielectric constant, Electrostatic fields in material space, polarization of dielectrics, Boundary conditions for electrostatic fields, Poisson's, Laplace's and Uniqueness Equation, Continuity equation & Relaxation time, Applications of electrostatic fields in Electrostatic discharge and multi-dielectric systems.

Magnetostatic Fields: Fundamental Postulates of Magnetostatics in free space, Ampere's circuit Law & its applications, Biot-Savart Law and applications, Magnetic dipole, Magnetic scalar and vector potentials, Behaviour of magnetic materials, Magnetization, magnetic field intensity and relative permeability, Boundary conditions for Magnetostatic fields, Applications of magneto static fields in lightning and magnetic levitation.

UNIT-III (12 Hrs)

Time Varying Electromagnetic Fields & Maxwell's Equations: Faraday's Law of Electromagnetic Induction and its applications, Maxwell's Equations in Integral form & their physical significance, Electromagnetic boundary conditions, Time Harmonic Fields, Wave Propagation and wave equations, Plane electromagnetic waves in Lossless and Lossy media, reflection and refraction of plane waves at boundaries for normal and oblique incidence, Group Velocity, Flow of Electromagnetic Power and Poynting Vector Theorem, Application of EM waves in telecommunications, radar systems and microwave heating.

UNIT-IV (12Hrs)

Transmission Lines: Introduction, Transverse Electromagnetic wave along a parallel plate, General transmission line equations and transmission line parameters, Wave characteristics on Finite Transmission Lines, Transients on Transmission Lines, Transmission Line Impedance matching, Single stub matching, Double stub matching, Smith chart and its use in transmission lines.

RECOMMENDED BOOKS:

1. Sadiku, Elements of Electromagnetics, Oxford Press.
2. W. H. Hayt. Engineering Electromagnetics, McGraw Hill, New York
3. E.C. Jordan, Electromagnetic Waves and radiating systems, Prentice Hall of India, New Delhi.
4. T.A. John, Engg. Electromagnetics & Fields
5. D.K. Cheng, Fields and Wave Electromagnetics, Pearson education.
6. Kraus, Electromagnetics, McGraw Hill., New York

ENGINEERING MECHANICS

Subject Code: BMECE0-001	**L T P C** **3 1 0 4**	**Duration: 43 Hrs**

Course Objectives:

1. The concepts of friction in screw jack & inclined plane.
2. To draw shear force and bending moment diagrams by analytical method
3. To find forces in simple trusses by using joints and section methods
4. The concepts related to torsions and mechanics of fluids.

UNIT-I

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. **10 Hrs.**

UNIT-II

Friction: Types of Friction, Limiting Friction, Angle of Repose, Coefficient of Friction, Laws of Friction, Static & dynamic Friction, Screw Jack, Minimum force required to drag a body on rough horizontal plane, body tending to move upwards on an inclined plane, body moving down the plane. **10 Hrs.**

UNIT-III

Centroid and Centre of gravity: Centroid of composite sections, Parallel & perpendicular axes theorem, Moment of area, Moment of inertia of standard sections and composite sections, mass moment of inertia of cylinder cone sphere, and Polar moment of inertia. **08 Hrs.**

Shear force and bending moment diagram, simple trusses, Method of joints, Method of section **07 Hrs.**

UNIT-IV

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component. Kinetics of Particles: Equation of motion, rectilinear motion

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and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.
08 Hrs.

Expected Outcomes:

After going through these contents the student shall be able to solve the simple problems related to kinematics of particles, Co-planar and concurrent forces, solids mechanics, moment of inertia centre of gravity and role of friction in screw Jack and inclined planes.

Recommended Books:

1. Theory of machines by V.P Singh Dhanpat rai & Co
2. Jindal U.C Engineering Mechanics Part-I Galgotia Publications
3. Sadhu Singh, 'Strength of Materials', Khanna Publishers
4. Dr. Kirpal Singh, 'Mechanics of Materials', Standard Publishers
5. E.P.Popov, 'Mechanics of Materials', Pearson Education
6. K.L. Kumar, 'Engineering Fluid Mechanics', S. Chand
7. P.N. Chandramouli, 'Engineering Mechanics', PHI

17/04/2019

ANALOG AND DIGITAL COMMUNICATION LAB

Subject Code: BECES1-404	L T P C	Duration: 24 Hrs
	0 0 2 1	

Course Objectives:

1. To familiarize with modulation & demodulation techniques and study their waveforms on oscilloscope.
2. To learn design of useful circuits required in communication system.
3. To provide students with tools for communication signal analysis.

Course Outcomes:

Upon completion of the course, students will be able to

1. An ability to perform transmission of signals from transmitter to receiver using various modulation and demodulation techniques.
2. Design and implement base band transmission schemes.
3. Design and implement band pass signaling schemes.
4. Understand basic blocks of communication using MATLAB

LIST OF EXPERIMENTS

1. To study Amplitude Modulation using a transistor and determine depth of modulation.
2. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
3. Frequency Modulation using Voltage Controlled Oscillator
4. Generation of DSB-SC signal using Balanced Modulator.
5. Generation of Single Side Band (SSB) signal.
6. Study of Phase Lock Loop (PLL) and detection of FM Signal using PLL.
7. Measurement of Sensitivity, Selectivity and Fidelity of radio receivers.
8. Study of pulse code modulation and demodulation.
9. Study of delta modulation and demodulation and observe effect of slope overload.
10. Study pulse data coding techniques for various formats.
11. Data decoding techniques for various formats.
12. Study of amplitude shift keying modulator and demodulator.
13. Study of frequency shift keying modulator and demodulator.
14. Study of phase shift keying modulator and demodulator.

15. Digital link simulation: error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

Note: At least 10 experiments are required to be performed.

ANALOG ELECTRONIC CIRCUITS LAB

Subject Code: BECES1-405 **L T P C** **Duration: 24 Hrs**
0 0 2 1

Course Objectives:

1. To understand the characteristics of various power amplifiers.
2. To understand various sources of oscillations.
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.
5. To understand various Applications of Op amp.

Course Outcomes:

1. An ability to understand different types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyse and interpret output.

LIST OF EXPERIMENTS

1. To observe and analyze the frequency response of Class- A amplifier.
2. To observe and analyze the frequency response of Class- B amplifier.
3. To observe and analyze the frequency response of Class- B push-pull amplifier.
4. To observe and analyze the frequency response of complementary symmetry push-pull amplifier.
5. To study frequency response of a tuned amplifier.
6. To demonstrate and study a single stage RC coupled amplifier.
7. To demonstrate and study a two stage RC coupled amplifier.
8. To demonstrate and study a Transformer coupled amplifier.
9. To observe the response of RC phase shift oscillator/Wien Bridge oscillator and determine frequency of oscillation.
10. To observe the response of Hartley/Colpitts oscillator and determine frequency of oscillation.
11. To observe the response of Clapp's oscillator and determine frequency of oscillation
12. To understand and plot working of Monostable and Astable Multivibrators.
13. To demonstrate Application of Op amp as Inverting and Non Inverting amplifier.
14. To demonstrate the use of Op-Amp as summing, scaling & averaging amplifier.
15. Design of differentiator and Integrator using Op-Amp.

Note: At least 10 experiments are required to be performed.

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001 **L T P C** **Duration: 24 Hrs**
2 0 0 0

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

3rd SEMESTER

S.No.	Course Code	Course Title	L	T	P	Marks Int	Marks Ext	Marks Total	Credits
1	BEEES1S1-301	Electronic Devices & Circuits	3	1	0	40	60	100	4
2	BEEES1S1-302	Electrical Machines-I	3	1	0	40	60	100	4
3	BEEES1S1-303	Signals and Systems	3	1	0	40	60	100	4
4	BEEES1S1-304	Network Theory: Analysis & Synthesis	3	1	0	40	60	100	4
5	BEEES1S1-305	Electronics Devices & Circuits Lab	0	0	2	60	40	100	1
6	BEEES1S1-306	Electrical Machines lab-I	0	0	2	60	40	100	1
7	BMATH3-301	Mathematics-III*	3	1	0	40	60	100	4
8	BEEES1S1-307	Training-I	-	-	-	60	40	100	3
		TOTAL	**15**	**5**	**4**	**380**	**420**	**800**	**25**

** Framed and Approved by Deptt. of Applied Mathematics, MRSPTU, BTI*

4th SEMESTER

Sr. No.	Course Code	Course Title	Contact Hours L	T	P	Marks Int	Ext	Total	Credits
1	BEEES1S1-401	Digital Electronics	3	0	0	40	60	100	3
2	BEEES1S1-402	Analog Electronic Circuits	3	1	0	40	60	100	4
3	BEEES1S1-403	Electrical Machines-II	3	1	0	40	60	100	4
4	BEEES1S1-404	Electromagnetic Theory and Applications	3	1	0	60	40	100	4
5	BEEES1S1-405	Digital Electronics Lab	0	0	2	60	40	100	1
6	BEEES1S1-406	Analog Electronic Circuits Lab	0	0	2	60	40	100	1
7	BEEES1S1-407	Electrical Machines Lab-II	0	0	2	60	40	100	1
8	BMECE0-001	Engineering Mechanics*	3	1	0	40	60	100	4
9	BMNCC0-001	Constitution of India	2	0	0	100	-	100	--
		TOTAL	**17**	**4**	**6**	**500**	**400**	**900**	**22**

** Framed and Approved by Deptt. of Mechanical Engg, GZSCCET, MRSPTU, BTI*

There will be 4-week Internship after 4th semester.

ELECTRONIC DEVICES & CIRCUITS

Subject Code: BEEES1S1-301	**L T P C**	**Duration: 48 Hrs**
(common to BECE-301)	**3 1 0 4**	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various electronic devices, their circuits & behaviour under various conditions.

1. To make aware the students about the various electronic devices and their circuits.
2. To impart knowledge of BJTs and FETs.
3. To provide the students detailed concepts of MOSFETs and CMOSFETs.
4. To analyze low and high frequency transistor models.

Course Outcomes:

At the end of this course student will be able to:

1. Understand the principles of semiconductor physics
2. Understand the concepts of junction diodes and their applications.
3. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems
4. Analyze BJT characteristics and determine their behaviour under low and high frequencies.
5. Analyze various concepts of FETs and their characteristics.
6. Design low and high frequency models and observe and their various characteristics.

UNIT-I (12 Hrs)

Semiconductors: Introduction to Semiconductors and their classification, Energy bands in intrinsic and extrinsic semiconductors, Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, Generation and recombination of carriers.

Semiconductors Diodes: P-N junction diode, diode resistance and capacitance, I-V characteristics, small signal switching models, Avalanche/Zener breakdown, Applications of PN diode: rectifier, clipper and clamper, Zener diode, Schottky diode, LED, photodiode and solar cell

UNIT-II (12 Hrs)

Bipolar Junction Transistor: BJT and its operation, Ebers-Moll Model, Various BJT configurations and their I-V characteristics, Biasing techniques and bias stability, BJT as a switch and as an amplifier.

Field Effect Transistor: JFET and its operation, various configurations and I-V characteristics, Biasing techniques, FET as a switch and as an amplifier, MOS capacitor, C-V characteristics, MOSFETs; their operation and characteristics, biasing and small signal models of MOS transistor, CMOS devices and CMOS inverter.

UNIT-III (12 Hrs)

Low & High Frequency Transistor Models: Small signal low frequency BJT hybrid Model, Analysis of transistor amplifier in CB, CE and CC configuration using h-parameters, small signal low frequency analysis of FET/MOSFET, Need of high frequency BJT model, high frequency T model, hybrid-pi model, hybrid-pi conductances in terms of low frequency h parameters.

UNIT-IV (12 Hrs)

Integrated Circuit Fabrication Process: Fundamentals of IC fabrication, photolithography, etching, oxidation, diffusion, ion implantation, chemical vapor deposition, sputtering, twin-tub CMOS process. Monolithic IC-Fabrication: Resistor, PN junction Diode and BJTs.

Text/Reference Books:

1. G.Streetman,andS.K.Banerjee,“SolidStateElectronicDevices,”7thedition,Pearson,2014.
2. D.Neamen,D.Biswas"SemiconductorPhysicsandDevices,"McGraw-HillEducation
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons,2006.
4. C.T.Sah,“Fundamentalsofsolidstateelectronics,”WorldScientificPublishingCo.Inc,1991.
5. Y.TsividisandM.Colin,“OperationandModelingoftheMOSTransistor,”OxfordUniv.Press, 2011.
6. J. Luo, “Integrated Modelling of Chemical Mechanical Planarization for sub-micron IC Fabrication”, Springer.

ELECTRICAL MACHINES-I

Subject Code: BEEES1-302	**L T P C**	**Duration: 40 Hrs**
(common to BELE-304)	**3 1 0 4**	

UNIT- I (8 Hours)

Magnetic Fields and Magnetic Circuits

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air

Influence of highly permeable materials on the magnetic flux lines, B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit.

UNIT- II (10 Hours)

DC Machines

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.

Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation, Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT- III (8 Hours)

DC machine - motoring and generation

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series.
Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors.
Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

UNIT- IV (14 Hours)

Transformers

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers,

Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers, Cooling of transformers.

Text / Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of magnetic circuits.
2. Understand the operation of dc machines.
3. Analyse the differences in operation of different dc machine configurations.
4. Analyse single phase and three phase transformers circuits.

SIGNALS AND SYSTEMS

Subject Code: BEEES1-303	**L T P C**	**Duration: 48 Hrs**
(common with BECE-303)	**3 1 0 4**	

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To make the students aware about the signal transmission through linear networks.
3. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
4. To impart them knowledge of various types of noises.

Course Outcomes:

Upon the completion of the course, students will be able to:

1. Analyze the properties of signals & systems and representation in time and frequency domain.

2. Classify systems based on their properties and determine the response of LSI system.
3. Apply random signal theory and understand various types of noise.
4. Understand the process of sampling and reconstruction.

UNIT-I (12 Hrs)

Classification of Signals and systems: Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals, System properties: linearity, additivity and homogeneity, shift-invariance, causality, stability, realizability.

Fourier Representation: The notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, Convolution theorem and its graphical interpretation, Parseval's Theorem, idea of signal space and orthogonal bases.

UNIT-II (12 Hrs)

Linear shift-invariant (LSI) systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems, System representation through differential equations and difference equations, Periodic and semi-periodic inputs to an LSI system,

Introduction to Noise: Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure.

UNIT-III (12 Hrs)

Random Signal Theory: Introduction to Probability Theory, Joint and Conditional Probability, Random Events, Probability Mass Function, Statistical Averages. Probability Density Functions (PDF) and Statistical Averages, mean, moments and expectations, standard deviation and variance, Probability models: Uniform, Gaussian, Binomial, Examples of PDF, Transformation of Random Variables, Random Processes, Stationary and Ergodicity, Auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

UNIT-IV (12 Hrs)

Sampling and Reconstruction: Sampling Theorem and its implications- Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on, Aliasing and its effects, Relation between continuous and discrete time systems.

Concept of State-space analysis: State-space analysis and multi-input, multi-output representation, The state-transition matrix and its role.

Text/Reference Books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. A. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons (SEA) Private Limited, c1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw Hill Edition, 2003.
9. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2001.
10. Ashok Ambardar, "Analog and Digital Signal Processing", Second Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), c1999.

NETWORK THEORY: ANALYSIS & SYNTHESIS

Subject Code: BEEES1-304	**L T P C**	**Duration: 48 Hrs**
(common with BECE-304)	**3 1 0 4**	

Course Objectives:

1. To introduce nodal, mesh analysis and network theorems for network analysis.
2. To give knowledge of Trigonometric, exponential Fourier series and Laplace transforms along with its properties.
3. To provide overview of network functions and network synthesis techniques.
4. To familiarize with the classifications of filters and their design.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.
6. Students will be able to design analog filters.

UNIT-I (12 Hrs)

Fundamentals of Network Analysis: Node and Mesh analysis, Matrix approach of network containing voltage and current sources and reactances, Source transformation and duality.

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Compensation and Tallegen's theorem as applied to A.C. circuits.

UNIT-II (12 Hrs)

Trigonometric and Exponential Fourier Series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra.

Laplace Transforms and Properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT-III (12 Hrs)

Network Functions: Transient behaviour, concept of complex frequency, Driving points and transfer functions, poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two port network and interconnections, Behaviour of series and parallel resonant circuits.

UNIT-IV (12 Hrs)

Network Synthesis: Fundamental concepts of network synthesis, Hurwitz Polynomials, Properties of RC, RL & LC networks, Foster and Cauer forms of realization.

Network Filters: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Design of constant-K, m-derived and Composite filters.

Text/Reference Books:

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi,1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
4. Chakrabarti A., "Network Analysis and Synthesis" DhanpatRai& Co.

ELECTRONIC DEVICES & CIRCUITS LAB

Subject Code: BEEES1-305	**L T P C**	**Duration: 24 Hrs**
(common with BECE-305)	**0 0 2 1**	

Course Objectives:

1. Able to understand and identification of various electronic components.
2. To understand and plot characteristics of various semiconductor devices.
3. To understand the applications of Transistors as amplifier in various configurations.

Course Outcomes:

1. An ability to understand all types of electronics devices and circuits
2. An ability to conduct experiments, as well as to analyze and interpret various data sheets.

LIST OF EXPERIMENTS

1. To study I-V characteristics of PN junction diode and Zener diode.
2. To perform & analyze the use of PN junction diode as clipper and clamper.
3. To observe and calculate the characteristics/behavior of Half/Full wave rectifier.
4. To perform & analyze the use of Zener diode as voltage regulator.
5. Design of clipper circuit using diode and other components.
6. To plot the input and output characteristics of BJT in CE configuration.
7. To plot the input and output characteristics of BJT in CB/CC configuration.
8. To demonstrate use of BJT as amplifier in a CE configuration.
9. To demonstrate use of a BJT in a CC amplifier circuit configuration.
10. To plot the input and output characteristics of JFET in CG/CD/CS configurations.
11. To perform an experiment to observe the working of JFET as an amplifier.
12. Study and verification of the DC Superposition/Thevenin theorem
13. Study of simple capacitive filters (T & π).
14. Design of constant K filters.
15. Design of m- derived filters.

Note: At least 10 experiments are required to be performed.

ELECTRICAL MACHINES LAB-I

Subject Code: BEEES1-306	**L T P C**	**Duration: 24 Hrs**
(common with BELE-305)	**0 0 2 1**	

Course Objectives

1. To understand the characteristics of D.C. Machines.
2. To understand speed control methods and testing methods.
3. To determine efficiency and voltage regulation of transformers.

Course Outcomes

1. To acquire skills to operate all types of dc machines.
2. Ability to analyse the speed control methods and efficiency of DC machines.
3. To be able to compute efficiency and voltage regulation of transformers.

LIST OF EXPERIMENTS

1. To study three point and four point starters of DC shunt motor.
2. To obtain torque and speed characteristics of a D.C. motor.
3. To obtain external characteristics of D.C. shunt generators.
4. To obtain external characteristics of D.C. series generators.
5. Speed control of a dc shunt motor by varying armature circuit and field circuit methods.
6. To calculate the power rating of DC machines.
7. To determine losses and efficiency of DC machines.
8. To check the transformation ratio and polarity of single phase transformer.
9. To perform open and short circuit test onsingle phase transformer and to determine its efficiency
10. To perform load test on a single phase transformer and to determine voltage regulation.
11. To perform parallel operation on single phase transformers.

Note: At least ten experiments should be performed in semester.

MATHEMATICS-III

Subject Code: BMATH3-301	**L T P C**	**Duration: 48 Hrs**
(common with BECE-307)	**3 1 0 4**	

UNIT-I (12 Hrs)

Fourier Series & Fourier Transform: Definition of Periodic functions, Euler's formula, Even and odd functions, half range expansions, Fourier series of different wave forms, Fourier transform, Dirichlet's conditions, Fourier integral formula (without proof), properties of Fourier transform, inversion formula, convolution, Parseval's equality; Fourier transform of generalized functions, application of transforms to heat wave and Laplace equation.

UNIT-II (12 Hrs)

Partial Differential Equations: Definition of PDE, origin of first-order PDE; determination of integral surfaces of linear first order partial differential equations passing through a given curve; surfaces orthogonal to given system of surfaces; non-linear PDE of first order, Cauchy's method of characteristic; compatible system of first order PDE; Charpit's method of solution.

UNIT-III (12 Hrs)

Solution to Linear Partial Differential Equations: Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method, Separation of variables in a PDE; wave and heat equations in one dimensional form, Elementary solutions of Laplace equations.

UNIT-IV (12 Hrs)

Propositional Logic: Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc., Decision problems of propositional logic, Introduction to first order logic and first order theory.

Partially Ordered Sets: Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices, Boolean and pseudo Boolean lattices.

References Books:

1. Kreyszing, E., Advanced Engineering Mathematics, 8th edition, John Wiley, New Delhi.
2. Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
4. Advanced Engineering Mathematics, O'Neil, Cengage Learning.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
8. C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, Tata McGraw Hill, 2000.

DIGITAL ELECTRONICS

Subject Code: BEEES1-401	**L T P C**	**Duration: 40 Hrs**
(common with BELE-407)	**3 0 0 3**	

UNIT- I (7Hours)

Fundamentals of Digital Systems and Logic Families

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates

Number systems-binary, signed binary, octal and hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

UNIT- II (10 Hours)

Combinational Digital Circuits

Standard representation for logic functions, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, Carry look ahead adder, Serial adder, Arithmetic and Logic unit (ALU), elementary ALU design, popular MSI chips, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/drivers for display devices.

UNIT- III (10 Hours)

Sequential Circuits and Systems

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K and D and T flipflops, Applications of flipflops, Shift registers, Applications of shift registers, Serial to parallel converter, Parallel to serial converter.

Ring counter, Sequence generator, Ripple(Asynchronous) counters, Synchronous counters, Counters design using flipflops, special counter IC's, Asynchronous sequential counters, applications of counters.

UNIT IV (13 Hours)

Semiconductor Memories and Programmable Logic Devices

Memory organization and operation, Expanding memory size, Classification and characteristics of memories, Sequential memory, Read only memory (ROM), Read and write memory(RAM), Content addressable memory (CAM), Charge de-coupled device memory (CCD), Commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, Complex programmable logic devices (CPLDS), Field programmable gate array (FPGA).

Analog-to-Digital (A/D) and Digital-to-Analog (D/A) Converters

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, Analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, Dualslope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, Example of A/D converter ICs.

Text/Reference Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Malvino and Leach, "Digital Principles and Applications", TMH, 4th Ed.1991

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

ANALOG ELECTRONIC CIRCUITS

Subject Code: BEEES1-402	**L T P C**	**Duration: 48 Hrs**
(common with BECE-410)	**3 1 0 4**	

Course Objectives:

1. To understand the characteristics of various power amplifiers.
2. To understand various sources of oscillations.
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.
5. To understand various Applications of Op amp.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

UNIT-I (12 Hrs)

Amplifiers: Review of small signal low frequency BJT models and their analysis, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier.

Feedback Amplifiers: Concept of negative feedback, Feedback topologies, effect of feedback on gain, bandwidth, input/output impedances etc., practical circuits, concept of stability.

Oscillators: Concept of positive feedback, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.) their operation and conditions for sustained oscillations, crystal oscillator.

UNIT-II (12 Hrs)

Power Amplifiers: Frequency response of single stage amplifiers, Multistage amplifiers, cascade and cascade amplifiers, Different coupling schemes for multi stage amplifiers, different classes of operation(Class A, B,AB, C etc.),their power efficiency and linearity issues. Push-pull amplifier, cross over distortion, transistor phase inverter, complementary symmetry push-pull amplifier.

UNIT-III (12 Hrs)

Differential Amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

OP-AMP Applications: Review of inverting and non inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, Active filters: Low pass, high pass, band pass and band stop, design guidelines.

UNIT-IV (12 Hrs)

Multivibrators: Collector/Emitter Coupled- Astable, Mono-stable multivibrators and Fixed/Self biased Bistable mutlivibrators, Triggering methods of Monostable and Bistable multivibrators.

Converter Circuits Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to- digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millmanand A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder'sCollege11
5. Publishing,EditionIV
6. Paul R. Gray and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, JohnWiley, 3rd Edition

ELECTRICAL MACHINES-II

Subject Code: BEEES1-403	**L T P C**	**Duration: 40 Hrs**
(common with BELE-409)	**3 1 0 4**	

UNIT- I (8 Hours)

Fundamentals of AC machine windings

Physical arrangement of windings in stator and cylindrical rotor; Slots for windings; Single-turn coil - active portion and overhang; Full-pitch coils, Concentrated winding, Distributed winding, Winding axis, 3D visualization of the above winding types.

Air-gap MMF distribution with fixed current through winding, Concentrated and distributed winding, Sinusoidally distributed winding, Winding distribution factor.

UNIT- II (4 Hours)

Pulsating and revolving magnetic fields

Constant magnetic field, Magnetic field produced by a single winding - fixed current and alternating current, Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), Revolving magnetic field.

UNIT- III (16 Hours)

Three-phase induction machines

Construction, Types (squirrel cage and slip-ring), Torque-slip characteristics, Starting and maximum torque. Equivalent circuit. Phasor diagram, Losses and efficiency.

Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors.

Generator operation. Self-excitation. Doubly-fed induction machines.

Single-phase induction motors

Constructional features, Double revolving field theory, Equivalent circuit, Determination of parameters. Split-phase, Starting methods and applications.

UNIT- IV (12 Hours)

Synchronous machines

Constructional features, Cylindrical rotor synchronous machine - Generated EMF, Equivalent circuit and phasor diagram, Armature reaction, Synchronous impedance, Voltage regulation. Operating characteristics of synchronous machines, V-curves.

Salient pole machine - Two reaction theory, Analysis of phasor diagram, Power angle characteristics. Parallel operation of alternators - Synchronization and Load division.

Text/Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of rotating magnetic fields.
2. Understand the operation of ac machines.
3. Analyse performance characteristics of ac machines.

ELECTROMAGNETIC THEORY & APPLICATIONS

Subject Code: BEEES1-404	**L T P C**	**Duration: 48 Hrs**
(common with BECE-411)	**3 1 0 4**	

Course Objectives:

1. To introduce students with different coordinate systems.
2. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
3. To expose the students to the ideas of electromagnetic waves and structure of transmission lines.

Course Outcomes:

After the completion of this course the students shall be able to:

1. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
2. Understand the concepts of magnetic field and magnetic field intensity.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4. Understand transmission lines and use of smith chart in electromagnetic engineering problems.

UNIT-I (06 Hrs)

Introduction: The Electromagnetic model, vector algebra: vector addition, subtraction and product, orthogonal coordinate system and their transformations, vector calculus: del operator, gradient, divergence and curl operations and their physical significance, Divergence and Stokes's Theorem and their physical significance, Null Identities, Helmholtz's Equation

UNIT-II (18 Hrs)

Electrostatic Fields: Fundamental Postulates of Electrostatic in free space, Coloumb' s law, Gauss's law and its applications, Electric potential, Electric flux density and dielectric constant, Electrostatic fields in material space, polarization of dielectrics, Boundary conditions for electrostatic fields, Poisson's, Laplace's and Uniqueness Equation, Continuity equation & Relaxation time, Applications of electrostatic fields in Electrostatic discharge and multi-dielectric systems.

Magnetostatic Fields: Fundamental Postulates of Magnetostatics in free space, Ampere's circuit Law & its applications, Biot-Savart Law and applications, Magnetic dipole, Magnetic scalar and vector potentials, Behaviour of magnetic materials, Magnetization, magnetic field intensity and relative permeability, Boundary conditions for Magnetostatic fields, Applications of magneto static fields in lightning and magnetic levitation.

UNIT-III (12 Hrs)

Time Varying Electromagnetic fields & Maxwell's Equations: Faraday's Law of Electromagnetic Induction and its applications, Maxwell's Equations in Integral form & their physical significance, Electromagnetic boundary conditions, Time Harmonic Fields, Wave Propagation and wave equations, Plane electromagnetic waves in Lossless and Lossy media, reflection and refraction of plane waves at boundaries for normal and oblique incidence, Group Velocity, Flow of Electromagnetic Power and Poynting Vector Theorem, Application of EM waves in telecommunications, radar systems and microwave heating.

UNIT-IV (12Hrs)

Transmission Lines: Introduction, Transverse Electromagnetic wave along a parallel plate, General transmission line equations and transmission line parameters, Wave characteristics on Finite Transmission Lines, Transients on Transmission Lines, Transmission Line Impedance matching, Single stub matching, Double stub matching, Smith chart and its use in transmission lines.

Text/Reference Books:

1. Sadiku, Elements of Electromagnetics, Oxford Press.
2. W. H. Hayt. Engineering Electromagnetics, McGraw Hill, New York
3. E.C. Jordan, Electromagnetic Waves and radiating systems, Prentice Hall of India, New Delhi.
4. T.A. John, Engg. Electromagnetics & Fields
5. D.K. Cheng, Fields and Wave Electromagnetics, Pearson education.
6. Kraus, Electromagnetics, McGraw Hill., New York

DIGITAL ELECTRONICS LAB

Subject Code: BEEES1-405	**L T P C**	**Duration: 24 Hrs**
(common with BELE-408)	**0 0 2 1**	

Course Objectives

1. To give students a practical knowledge about various types of gates and verify their truth tables.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students knowledge of working of different combinational and sequential circuits.

LIST OF EXPERIMENTS

1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universal gates.
2. To design Half Adder using Logic gates on bread board.
3. To design Full Adder using Logic gates on bread board.
4. To design Half Subtractor using Logic gates on bread board.
5. To design Full Subtractor using Logic gates on bread board.
6. To design 4-Bit Binary-to-Gray Code Converter on bread board.
7. To design 4-Bit Gray-to-Binary Code Converter on bread board.
8. To study and design 4-Bit magnitude comparator using logic gates on bread board.
9. Design and verification of Truth-table of multiplexer.
10. Realization of Half adder and Full adder using MUX.
11. Design and verification of Truth-table of Demultiplexer.
12. Realization of half subtractor and full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.

15. To Study different shift registers: SIPO, SISO, PIPO, and PISO.

Note: At least ten experiments should be performed in semester.

ANALOG ELECTRONIC CIRCUITS LAB

Subject Code: BEEES1-406	**L T P C**	**Duration: 24 Hrs**
(common with BECE-413)	**0 0 2 1**	

Course Objectives:

1. To understand the characteristics of various power amplifiers.
2. To understand various sources of oscillations.
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.
5. To understand various Applications of Op amp.

Course Outcomes:

1. An ability to understand different types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyse and interpret output.

LIST OF EXPERIMENTS

1. To observe and analyze the frequency response of Class- A amplifier.
2. To observe and analyze the frequency response of Class- B amplifier.
3. To observe and analyze the frequency response of Class- B push-pull amplifier.
4. To observe and analyze the frequency response of complementary symmetry push-pull amplifier.
5. To study frequency response of a tuned amplifier.
6. To demonstrate and study a single stage RC coupled amplifier.
7. To demonstrate and study a two stage RC coupled amplifier.
8. To demonstrate and study a Transformer coupled amplifier.
9. To observe the response of RC phase shift oscillator/Wien Bridge oscillator and determine frequency of oscillation.
10. To observe the response of Hartley/Colpitts oscillator and determine frequency of oscillation.
11. To observe the response of Clapp's oscillator and determine frequency of oscillation
12. To understand and plot working of Monostable and Astable Multivibrators.

13. To demonstrate Application of Op amp as Inverting and Non Inverting amplifier.
14. To demonstrate the use of Op-Amp as summing, scaling & averaging amplifier.
15. Design of differentiator and Integrator using Op-Amp.

Note: At least 10 experiments are required to be performed.

ELECTRICAL MACHINES LAB-II

Subject Code: BEEES1-407	**L T P C**	**Duration: 24 Hrs**
(common with BELE-410)	**0 0 2 1**	

Course Objectives:

1. To plot speed-torque characteristics of three-phase and single-phase induction motors.
2. To obtain equivalent circuit parameters of three-phase and single-phase induction motors.
3. To study speed control of induction motors using different techniques.
4. To plot characteristics of a three-phase alternator and a synchronous motor.
5. To synchronise two 3-phase alternators by different methods

Course Outcomes:

Students will be able to

1. Obtain equivalent circuit parameters of single-phase and three- phase Induction motors.
2. Control speed of Induction motors by different methods.
3. Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor.
4. Find out voltage regulation of an alternator by different tests.
5. Synchronise two or more 3-phase alternators.

LIST OF EXPERIMENTS

1. To perform load-test on three-phase induction motor and to plot speed-torque characteristics.
2. To perform no-load and blocked rotor test on three-phase induction motor to obtain equivalent circuit parameters and to draw circle diagram.
3. To study the speed control of three-phase induction motor by Kramer's method.
4. To study the speed control of three-phase induction motor by cascading of two induction motors.
5. To study star- delta starters and
   a) To draw electrical connection diagram.

b) To start the three-phase induction motor using it.

c) To reverse the direction of three-phase induction motor.

6. To start a three-phase slip ring induction motor by inserting different levels of resistance in the rotor circuits and to plot speed- torque characteristics.
7. To perform no-load and blocked rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
8. To perform load test on single-phase induction motor and plot speed-torque characteristics.
9. To perform no load and short circuit test on three-phase alternator and draw open and short circuit characteristics.
10. To find voltage regulation of an alternator by zero power factor (ZPF) method.
11. To study effect of variation of field current upon the stator current and power factor of synchronous motor running at no load and draw V and inverted V curves of motor.
12. To synchronise two 3-phase alternators using dark lamp method, and two-bright & one dark lamp method.
13. To start a synchronous motor using appropriate method.

Note: At least ten experiments should be performed in the semester.

ENGINEERING MECHANICS

Subject Code: BMECE0-001	L T P C	Duration: 48 Hrs
	3 1 0 4	

Course Objectives:

1. The concepts of friction in screw jack & inclined plane.
2. To draw shear force and bending moment diagrams by analytical method
3. To find forces in simple trusses by using joints and section methods
4. The concepts related to torsions and mechanics of fluids.

UNIT-I

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. **10 Hrs.**

UNIT-II

Friction: Types of Friction, Limiting Friction, Angle of Repose, Coefficient of Friction, Laws of Friction, Static & dynamic Friction, Screw Jack, Minimum force required to drag a body on rough horizontal plane, body tending to move upwards on an inclined plane, body moving down the plane. **10 Hrs.**

UNIT-III

Centroid and Centre of gravity: Centroid of composite sections, Parallel & perpendicular axes theorem, Moment of area, Moment of inertia of standard sections and composite sections, mass moment of inertia of cylinder cone sphere, and Polar moment of inertia. **08 Hrs.**

Shear force and bending moment diagram, simple trusses, Method of joints, Method of section **07 Hrs.**

UNIT-IV

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component. Kinetics of Particles: Equation of motion, rectilinear motion

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and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact. **08 Hrs.**

Expected Outcomes:

After going through these contents the student shall be able to solve the simple problems related to kinematics of particles, Co-planar and concurrent forces, solids mechanics, moment of inertia centre of gravity and role of friction in screw Jack and inclined planes.

Recommended Books:

1. Theory of machines by V.P Singh Dhanpat rai & Co
2. Jindal U.C Engineering Mechanics Part-I Galgotia Publications
3. Sadhu Singh, 'Strength of Materials', Khanna Publishers
4. Dr. Kirpal Singh, 'Mechanics of Materials', Standard Publishers
5. E.P.Popov, 'Mechanics of Materials', Pearson Education
6. K.L. Kumar, 'Engineering Fluid Mechanics', S. Chand
7. P.N. Chandramouli, 'Engineering Mechanics', PHI

12/04/2018

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001	**L T P C**	**Duration: 24 Hrs**
(common with BECE-414)	**2 0 0 0**	

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

Semester –III [Second year]

Branch/Course: Mechanical Engineering

Subject Code	Course Title	Hours per week			Credits
		L	T	P	
BMECE0-001	Engineering Mechanics	**3**	**1**	**0**	**4**
BMECS1-301	Strength of Materials-I	**3**	**1**	**0**	**4**
BMECS1-302	Fluid Mechanics	**3**	**1**	**0**	**4**
BMECS1-303	Thermodynamics	**3**	**1**	**0**	**4**
BECEE0-002	Basic Electronics & Instrumentation	**3**	**1**	**0**	**4**
BMECS1-304	Mechanical Engineering Lab-I (Design-I)	**0**	**0**	**2**	**1**
BMECS1-305	*Workshop Training	**0**	**0**	**0**	**4**
BMNCC0-002	Environmental Science	**1**	**0**	**0**	**0**
BMNCC0-007	Advisory Counselling	**1**	**0**	**0**	**0**
Total Credits		**18**	**5**	**2**	**25**

*Workshop training will be imparted in the institution at the end of 2nd semester for four-week duration.

Semester –IV [Second year]

Branch/Course: Mechanical Engineering

Subject Code	Course Title	Hours per week			Credits
		L	T	P	
BMECS1-401	Materials Engineering	3	0	0	3
BMECS1-402	Strength of Materials-II	3	1	0	4
BMECS1-403	Fluid Machines	3	1	0	4
BMECS1-404	Applied Thermodynamics	3	1	0	4
BMECS1-405	Machine Drawing using CAD	1	0	4	3
BMECS1-406	Mechanical Engineering Lab-1 (Thermal Lab-I)	0	0	2	1
XXXXX	*Elective-1	3	0	0	3
BMNCC0-007	Advisory Counselling	1	0	0	0
Total Credits		17	3	6	22

*** Elective-1 (Chose any one from the following)**

1. Biology (BMECS1-E 1.1)
2. Mathematics III (PDE, Probability & Statistics) (BMECS1-E 1.2)
3. Industrial Automation & Robotics (BMECS1-E 1.3)

ENGINEERING MECHANICS

Subject Code: BMECE0-001 **L T P C** **Duration: 43 Hrs.**

3 1 0 4

Course Objectives:

1. The concepts of friction in screw jack & inclined plane.
2. To draw shear force and bending moment diagrams by analytical method
3. To find forces in simple trusses by using joints and section methods
4. The concepts related to torsions and mechanics of fluids.

UNIT-I

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

10 Hrs.

UNIT-II

Friction: Types of Friction, Limiting Friction, Angle of Repose, Coefficient of Friction, Laws of Friction, Static & dynamic Friction, Screw Jack, Minimum force required to drag a body on rough horizontal plane, body tending to move upwards on an inclined plane, body moving down the plane.

10 Hrs.

UNIT-III

Centroid and Centre of gravity: Centroid of composite sections, Parallel & perpendicular axes theorem, Moment of area, Moment of inertia of standard sections and composite sections, mass moment of inertia of cylinder cone sphere, and Polar moment of inertia. **08 Hrs.**

Shear force and bending moment diagram, simple trusses, Method of joints, Method of section

07 Hrs.

UNIT-IV

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component. Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

08 Hrs.

Expected Outcomes:

After going through these contents the student shall be able to solve the simple problems related to kinematics of particles, Co-planar and concurrent forces, solids mechanics, moment of inertia centre of gravity and role of friction in screw Jack and inclined planes.

Recommended Books:

1. Theory of machines by V.P Singh Dhanpat rai& Co
2. Jindal U.C Engineering Mechanics Part-I Galgotia Publications
3. Sadhu Singh, ‘Strength of Materials’, Khanna Publishers
4. Dr. Kirpal Singh, ‘Mechanics of Materials’, Standard Publishers
5. E.P.Popov, ‘Mechanics of Materials’, Pearson Education
6. K.L. Kumar, ‘Engineering Fluid Mechanics’, S. Chand
7. P.N. Chandramouli, ‘Engineering Mechanics’, PHI

STRENGTH OF MATERIALS-I

Subject Code: BMECS1-301 **L T P C** **Duration: 44 Hrs.**

3 1 0 4

Course Objective: The course is designed to understand the basic concepts of stress, strain and their variations due to different type of loading. The concept of mechanical properties, Poisson's ratio, bulk modulus, elastic modulus, modulus of rigidity, combined stress and strain, principal stress, principal plane, bending moment and shear force in beams under various loading conditions, understanding of torsional shear stress in solid and hollow shaft; principal and maximum shear stress in a circular shaft subjected to combined stresses, forces and reactions in frames, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions.

UNIT-I

Stresses and Strains: Basic definitions: Stress and strain and their types, fatigue, creep, ductility, brittleness, hardness, toughness, impact strength, stress concentration, Elasticity, Plasticity. Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar with or without self-weight, bar of uniform strength and of varying cross section, elastic constants and their significance, Young's modulus of elasticity, modulus of rigidity and bulk modulus, thermal stress and strain in single and compound bars. Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Generalized Hook's law, Mohr's circle of stresses, Condition of plane stress and strain. **12 Hrs.**

UNIT-II

Bending Moment (B.M) and Shear Force (S.F.) Diagrams: S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under the following loads:

a) Concentrated loads

b) Uniformly distributed loads over the whole span or part of span

c) Combination of concentrated and uniformly distributed load

d) Uniformly Varying load (optional)

e) Application of moments **11 Hrs.**

Bending Stresses in Beams: Derivation of bending equation and its application to find stresses in beams of rectangular, circular and channel, I and T- sections. Flexural Rigidity, combined direct and bending stresses in afore-mentioned sections, stresses in composite / flitched beams.

UNIT–III

Slope and Deflection: Relationship between moment, slope and deflection; double integration method, Macaulay's method and use of these methods to calculate slope and deflection for:

a) Cantilevers

b) Simply supported beams with or without overhang

c) beams under concentrated loads, uniformly distributed loads and their combination.

Columns and Struts: Introduction of columns and struts, end conditions, failure of columns, Euler's formula, empirical formulas to find buckling load. **11 Hrs.**

UNIT–IV

Torsion: Derivation of torsion equation and its application to the hollow and solid circular shafts. Torsional rigidity, Angle of twist, combined torsion and bending of circular shafts; Principal stress and maximum shear stresses under combined loading of bending and torsion, comparison of solid and hollow shaft in terms of strength.

Frames: Introduction of frames, types of frames, assumptions made in finding out the forces in frame, reactions of the supports of a frame, analysis of frames: method of joints, method of sections, graphical method and its applications. **10 Hrs.**

Expected Outcome/s:

After studying the course, the student will be able to analyze different stresses, strains and deflection for designing a simple mechanical element e.g. beams, shafts, columns and frames under various loading conditions.

Recommended Books

1. Sadhu Singh, 'Strength of Materials', Khanna Publishers.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers.
3. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.
6. E.P. Popov, 'Mechanics of Materials', Pearson Education.
7. R. K. Bansal, 'Strength of Materials', Laxmi Publication P) Ltd

FLUID MECHANICS

Subject Code: BMECS1-302 **L T P C** **Duration: 40 Hrs.**

3 1 0 4

Course Objectives:

1. To make conceptual understanding of fluids and their properties,
2. To apply analytical tools to solve different types of problems related to fluid flow
3. To learn about the application of mass and momentum conservation laws for fluid flows.
4. To understand the importance of dimensional analysis.

Unit –I

Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.

04 Hrs.

Unit –II

Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane suBMECS1rged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and suBMECS1rged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to : (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation.Flow Measurement: Manometers.

08 Hrs.

Unit –III

Fluid Kinematics: Classification of fluidsand fluid flows; Lagrangian and Euler flow dBMECS1riptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

10 Hrs.

Fluid Dynamics: Derivation of Euler's equation of motion, Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system, Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions. Momentum equation, Introduction to Computational fluid dynamics. Flow Measurement: Pitot tubes, Venturi meters, Rotameters,Orifice meters; mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs. **08 Hrs.**

Unit –IV

Dimensional Analysis and Similitude: Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. **04 Hrs.**

Internal Flows: Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart. **06 Hrs.**

Expected Outcomes:

1. Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
2. Gains knowledge to calculate and design engineering applications involving fluid.
3. Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.

Recommended Books:

1. S.K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill.
2. Y.A. Cengel and J.M. Cimbala, Fluid Mechanics - Fundamentals and Applications, Tata McGraw Hill.
3. D. S Kumar, Fluid Mechanics and Fluid Power Engineering, S. K Kataria and Sons

THERMODYNAMICS

Subject Code: BMECS1-303 **L T P C** **Duration: 40 Hrs.**

3 1 0 4

Objectives:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings
2. To learn about application of I law to various energy conversion devices
3. To evaluate the changes in properties of substances in various processes
4. To understand the difference between high grade and low grade energies and II law limitations on energy conversion

Unit –I

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

0**5 Hrs.**

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy 'E' Demonstration that 'E' is a property; Various modes of energy, Internal energy and Enthalpy.

0**5 Hrs.**

Unit –II

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheat tables; Identification of state & determination of properties, Mollier's chart.

08 Hrs.

Unit –III

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of unsteady flow applications for system and control volume.

05 Hrs.

Unit –IV

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

0**5 Hrs.**

Clausius inequality; Definition of entropy 'S' ; Demonstration that entropy 'S' is a property; Evaluation of 'S' for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of 'S' from steam tables- Principle of increase of entropy; Illustration of processes in T-S coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles - Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Energy balance equation and Energy analysis.

0**8 Hrs.**

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; comparison with Carnot cycle. 0**4**

Hrs.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

Recommended Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of*
   Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd.

BASIC ELECTRONICS & INSTRUMENTATION

Subject Code: BECEE0-002 **L T P C** **Duration: 40 Hrs.**

3 1 0 4

Course Objectives:

1. Know broadly the concepts and functionalities of the electronic devices, tools and instruments.
2. Understand use, general specifications and deployabilities of the electronic devices, and assemblies.
3. learning of handling and usage of electronic devices, tools and instruments in engineering applications.

UNIT – I

Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications. **10 Hrs.**

UNIT – II

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement Type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits.**8 Hrs.**

UNIT –III

Measurements:SI units, systematic and random errors in measurement, expression of uncertainty – accuracy and precision index, propagation of errors. PMMC, MI and dynamometer type instruments; dc potentiometer; bridges for measurement of R, L and C, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.**12 Hrs.**

UNIT-IV

Sensors and Industrial Instrumentation:Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity and viscosity measurement.**10 Hrs.**

Expected Outcomes:

1. Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.
2. An ability to apply knowledge of mathematics, science and engineering fundamentals appropriate to the discipline.
3. An ability to identify, formulate and solve problems by applying the principles of electronic instrumentation and control system.
4. An ability to use the techniques, skills and modern engineering tools necessary for his engineering practice.

Recommended Books:

1. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
2. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.
3. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann.
4. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press.
5. E.O Doebelin, Measurement System: Application and Design, McGraw Hill.

MECHANICAL ENGINEERING LAB-I (DESIGN-I)

Subject Code: BMECS1-304 **L T P C**

0 0 2 1

Course Outcomes: After studying this course, students shall be able to:

1. Measure the various mechanical properties such as tensile strength, compressive strength, shear strength, torsion strength, impact strength, fatigue strength and hardness of various materials.
2. To measure the bending stress and deflection in beams.
3. To measure the strain energy and spring stiffness of a helical spring.
4. Calculate load carrying capacity of long columns and their buckling strength.

EXPERIMENTS

1. Tension test on a mild steel rod specimen and to draw stress-strain curve.
2. Compression test on Mild steel and Cast Iron specimen.
3. Double shear test on Mild steel and Aluminum rod specimens.
4. Torsion test on mild steel rod specimen.
5. Impact test on metal specimen to determine impact strength.
6. Fatigue test on Mild Steel specimen.
7. Hardness test on metals and alloys - (Rockwell, Brinell & Vicker's test).
8. Bending test on steel bar under point load.
9. Deflection test on beams under point load.
10. Compression test on helical spring.
11. Determination of Bucking loads of long columns with different end conditions.

ENVIRONMENTAL SCIENCES

Subject Code: BMNCC0-002 **L T P C** **Duration: 38 Hrs.**

1 0 0 0

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

. UNIT-I

1. The Multidisciplinary Nature of Environmental Studies:

Definition, scope and importance, Need for public awareness.

2. **Natural Resources**

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

12Hrs.

UNIT-II

Environmental Pollution: Definition

(a) Causes, effects and control measures of:

i) Air pollution

ii) Water pollution

iii) Soil pollution

iv) Marine pollution

v) Noise pollution

vi) Thermal pollution

vii) Nuclear pollution

(b) **Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes.

(c) Role of an individual in prevention of pollution.

(d) Pollution Case Studies.

(e) Disaster management: floods, earthquake, cyclone and landslides. **10 Hrs.**

UNIT-III

Social Issues and the Environment

(a) From unsustainable to sustainable development

(b) Urban problems and related to energy

(c) Water conservation, rain water harvesting, Watershed Management

(d) Resettlement and rehabilitation of people; its problems and concerns, Case studies.

(e) Environmental ethics: Issues and possible solutions

(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.

(g) Issues involved in enforcement of environmental legislation **08 Hrs.**

UNIT-IV

Human Population and the Environment

(a) Population growth, variation among nations

(b) Population explosion – Family Welfare Programmes

(c) Environment and human health

(d) Human Rights

(e) Value Education

(f) Women and Child Welfare

(g) Role of Information Technology in Environment and Human Health

(h) Case Studies.

<u>Environmental Science related activities</u>:

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around US. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.

ii) Slogan making event

iii) Poster making event

iv) Cycle rally

v) Lectures from experts.

(b) Actual Activities:

i) Plantation

ii) Gifting a tree to see its full growth

iii) Cleanliness drive

iv) Drive for segregation of waste

v) To live some big environmentalist for a week or so to understand his work

vi) To work in kitchen garden for mess

vii) To know about the different varieties of plants

viii) Shutting down the fans and ACs of the campus for an hour or so **08 Hrs**.

Recommended Books

1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner.
2. Jadhav, H & Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284p.
3. Rao M. N. & Datta A.K. 1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
4. Principle of Environment Science by Cunninghan, W.P.
5. Essentials of Environment Science by Joseph.

MATERIALS ENGINEERING

Subject Code: BMECS1-401 **L T P C** **Duration: 38 Hrs.**

3 0 0 3

Course Objectives:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties.
2. To provide a detailed interpretation of equilibrium phase diagrams
3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Unit - I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, Diffusion: diffusion mechanism, steady state and non-steady state diffusion **06 Hrs.**

Unit - II

Advanced Materials and Tools: Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunneling microscopy, atomic absorption spectroscopy, differential scanning calorimetry. **12 Hrs.**

Unit - III

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron. **06 Hrs.**

Unit - IV

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. **06 Hrs.**

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys

08 Hrs.

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures.
2. Understand how to tailor material properties of ferrous and non-ferrous alloys.

Recommended Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition,Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall ofIndia Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited,1999.U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.
4. K.M. Gupta, “Material Science, Metallurgy and Engineering Materials”, Umesh, 2012.

STRENGTH OF MATERIALS-II

Subject Code: BMECS1-402 **L T P C** **Duration: 44 Hrs.**

3 1 0 4

Course Objectives and Outcomes: The course is designed to understand the concepts of strain energy, resilience, stress under impact loading; shear stress distribution in a beam of various cross sections; stress in curved beams; stresses in helical, spiral, leaf and flat spiral springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; various theories of failure.

UNIT-1

Strain Energy: Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied and impact loading. Castigliano's theorem, Maxwell theorem.

Theories of Failure: Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application related to two dimensional stress systems.

11 Hrs.

UNIT-II

Thin Cylinders and Spheres: Calculation of Hoop stress, longitudinal stress in a thin cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.

Thick Cylinders: Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, shrinkage allowance and shrinkage stress.

Rotational discs: Stresses in rotating discs and rims of uniform thickness; disc of uniform strength. **12 Hrs.**

UNIT –III

Bending of Curved Beams: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section and chain links with straight sides.

Shear Stresses in Beams: Shear stress distribution in rectangular, circular, triangular, I, T and channel section beams. **11 Hrs.**

UNIT-IV

Springs: Types of springs, derivation of strain energy (S.E.) equation, stress and S.E. in open and closed coiled helical springs under the action of axial load and/or couple. Bending stress, deflection and S.E. in Leaf spring, S.E. in flat spiral springs.

10 Hrs.

Expected Outcome/s:

The outcome of the course is to understand the stress analysis in various mechanical members e.g. thin and thick cylinders, rotating discs, curved beams and springs under various load conditions. The student will be able to properly analyze and design these mechanical members from the strength point of view.

Recommended Books:

1. Sadhu Singh, ‘Strength of Materials’, Khanna Publishers.
2. Kirpal Singh, ‘Mechanics of Materials’, Standard Publishers.
3. G.H. Ryder, ‘Strength of Materials’, Macmillan India Ltd.
4. S.S. Rattan, ‘Strength of Materials’, Tata McGraw Hills.
5. Timoshenko and Gere, ‘Mechanics of Materials’, CBS Publishers.
6. E.P. Popov, ‘Mechanics of Materials’, Pearson Education.
7. R. K. Bansal, ‘Strength of Materials’, Laxmi Publication P) Ltd

FLUID MACHINES

Subject Code: BMECS1-403 **L T P C** **Duration: 40 Hrs.**

3 1 0 4

Course Objectives:

1. To recognize basic components of turbo machines and understand related fundamental laws/ principles
2. To Know about constructional, working and design aspects various turbines and pumps
3. Able to evaluate working and performance of various turbo machines.
4. Know about constructional details and working of hydraulic devices.

UNIT I

General Concepts: Impulse momentum principle; jet impingement on stationary and moving flat plates; and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted; work done and efficiency of jet. **05 Hrs.**

UNIT II

Basic components of a turbo machine and its classification on the basis of purpose; fluid dynamic action; operating principle; geometrical features; path followed by the fluid. Euler's equation for energy transfer in a turbo machine. **03 Hrs.**

Pelton Turbine: Component parts and operation; velocity triangles; work output; Effective head; available power and efficiency; design aspects such as mean diameter of wheel; jet ratio; number of jets; number of buckets with working proportions; governing of Pelton turbine. **04 Hrs.**

Francis and Kaplan Turbines: Component parts and operation velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes - its function and types. Function and brief dBMECS1ription of commonly used surge tanks; governing of reaction turbines. **06 Hrs.**

UNIT III

Centrifugal Pumps: Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump; Heads of a pump - suction; delivery; static; manometric; total; net positive suction head and Euler’s head; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and

efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; model testing and Priming and priming devices; Multistage pumps - series and parallel arrangement; suBMECS1rsible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems; causes and remedies.
06 Hrs.

Reciprocating Pumps: Introduction to single acting and double acting reciprocating pumps; their components; and parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Functions of Air vessels.
04 Hrs.

UNIT IV

Similarity Relations and Performance Characteristics: Unit quantities; specific speed and model relationships; scale effect; Cavitation and Thomas's cavitation number; Concept of Net Positive Suction Head (NPSH) and its application.
04 Hrs

Hydraulic Devices and Systems: Construction; operation and utility of simple and differential accumulator; intensifier; fluid coupling and torque converter; Air lift and jet pumps; gear; vane and piston pumps; Hydraulic Ram; Hydraulic lift; Hydraulic crane and Hydraulic press. **04 Hrs**

Expected Outcomes:

After completion of the course, the students will have a strong foundation on Fluid Machines and will be able to apply the basic principles, the laws, and the pertinent equations to engineering design of the machines for required applications.

Recommended Books:

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2. Shiv Kumar, Fluid Systems, Satya Prakashan
3. Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
4. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
5. K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill
6. R.K. Purohit., Hydraulic Machines, Scientific Publishers

APPLIED THERMODYNAMICS

Subject Code: BMECS1-404 **L T P C** **Duration: 36 Hrs.**

3 1 0 4

Course Objectives:

1. To learn about of I law for reacting systems and heating value of fuels
2. To learn about gas and vapor cycles and their first law and second law efficiencies
3. To learn about gas dynamics of air flow and steam through nozzles
4. To learn the about reciprocating compressors with and without intercooling
5. To analyze the performance of steam turbines

Unit I

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

08 Hrs.

Unit II

Vapor power cycles, Rankine cycle with superheat, reheat and regeneration, energy analysis. Supercritical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles.

12 Hrs.

Analysis of steam turbines, velocity and pressure compounding of steam turbines. **03 Hrs.**

Unit III

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation compressible flow in diffusers, efficiency of nozzle and diffuser. **08 Hrs.**

Unit IV

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. **05 Hrs.**

Expected Outcomes:

1. After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. They will be able to understand phenomena occurring in high speed compressible flows

Recommended Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of*

   Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, JohnWiley and Sons.
4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd

MACHINE DRAWING USING CAD

Subject Code: BMECS1-405 **L T P C** **Duration: 60 Hrs.**

1 0 4 3

Course Objectives:

The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts used in major mechanical engineering applications.

Unit –I

Introduction: Principles and classification of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296. Manual Drafting and Computer Aided Drafting using software like Pro-desktop or Pro-E or AutoCAD / any other software. **06 Hrs.**

Unit –II

Practical applications& working of

a) Fasteners: Types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints
b) Couplings: Solid or Rigid Coupling, Protected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling.
c) Knuckle and cotter joints
d) Pipe and Pipe Fittings: flanged joints, spigot and socket joint, union joint. **12 Hrs.**

Unit –III

Assembly and Disassembly:

a) IC Engine Parts: Piston, connecting rod
b) Boiler Mountings: Steam stop valve, feed check valve, Safety valve, Blow off cock.
c) Bearings: Swivel bearing, Thrust bearing, Plummer block
d) Miscellaneous: Screw Jack, Drill Press Vice, Crane hook, Tool Post **30 Hrs.**

Unit – IV

Computer Aided Drafting (CAD)

Drawing using software like Pro-E or AutoCAD / other

a) Machine Components: Screw fasteners, Keys cotters and joints, Shaft Couplings, Pipe joints and fittings, Riveted joints.

b) Assemblies: Bearings (Plumber Block, Footstep, Swivel), Engine Parts, Machine components, Valves. Exercise in computer plots of drawings/ blueprints. **12 Hrs.**

Expected Outcomes:

1. After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design of components.
2. The student shall be in the position to carry out the assemblies both on sheet and on the computer using software.

Recommended Books:

1. P.S. Gill, ‘Machine Drawing’, S.K. Kataria and Sons.
2. N.D. Bhatt, ‘Machine Drawing’, Charotar Publishing House
3. G. Pohit, ‘Machine Drawing with AutoCAD’, Pearson Education Asia.
4. R.K. Dhawan, ‘Machine Drawing’, S. Chand & Company Limited, 2003
5. K.L. Narayana, P. Kannaiah and K.V. Reddy, ‘Machine Drawing’, New Age International Publishers.

BIOLOGY

Subject Code: **L T P C** **Duration: 29 Hrs.**

3 0 0 3

Unit –I

Introduction: Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

02 Hrs.

Classification: Purpose: To convey that classification per se is not what biology is all about. The underlyingcriterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus **03 Hrs.**

Unit –II

Genetics: Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans.

Discuss the concept of complementation using human genetics. **04 Hrs.**

Biomolecules: Purpose: To convey that all forms of life have the same building blocks and yet the manifestations areas diverse as one can imagine
Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss aboutsugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. **04 Hrs.**
Enzymes: Purpose: To convey that without catalysis life would not have existed on earth
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyse reactions.Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. 04 Hrs.

Unit –III

Information Transfer: Purpose: The molecular basis of coding and decoding genetic information is universalMolecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality anddegeneracy of genetic code. Define gene in terms of complementation and recombination. **04 Hrs.**
Macromolecular analysis: Purpose: How to analyses biological processes at the reductionistic levelProteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary andquaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

05 Hrs.

Unit –IV

Metabolism: Purpose: The fundamental principles of energy transactions are the same in physical and biologicalworld.
Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonicand exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

04 Hrs.

Microbiology: Concept of single celled organisms. Concept of species and strains. Identification and classificationof microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization andmedia compositions. Growth kinetics.**03 Hrs.**

Course Outcomes

After studying the course, the student will be able to:

1. DBMECS1ribe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlyingcriteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic materialfrom parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are asdiverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

Recommended Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman andCompany
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company,Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, PrBMECS1ott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. BrownPublishers

Mathematics III (PDE, Probability & Statistics)

Subject Code: **L T P C** **Duration: 38 Hrs.**

3 0 0 3

Course Objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
2. To provide an overview of probability and statistics to engineers

Unit –I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation.

06 Hrs.

Unit –II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. **08 Hrs.**

Unit –III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. **12 Hrs.**

Unit –IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis -Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chisquare test for goodness of fit and independence of attributes. **12 Hrs.**

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Recommended Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

MECHANICAL ENGINEERING LABORATORY (THERMAL-I)

Subject Code: BMECS1-406

L	T	P	C
0	0	2	1

Objectives:

(i) To understand the principles and performance characteristics of flow and thermal devices

(ii) To know about the measurement of the fluid properties

Contents:

1. To study the flow through a variable area duct and verify Bernoulli's energy equation.
2. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe.
3. Measurement of Coefficient of Discharge of given Orifice and Venturi meters
4. Determination of the performance characteristics of a centrifugal pump
5. Determination of the performance characteristics of Pelton Wheel
6. Determination of the performance characteristics of a Francis Turbine
7. Determination of the performance characteristics of a Kaplan Turbine
8. Determination of the calorific value of a given fuel and its flash & fire points
9. Study the construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines; and draw the valve timing diagram.
10. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi-cylinder petrol engine running at constant speed (Morse Test).
11. Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Also make the heat balance sheet.
12. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Also make the heat balance sheet.

B.Tech. Textile Engineering
SEMESTER-3rd

Total Contact Hrs. = 27 **Total Marks =900** **Total Credits = 22**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEXS1-301	Fundamentals of Textile Machines and Processes	3	0	0	3	60	40	100
BTEXS1-302	Textile Fiber – I	3	0	0	3	60	40	100
BTEXS1-303	Fabric Manufacturing – I	3	1	0	4	60	40	100
BTEXS1-304	Yarn Manufacturing – I	3	1	0	4	60	40	100
BTEXS1-305	Kinematics of Machines	3	0	0	3	60	40	100
BTEXS1-306	Textile Fibers Lab. –I	0	0	2	1	40	60	100
BTEXS1-307	Fabric Manufacturing Lab. – I	0	0	2	1	40	60	100
BTEXS1-308	Yarn Manufacturing Lab. – I	0	0	2	1	40	60	100
BTEXS1-309	Workshop Training	0	0	4	2	40	60	100
BMNCC0-002	Environmental Science	1	0	0	0			
BMNCC0-007	Advisory Counseling	1	0	0	0			
	Theory = 6 Lab = 03	**15**	**2**	**10**	**22**	**460**	**440**	**900**

Environmental Science: Satisfactorily/ Not Satisfactorily

SEMESTER - 4TH

Total Contact Hrs. = 26 **Total Marks =900** **Total Credits = 22**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEXS1-401	Textile Fiber –II	3	0	0	3	60	40	100
BTEXS1-402	Yarn Manufacturing – II	3	1	0	4	60	40	100
BTEXS1-403	Fabric Manufacturing –II	3	1	0	4	60	40	100
BTEXS1-404	Textile Chemical Processing –I	3	1	0	4	60	40	100
BTEXS1-405	Fabric Structure Analysis	3	0	0	3	60	40	100
BTEXS1-406	Yarn Manufacturing Lab.-II	0	0	2	1	40	60	100
BTEXS1-407	Fabric Manufacturing Lab.-II	0	0	2	1	40	60	100
BTEXS1-408	Textile Chemical Processing Lab.–I	0	0	2	1	40	60	100
BTEXS1-409	Fabric Structure Analysis Lab	0	0	2	1	40	60	100
BMNCC0-007	Advisory Counseling	1	0	0	0			
	Theory 05 Lab 04	**15**	**03**	**08**	**22**	**460**	**440**	**900**

SEMESTER-5th

Total Contact Hrs. = 28 **Total Marks =900** **Total Credits = 23**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEXS1-501	Properties of Fiber	3	1	0	4	60	40	100
BTEXS1-502	Fabric Manufacturing- III	3	0	0	3	60	40	100
BTEXS1-503	Non Woven Technology	3	0	0	3	60	40	100
BTEXS1-504	Textile Testing-I	3	1	0	4	60	40	100
BTEXS1-505	Textile Chemical Processing –II	3	1	0	4	60	40	100
BTEXS1-506	Textile Testing Lab.-I	0	0	2	1	40	60	100
BTEXS1-507	Textile Chemical Processing Lab.–II	0	0	2	1	40	60	100
BTEXS1-508	Fabric Manufacture Lab – III.	0	0	2	1	40	60	100
BTEXS1-509	Training-II	0	0	4	2	40	60	100
BMNCC0-007	Advisory Counselling	1	0	0	0			
Total	**Theory 05 Lab 03**	**15**	**3**	**10**	**23**	**460**	**440**	**900**

SEMESTER-6th

Total Contact Hrs. = 24 **Total Marks =700** **Total Credits = 22**

Subject Code	Subject	Periods			Credits	Ext	Int	Total
		L	T	P				
BTEXS1-601	Theory of Textile Structure	3	1	0	4	60	40	100
BTEXS1-602	Process Control in Textiles	3	1	0	4	60	40	100
BTEXS1-603	Knitting Technology	3	1	0	4	60	40	100
BTEXS1-604	Textile Testing-II	3	1	0	4	60	40	100
BTEXS1-605	Quality Management in Textile Industry	3	1	0	4	60	40	100
BTEXS1-606	Knitting Technology Lab.	0	0	2	1	40	60	100
BTEXS1-607	Textile Testing Lab.-II	0	0	2	1	40	60	100
BMNCC0-007	Advisory Counseling	1	0	0	0			
	Theory 05 Lab 02	**15**	**05**	**04**	**22**	**380**	**320**	**700**

SEMESTER 7TH

Total Contact Hrs. = 20 **Total Marks =600** **Total Credits = 17**

Subject Code	Subject	Periods			Credits	Ext	Int.	Total
		L	T	P				
BTEXS1-701	Non Conventional Yarn Manufacture	3	0	0	3	60	40	100
BTEXS1-702	Garment Manufacturing Technology	3	1	0	4	60	40	100
BTEXS1-703	Apparel Merchandising and Management	3	0	0	3	60	40	100
BTEXS1-704	Training - III	0	0	4	2	40	60	100
BTEXS1-705	Seminar	0	0	2	1	40	60	100
Departmental Elective – I	**(Select any one)**	3	1	0	4	60	40	100
BTEXDI-711	Advances in Fabric Structure							
BTEXDI-712	Texturing Technology							
BTEXDI-713	Post Spinning Operation							
Departmental Elective – II	**(Select any one)**	3		0	3	60	40	100
BTEXDI-721	Process Control in Textile Chemical Processing							
BTEXDI-722	Marketing & Financial Management in Textiles							
BTEXD1-723	Entrepreneurship development and management in Textile							
BMNCC0-007	Advisory Counseling	1		0		0		0
Total	**Theory 04** **Lab 0**	**12**	**02**	**06**	20	**320**	**280**	**700**

SEMSETER- 8TH

Total Contact Hrs. = 20 **Total Marks =500** **Total Credits = 17**

Subject Code	Subject	Periods L	Periods T	Periods P	Credits	Ext.	Int.	Total
BTEXS1-801	Mechanics of Textile Process	3	1	0	4	60	40	100
BTEXS1-802	Mill Planning & Management	3	0	0	3	60	40	100
Departmental Elective – III	**(Select any one)**	3	1	0	4	60	40	100
BTEXD1-811	Technical Textiles							
BTEXD1-812	Advancement in Manmade Fibers							
BTEXD1-813	High Performance & Specialty Fibers							
	Open Elective	3	0	0	3	60	40	100
xxxx								
BTEXS1-803	Project	0	0	6	3	40	60	100
BMNCC0-007	Advisory Counseling	1	0	0	0			
Total	**Theory 04 Lab 0 P01**	**12**	**2**	**6**	**17**	**280**	**220**	**500**

Total Credits = 22+22+23+22+20+17= 126

FUNDAMENTALS OF TEXTILE MACHINE AND PROCESSES

Subject Code: BTEXS1- 301 LT P C 3 0 0 3 Duration: 40 Hrs.

UNIT– I (15 Hrs.)

Basic characteristics of textile materials; Classification of fibres.Basic requirements of fibre forming polymers.Elementary idea of polymerization.Concept of dimensional characteristics of textiles; (eg.Fiber and Yarn Numbering systems, fabric thickness etc.) Applications of textiles in diversified fields; Variations in textile structure and properties based on applications.

UNIT – II (12 Hrs.)

Role of different structure and material constituents for fulfillment of target requirements; Different machine sequences for processing textile materials differing in structure Introduction to the language of textile and process flow of fibers up to finished product.

UNIT – III (8 Hrs.)

Elementary idea about the objectives and working of each machine used in yarn manufacturing. Woven knitted and nonwoven fabric production. Basic idea of nonconventional spinning & weaving machineries.

UNIT – IV (5 Hrs.)

Elementary idea of desizing, scouring, bleaching, dyeing, printing & finishing processes. Different end uses of finished products.

Recommended Books:

1. V.A. Senhai, 'Textile Fibre', vol-1, Sevak Publishers, Bombay, **1995.**
2. W. Klein, 'Manual of Textile Technology' Textile Institute, Manchester, **1995.**
3. T.K. Pattabhiram, 'Essential Elements of Textile Calculations' 2nd Edn.,Textile Trade Press,Ahmedabad.
4. E.P.G. Gohl&Vilensky L.D., 'Textile Science', 1st Indian Edn.,CBS Publishers, **1987.**
5. Rose Sinclair,'Textiles and Fashion: Materials, Design and Technology', WoodheadPublishing Series in Textile, No. 126.
6. W.E. Morton and J.W.S. Hearle, 'Physical Properties of Textile Fibres', WoodheadPublishing Series in Textiles No. 68, 2008, UK.

TEXTILE FIBRE –I

Subject Code: BTEXS1- 302 LT P C 3 0 0 3 Duration : 40 Hrs.

UNIT -I (5 Hrs.)

Introduction: Fibre, Textile fibre, Staple fibre, Filament fibre, Natural fibres, Manmade fibres,regenerated and Synthetic Fibres, Classification of textile fibers.

UNIT- II (10 Hrs.)

Properties of Fibres and Polymers: Essential and desirable properties of textile fibers, Essential properties of fibre forming polymers. Correlation of structures with properties of fibres, Crystallinity and Orientation in fibres.

UNIT-III (10 Hrs.)

Production Properties and Uses of Major Natural Fibres: Production, Physical & Chemicalproperties and uses of Major natural Fibres (e.g. cotton, flax, jute, wool, silk).

UNIT-IV (15 Hrs.)

Man Made Fibres: Introduction to manmade fibres. Basic production systems for the manmadefibre i.e. melt, wet and dry spinning systems. Production, Properties and uses of regenerated fibres (e.g. viscose, Cuprammonium, polynomic, HWM & acetate rayons).

Recommended Books:

1. M. Lewin, 'Hand Book of Fibre Chemistry', 3rd Edn, CRC Press Tylor & Francis Group, **2007**.
2. B.P. Corbman, Textile Fibre to Fabric, 6th Edn, McGraw Hill Singapore, **1983**.
3. R.R., Wardman, R.H., The Chemistry of Textile Fibres, Royal Society of Chemistry (RSC)Publishing, Cambridge, U.K,**2011**.
4. R.M. Kozlowsky, 'Hand Book of Natural Fibres', Vol.-I, Wood Head Publishing,Cambridge, U.K,**2012.**
5. E.P.G. Gohl, L.D. Vilensky, 'Textile Science', CBS Publishers, New Delhi, India, **1987**.
6. V.A. Shenai., 'Technology of Textile Processing: Textile Fibres', Vol.-I, SewakPublications, Mumbai, India,**1995**.

FABRIC MANUFACTURE-I

Subject Code: BTEXS1- 303 **LT P C 3 1 0 4** **Duration: 40 Hrs.**

UNIT-I (12 Hrs.)

WINDING: Objectives, basic features of slub catchers and yarn clearers like Mechanical andelectronics types. Yarn tensioners: Additive, Multiplicative & Combined. Anti-patterning: Reasons and Remedies. Classification and basic features of auto winders, Yarn doubling systems, Splicing and knotting Yarn fault classifying systems.

CALCULATIONS ON: Production and efficiency related to winding and Machine Balancing in winding

UNIT-II (18 Hrs.)

WARPING: Comparison of various types of warping such as: Beam warping &Sectionalwarping. Basic features, Creels, Reeds, leasing systems and drawing systems

SIZING: Objectives & classification of sizing methods, features of sizing machine, machineelements, sizing ingredients, size preparation. Principles of different modern sizing techniques and their uses.

CALCULATIONS ON: Production and efficiency related to warping & sizing and Machine Balancing in warping & sizing

UNIT-III (4 Hrs.)

PIRN WINDING: Objective, different types of pirns, yarn traversing system, automation,standard winding parameters.

CALCULATIONS ON: Production and efficiency related to pirn winding and Machine Balancing in pirn winding

UNIT-IV (6 Hrs.)

WEAVING: Manual, automation, General loom classifications, and Overall concept of looms.Concepts of primary, secondary & auxiliary motions of looms

CALCULATIONS ON: Production and efficiency related to weaving and Machine Balancing in weaving

Recommended Books

1. J.E Booth, 'Textile Mathematics', CBS Publishers N. Delhi, **1995.**
2. N.N. Bannerjee, 'Weaving Mechanism', Textile Book House, Berhampore, WB.,**1993**.
3. M.K. Talukdar, 'Winding', Spinnet View, **1992**.
4. A. Sengupta, 'Weaving Calculations', DBT & SONS Pvt. Ltd., Mumbai.,**1996**.

5. R. Marks & Robinson A.T.C. 'Principles of Weaving', Textile Institute, Manchester, **1976**.

YARN MANUFACTURING - I

Subject Code: BTEXS1- 304   LT P C 3 1 0 4   Duration: 40 Hrs.

UNIT-I (4 Hrs.)

Introduction to short and long staple spinning

Ginning: Objectives of ginning, differential ginning, Roller, Saw and McCarthy ginningmachines.

UNIT-II (12 Hrs.)

Blow Room: Objectives of mixing and blending, Different methods of mixing and blending,Study of modern blending machines, Auto mixer. Principle of opening and cleaning objects of Blow room line. Various type of opener and cleaner their construction and working, its modern development. Study of Lap forming mechanism, Calendar roller pressure, Length measuring mechanism, feed regulating system. Single line processing, Selection of machinery for different types of cotton fibre, Different types of Lap defects and their remedies, Degree of opening, Norms, Recent development in Blow room, Calculation pertaining to blow room. Selection of Blow Room line for different types of cotton fibre.

UNIT-III (12 Hrs.)

Carding: Objectives of carding.Introduction to roller and clearer card.Principle of carding.Detailed study of revolving flat card.Construction, feature and working details of licker-in cylinder, doffer and flats. Card clothing; metallic & flexible, carding angle, card setting, Neps in card, Fibre hooks, Fibre transfer. Features of high production card.Defects in card web & their remedies.Autoleveller. Calculation pertaining to production, draft etc. of carding m/c.Recent development in Card.

UNIT-IV (12 Hrs.)

Draw Frame: Objectives of drawing, principles of roller drafting. Detailed study of draw framemachine. Roller & Rollers settings, Roller weighting, Roller clearer, Mechanics of roller slip, roller eccentricity, roller vibration. Conventional drafting system, Shirley draft distribution. Drafting wave, Different drafting system, Features of Modern draw frame, auto leveler in draw frame. Calculation pertaining to draft and production of draw frame machine.

Recommended Books:

1. W. Klein, 'Opening and Carding', Textile Institute Manchester, **1987**.
2. W. Klein, 'Short Staple Spinning Series', Textile Institute Manchester, **1987**.
3. K.R. and R. Chattopadhyay, 'Blow Room and Card NCUTE, IIT Delhi, **1998**.
4. Venkatsubramanian, 'Spun Yarn Technology', Vol.-I, & II, Mub. Sevak Pub.
5. T.K. Pattabhiram, 'Cotton Spinning, Somaiya Publication Pvt. Limited, New Delhi, 4^{th}Edn.,**1997**.
6. Gilbert R. Merill, 'Cotton Blow Room and Carding', Gilbert R Publication, Lowell, No.1955.
7. J.E. Booth, 'Textile Mathematics', Vol –I, Textile Institute Manchester,**1975**.
8. J.E. Booth, 'Textile Mathematics', Vol –II, Textile Institute Manchester, **1975**.
9. Gilbert R. Merill, 'Opening and Carding', Gilbert R. Publication, Lowell, Mass, **1960**.
10. Taggart William, 'Cotton Spinning', Universal Book Corporation, Mumbai.

KINEMATICS OF TEXTILE MACHINES

Subject Code: BTEXS1- 305 **LT P C 3 0 0 3** **Duration: 40 Hrs.**

UNIT – I (10 Hrs)

Kinematics of motion: Introduction, Plain, Rectilinear and Curvilinear motion, Equations of linear motion with graphical representation, Equations of angular motion, Relation between linear and angular quantities of motion

Simple Mechanisms: Introduction, Kinematic link or Element, Types of links, Structure, Kinematic pair, Types of constrained motions, Classification of kinematic pairs, Kinematic Chain, Types of Kinematic chains

UNIT – II (10 Hrs)

Gear and Gear Trains: Introduction, Nomenclature of gears, Classification of gears, Gears in textile machines, Types of gear trains, simple gear train, compound gear train, Reverted gear train, epicyclic gear train, Velocity ratio of epicyclic gear train, compound epicyclic gear train, epicyclic gear train with bevel gears, epicyclic gear train in textile testing, epicyclic gear train as transmission gear, epicyclic gear train in loom let off motion, epicyclic gear train as differentials

0UNIT – III (10 Hrs)

Brakes: Introduction, Materials for brake lining, Types of brakes, Single block or shoe brake, Pivoted block or shoe brake, Double block or shoe brake, Simple band brake, differential band brake, Band and block brake, Internal expanding brake

Unit IV (10 Hrs)

Belt, Rope and Chain drives: Introduction, selection of belt drive, Types of belt drives, Types of belts, Flat belt drives, Velocity ratio of belt drive, Power transmitted by a belt, Ratio of driving tension for flat belt drive, Centrifugal tension, Initial tension in a belt, V-belt drive, Rope drive and Chain drives

Recommended Books:

1. N. Gokarnashan, 'Mechanics and Calculation of Textile Machinery', Woodhead PublishingIndia, Delhi,**2015.**
2. G. Nagarajan, 'Textile Mechanisms in Spinning and Weaving machines', WoodheadPublishing India, Delhi, **2015.**
3. R.S Khurmi, Theory of machines
4. J.E. Booth, 'Textile Mathematics', Volumes – 2 & 3, Textile Institute, Manchester.

TEXTILE FIBRES LAB.-I

Subject Code: BTEXS1- 306 LT P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

Physical and Chemical Identification of following Textile Fiber (s)

1. Identification of cotton
2. Identification of wool
3. Identification of silk
4. Identification of Bastfibres
5. Identification of polyester
6. Identification of nylon
7. Identification of Acrylic
8. Identification of Polypropylene
9. Identification of fibres in blend and % fibre content in blend
10. Analysis of P/C blended fabric
11. Analysis of P/V blended fabric
12. Analysis of P/W blended fabric
13. Estimation of fibre/filament fineness using projection microscope.
14. Determination of moisture regain and content in cotton fibres.
15. Determination of fibre maturity percentage in cotton fibres.

FABRIC MANUFACTURE LAB.-I

Subject Code: BTEXS1-307 L T P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

1. Study of the motion transmission system in winding machine.
2. Study of the effect of slub catcher, yarn tensioner & yarn guide on package formation.
3. Study of Package stop motion in cone winding machine.
4. Calculation of winding speed on grooved drum winding system and study of anti-patterning system incorporated to it.
5. Study of precision winding machine and mechanism of package building.
6. Study of the motion transmission system in Pirn winding machine.
7. Calculation of winding speed and traversing speed of Pirn winding machine.
8. Study of the sectional warping machine & plan the width of a section according to the given striped fabric keeping in view the pattern.
9. To study the passage of yarn on a sizing machine and the features of various parts/mechanism of the sizing machine.
10. Study of primary motions of a loom

YARN MANUFACTURE LAB.-I

Subject Code: BTEXS1-308 LT P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

1. Study of general outline of opener & clearer machine employed in B/R line process.
2. Study of following in Shirley Trash Analyzer machine.
   A) Chief organs.
   B) Gearing arrangements.
   C) Speed of different beater.
   D) Teeth inclination & Teeth per inch.
3. Determination of trash content and analysis of waste by using trash analyzer machine.
4. Study of carding machine with technical details.
5. Study of gearing mechanism calculation of the speed of different organs of carding machine.
6. Calculation of draft between different zone & production of carding machine.
7. Study of card settings for different fibre lengths & types.
8. Maintenance and overhauling of carding machine.
9. Study of distribution of fibrous waste in a carding machine.
10. Study of the `Nep -COUNT' in a card.
11. Study of drafting arrangement & top roller weighting system of Draw Frame machine.
12. Calculation of the total draft and its distribution in draw frame machine
13. Effects of break draft and roller settings on sliver uniformity.
14. Measurement of nip-load pressure, roller eccentricity & shore hardness of top roller drafting rollers.
15. Maintenance and overhauling of draw frame machine.

TEXTILE FIBRE-II

Subject Code: BTEXS1-401 LT P C 3 0 0 3 Duration: 40 Hr

Unit-I (5 Hrs.)

Introduction: Introduction to man-made fibres, Idea about fine structure of man-made fibres. **Crystallinity, orientation:** Detailed study of crystallinity, orientation and its effects on fibreproperties.

Unit-II (15 Hrs.)

Melt Spinning: Melt Spinning with special reference to Polyester & Nylon. Melting of polymerchips, extrusion, spinning, drawing, heat setting & cutting of melt spun filaments/fibre.
Wet and Dry Spinning: Wet and dry spinning with special reference to acrylic. Relative merits & demerits of the wet & dry spinning systems. Preparation of polymer solution, extrusion, spinning, filament formation drawing, heat setting, cutting of wet & dry spun filaments/fibre.

Unit-III (10 Hrs.)

Heat Setting: Introduction about heat setting.Important parameters of heat setting & their effectonfibre properties.

Drawing and Stretching: Introduction about drawing. Drawing condition, phenomenon ofnecking, Machines for stretching continuous, filament yarns, Drawing, heat setting, crimping of staple fibres.

Unit-IV (10 Hrs.)

Production Properties and Uses of Synthetic Fibres: Detail study of the production, physical,chemical structures & Properties of polyester, nylon 6 & 66, **Polypropylene**, acrylic, elementary idea about high speed spinning.

High Performance Fibres: Introduction to high performance fibres, Elementary idea aboutaramid, carbon & glass fibres.

Recommended Books:

1. R.R. Matter, R.H. Wardman, 'The Chemistry of Textile Fibres', Royal Society of Chemistry(RSC) Publishing, Cambridge, U.K, **2011**.
2. M. Lewin, 'Hand Book of Fibre Chemistry', 3rd Edn, CRC Press Tylor & Francis Group, **2007**.
3. V.K Kothari., 'Progress in Science and Technology, Textile Fibres- Development and Innovation', Volume-2, IAFL Publication, New Delhi, India, **2000**.
4. B.P. Corbman, 'Textile Fibre to Fabric', 6th Edn, McGraw Hill Singapore, **1983**.
5. B.L. Deopura, B. Gupta, Manmade Fibres, NCUTE-Pilot Programme, Dept. of TextileTechnology, IIT, Delhi, **1999**.
6. E.P.G. Gohl, L.D. Vilensky, 'Textile Science', CBS Publishers, New Delhi, India, **1987**.
7. S.P. Mishra, 'Science and Technology of Manmade fibres', Suraj Publication, **2007**.
8. V.A. Shenai, Technology of Textile Processing: Textile Fibres, Volume-I, SewakPublications, Mumbai, India, 1**991**.
9. A.A. Vaidya, 'Production of Synthetic fibres', Prentice Hall of India Pvt. Ltd. Publisher, **1988**.

YARN MANUFACTURE – II

Subject Code: BTEXS1-402 LT P C 3 1 0 4 Duration: 40 Hrs.

UNIT-1 (3 Hrs.)

Brief idea about short staple spinning technology.

UNIT-II (11 Hrs.)

Combing Process: Objectives, combing for shorter and medium varieties of cotton, cottonssuitable for combing, preparation of stock for combing, combing cycle, role of machine components and settings, noil extraction at backward feed and forward feed comber, norms, assessment and production calculations. Recent developments, Process related to roving formation: Objectives, functions of different machine components and high drafting system, roving twist in speed frame, winding principles and equations related to bobbin leading and flyer leading, building motion, production calculations, norms, and performance assessment. Developments in speed frame.

UNIT-III (13 Hrs.)

Ring Spinning Process: Function and mode of operation of ring frame, role of drafting system,yarn guiding devices, forces acting between ring and traveler, yarn tension variation, angle of yarn pull, tasks of traveler, limiting speed, classification, form of traveler, traveler mass and material, different ring-traveler combinations, fiber lubrication, running on new-ring, winding process, cop building, cylinder and conical tip, spinning geometry, causes of end breaks, production calculations, norms, performance assessment. Latest developments including compact spinning.

UNIT-IV (13 Hrs.)

Non-Conventional Spinning Processes: Brief idea about principle of open end spinning, rotorspinning, chief organs and their functions, yarn properties in comparison with ring-spun yarn, principle of friction spinning, function of chief organs, yarn properties, basic principle to air jet spun yarn, functions of chief organs, yarn properties.

Recommended Books:

1. W. Klein, 'Manual of Textile Technology', vol.1 to 5', The Textile Institute Manchester, **1995**.
2. A.R. Khare, 'Elements of Combing', Sai Book Center, Mumbai, **1999**.
3. A.R. Khare, 'Elements of Ring Frame and Doubling', Sai Book Centre, Mumbai, **1999**.
4. K.R. Salhotra, 'Spinning of Man Made and Its Blends in Cotton System', The TextileAssociation of India, Mumbai, **1989**.
5. R. Chattopadhyay and R. Rengasamay, 'Spinning: Drawing, Combing and Roving', NCUTE, IIT, Delhi, **1999**.
6. Merill, R Gilbert, Roving, Gilbert R Publication, Lowell, Mass, **1956**.
7. W. Klein, 'Practical Guide to Ring Spinning', Vol. -4, Textile Institute, Manchester, **1987**.
8. W. Klein, 'Short Staple Spinning Series', Textile Institute, Manchester, **1987**.
9. P.R. Lord, 'Roller Drafting', Textile Progress 23 vol. 4, Textile Institute, Manchester, **1993**.
10. Taggart William, 'Cotton Spinning', Universal Book Corporation, Mumbai.
11. K.R. Salhotra, R. Alagiruswamy, R. Chattopadhyay, 'Ring Spinning, Doubling and Twisting', NCUTE, IIT Delhi, **2000**.
12. K.R. Salhotra and B. Dutta, 'Seminar on Rotor Spinning', IIT Delhi, **1981**.
13. J.E. Booth, 'Textile Mathematics', Vol. –II, Textile Institute Manchester, **1975**.
14. Taggart William, 'Cotton Spinning', Universal Book Corporation, Mumbai.

FABRIC MANUFACTURE - II

Subject Code: BTEXS1-403 LT PC 3 1 0 4 Duration: 40 Hrs.

UNIT-I (16 Hrs)

BASIC MOTIONS: Different types with advantages and disadvantages,
Tappet shedding: Mechanisms & principles. Positive & negative shedding, Heald reversing motions, Types of picking such as: under picking, over picking and parallel picking. Calculation of Picking force & shuttle velocity, Different picking accessories and its function, Reasons of false picking & shuttle fly.

UNIT-II (8 Hrs)

Movement of sley, Beat-up &sley eccentricity, Calculation related to sley eccentricity & its effects. Reed and reed counting systems,

UNIT-III (8 Hrs)

LET OFF: Different types of let-off systems, long term, short term and medium term variations.Relation between beam diameter and tension of warp. Principles of modern positive Let-off systems as such as Sulzer, Hunt, etc.

TAKE-UP: Types of take-up, examples of each: Periodicity in Take - up, Modern continuous take up like Sulzer, Saurer etc.

UNIT-IV (8 Hrs)

WARP STOP: Types of warp stop motions with examples such as Mechanical & Electrical stop motion.

WARP PROTECTOR: Study of Loose reed and fast reed warp protector motion.

WEFT STOP: Functions of Weft feelers and its different types.

Recommended Books:

1. R. Marks and A.T.C. Robinson, 'Principles of Weaving', Textile Institute, **1976**.
2. Prabir Kumar Banerjee, 'Principles of Fabric Formation', CRC Press, **2015.**
3. P.R. Lord & M.H. Mohamod, 'Weaving: Conversion of Yam to Fabric',MerrowPublishingCo. Ltd., **1992**.
4. V. Valeriy, Choogin, 'Mechanisms of Flat Weaving Technology, Woodhead Publishing, **2013.**
5. Sabit, Adanur, 'Handbook of Weaving', Technomic Publications, **2001**.

TEXTILE CHEMICAL PROCESSING – I

Subject Code: BTEXS1-404 LT P C 3 1 0 4 Duration: 40 Hrs.

UNIT-I (10 Hrs.)

Introduction: Process line for pretreatment, colouration and finishing of textiles

Singeing: Object of the process, types of singeing, details of various singeing methods,drawbacks and advantages. Process and quality control aspects involved.

Desizing: Object, types, method details and mechanism of removal of starch in various methods. Efficiency of desizing.

Scouring: Objectives, mechanism of removal of impurities, recipe and controlling parametersinvolved. Scouring of colouredtextiles.Scouring of natural, manmade and blended textiles.Evaluation of scouring efficiency.

UNIT-II (10 Hrs.)

Bleaching: Objectives of bleaching.Hypochlorite, peroxide, chlorite and per-acetic acidbleaching methods and their effectiveness on various textiles. Controlling parameters and mechanism involved in each method. Efficiency of bleaching.

Mercerization: Objectives, mechanism related to various physical and chemical changes incotton during mercerization. Process parameters and operation details.Causticization.Wet and hot mercerization.Ammonia treatment of cotton. Performance of various mercerization /alkali treatment processes. Assessment of efficiency of mercerization: Barium activity number, its determination and interpretation.

Pretreatment Machineries: Singeing m/c, J-box, kier, mercerizing machine,

UNIT-III (10 Hrs.)

Heat Setting: Objectives and mechanism of setting. Different methods of heat setting and theireffectiveness on various man made textiles and blends. Heat setting conditions and controls. Heat setting of polyester, nylon, acetate and their blends.Evaluation of degree of heat setting.

Mechanical Finishes: Physical and chemical softening processes, selection of chemical andevaluation of softening. Calendaring - its types, construction and function of various calendaring m/cs. Sanforizing - method, mechanism and machineries involved. Evaluation of sanforizing.

UNIT-IV (10 Hrs.)

Carbonization: Objectives, selection of chemical, process details, trouble shoots, precautionarymeasures and efficiency of carbonization.

Functional Finishes: Problem of creasing, anti-crease finish on cotton. Choice of chemical,catalyst and process parameters. Drawback and advantages associated with use of various anti-crease chemicals. Measures to reduce release of formaldehyde.Water repellency and water repellent finishes on cotton.Evaluation of water repellency.

Recommended Books:

1. A.K. Roy Choudhary, ‘Textile Preparation & Dyeing’, Science Publishers, USA,**2006**.
2. R.H. Peters ‘Textile Chemistry’, Vol - II, Elsevier Publishing Company, London, **1967**.
3. R.M. Mittal and S.S. Trivedi, ‘Chemical Processing of Polyester / Cellulosic Blends’, Ahmedabad Textile Industries Research Association, Ahmedabad, India,**1983**.
4. S.R. Karmakar, ‘Chemical Technology in the Pretreatment Processes of Textiles’, TextileScience & Technology Series, Vol-12, 1^{st}Edn, Elsevier, **1999**.
5. A.J. Hall, ‘Textile Finishing’, Haywood Books, London, **1996**.
6. V.A. Shenai, ‘Technology of Bleaching & Mercerization’.
7. A.A. Vaidya, ‘Textiles Auxiliaries & Finishing Chemicals’.
8. V.A. Shenai and N.M. Saraf, ‘Technology of Textile Finishing’, Sevak Publications, Mumbai, **1990**.

FABRIC STRUCTURE & ANALYSIS

Subject Code: BTEXS1-405 LT P C 3 0 0 3 Duration: 40 Hrs.

UNIT-I (10 Hrs.)

Formation of Fabric. Fabric cover and crimp. Detection of directions of warp and weft. Weaving plan.Methods of its preparation.

UNIT-II (10 Hrs.)

Detailed study of various weaves for their reproduction: Plain weave & its derivatives, Twill weave & its derivatives. Satin/sateen weave & its derivatives. Diamond and diaper, Honeycomb, Huck-a-back, Mock leno.

UNIT-III (10 Hrs.)

Welt/pique, Bedford cord, crepe weaves. Stripe & check effects. Its types.Different methods to produce these weaves. Color and weave effect.

UNIT-IV (10 Hrs.)

Terry weaves Backed fabric, Doubled fabric. Technical specification of important weaves. Calculation relating to raw material required to produce different weaves.

Recommended Books

1. Watsons, ‘Textile Design & Color’, 7^{th}Edn.,Butterworth& Co. Ltd., London, **1988**.
2. Watsons, ‘Advanced Textile Design’, 7^{th}Edn.,Butterworth& Co. Ltd., London,**1989**.
3. Nisbet, ‘Grammar of Textile Design’, **1994**.

YARN MANUFACTURE LAB.-II

Subject Code: BTEXS1-406 **LT P C 0 0 2 1** **Duration: 20 Hrs.**

At least 10 experiments are to be performed by each student.

1. To study the timing diagram of a comber.
2. To study the function of top comb and its depth of penetration with reference to noil extraction and fractionating efficiency.
3. To study the nature of movement of nipper assembly.
4. To study the mechanism of detaching roller drive and the nature of its motion.
5. To study the effect of type of feed and detachment setting on noil percentage and fractionating efficiency.
6. To estimate the noil percentage in comber.
7. To study the construction and working of speed frame.
8. To study the differential motion of speed frame and calculation of Bobbin speed.
9. To study the gearing diagram of speed frame and calculation of break draft constant, draft constant, twist constant and production.
10. To study the building motion in Ring Frame.
11. To study the gearing diagram of Ring frame and calculation of Draft constants, Twist constant, Coils per inch and production.
12. To study the construction and working of Ring Frame.
13. To study the construction and working of Rotor Spinning.
14. To study the construction of and working of Dref-2 friction spinning machine.
15. To study the construction and working of Dref-3 friction spinning machine.
16. To study the construction and working of Air-jet Spinning machine.

FABRIC MANUFACTURE LAB.-II

Subject Code: BTEXS1-407 LT P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

1. To select the proper reed and heald for a weaver's beam keeping in mind the beam, loom size and fabric construction.
2. Study of shedding mechanism of shuttle loom and cam positioning with respect to loom cycle.
3. Study of picking mechanism, Picker movement in relation with crank shaft rotation & calculation of average velocity of shuttle.
4. Study of Beating up system in conventional loom
5. Study of sley movement, construction and calculation of sley eccentricity.
6. Study of take up motion and calculation of loom take up constant.
7. Study of positive let-off system.
8. Study of Warp protection motion (both loose reed and fast reed).
9. Study of warp stop motion.
10. Study of side/centre weft fork mechanism.

TEXTILE CHEMICAL PROCESSING LAB. – I

Subject- BTEXS1-408 L T P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

1. Scouring of cotton goods
2. Scouring of polyester goods
3. Scouring of P/C blended goods
4. Scouring of wool fibre
5. Degumming of silk
6. Bleaching of cotton with H_2O_2
7. Bleaching of cotton with $NaClO_2$
8. Bleaching of cotton with NaOCl
9. Bleaching of Polyester
10. Bleaching of P/C blend
11. Bleaching of jute yarns / fabric
12. To finish cotton fabric with

- Water repelling agent
- Urea – formaldehyde

FABRIC STRUCTURE & ANALYSIS LAB.

Subject- BTEXS1-409 LT P C 0 0 2 1 Duration: 20 Hrs.

At least 10 experiments are to be performed by each student

1. Analysis of different fabric samples to know their particulars as stated:
2. For Yarns: Ends & Picks/inch, Warp & Weft Count & Crimp, Warp & Weft Crimp, Ply & Twist.
3. For Fabrics: Tape length, Reed width, Denting order, Weight of warp & Weft & fabrics, Weight per square yard, Warp & weft cover, Colour plan, and use.

1. Plain & derivatives
2. Twill & derivatives
3. Diamonds & Drapers
4. Honey comb
5. Huck-a-back
6. Mockleno
7. Welts & Piques
8. Stripe &Cheques
9. Satin / Sateen
10. Crepe
11. Terry pile
12. Colour& Weave effect.
13. Double Cloth

MRSPTU B.Sc. (FOOD TECHNOLOGY)/B.F.S.T (Hons.) SYLLABUS 2019 BATCH ONWARDS

(1st Year)

Total Contact Hours = 23 **Total Marks = 600** **Total Credits = 21**

Semester 1st		Contact Hrs.			Marks			Credits
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BFOTS1-101	General Microbiology	3	1	-	40	60	100	4
BFOTS1-102	Introduction to Food Technology-I	3	1	-	40	60	100	4
BFOTS1-103	*Mathematics	3	1	-	40	60	100	4
BFOTS1-104	Computer Science and Applications	3	1	-	40	60	100	4
BFOTS1-105	General Microbiology Lab	-	-	4	60	40	100	2
BPHAR0-002	**Life Sciences	3	1	-	40	60	100	4
BHUMA0-001	Communicative English	3		-	40	60	100	3
Total	**Theory= 5 Lab=1**	**15**	**04**	**04**	**260**	**340**	**600**	**21**

*Mathematics for Medical Students
** Life Sciences for Non-Medical students

Total Contact Hours = 23 **Total Marks = 600** **Total Credits = 19**

Semester 2nd		Contact Hrs.			Marks			Credits
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BFOTS1-201	Introduction to Food Technology-II	3	1	-	40	60	100	4
BFOTS1-202	Principles of Food Preservation	3	1	-	40	60	100	4
BFOTS1-203	Environmental studies	3		-	40	60	100	3
BFOTS1-204	Food Chemistry	3	1	-	40	60	100	4
BFOTS1-205	Lab-II Introduction to Food Technology-II	-	-	4	60	40	100	2
BFOTS1-206	Lab-III Principles of Food Preservation	-	-	4	60	40	100	2
Total	**Theory = 4** **Lab = 2**	**12**	**03**	**08**	**280**	**320**	**600**	**19**

COMMUNICATIVE ENGLISH

Subject Code: BHUMA0- 101 **LTPC** **Duration:45Hrs.**
3 0 0 3

UNIT-I (12Hrs.)

Communication Skills: Introduction, Definition, the Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.

UNIT-II (11Hrs.)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication),Verbal Communication, Physical Communication.

UNIT-III (12Hrs.)

Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations.

UNIT-IV (10Hrs.)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview

Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Recommended Books

1. Andreja. J. Ruther Ford, 'Basic Communication Skills for Technology', 2ndEdn., Pearson Education, **2011.**
2. Sanjay Kumar, Pushpalata, 'Communication Skills', 1stEdn., Oxford Press, **2011.**
3. Stephen P. Robbins, 'Organizational Behaviour', 1stEdn., Pearson, **2013**.
4. Gill Hasson, 'Brilliant-Communication Skills', 1stEdn., Pearson Life, **2011**.
5. Gopala Swamy Ramesh, 'The Ace of Soft Skills: Attitude, Communication and Etiquette forSuccess', 5thEdn., Pearson, **2013**.
6. Deborah Dalley, Lois Burton, Margaret, 'Developing your Influencing Skills', Green Hall, 1stEdn., Universe of Learning LTD, **2010.**
7. Konarnira, 'Communication Skills for Professionals', 2nd Edn., PHI, **2011.**
8. Barun K. Mitra, 'Personality Development and Soft Skills', 1stEdn., Oxford Press, **2011**.

9. 'Soft Skill for Everyone', Butter Field, 1st Edn., Cengage Learning India Pvt. Ltd., **2011**.
10. S.J. Francis Peters, 'Soft Skills and Professional Communication', 1st Edn., McGraw Hill Education, **2011.**
11. John Adair, 'Effective Communication', 4th Edn., Pan Mac Millan, **2009**.
12. Aubrey Daniels, 'Bringing out the Best in People', 2nd Edn., McGraw Hill, **1999**.

COMPUTER SCIENCE & APPLICATIONS

Subject Code: BFOTS1-104 **LTPC 3104** **Duration:45Hrs.**

UNIT-I (13Hrs.)

Computer Fundamentals Introduction to Computers:
Characteristics of computers, Historical perspectives of computers, Computer generations, types of computers and uses, Software, Hardware, Basic architecture and functions of CPU and its parts, Important I/O devices like Keyboard, Mouse, Printers, Video Monitors.
Memory Storage: Memory Cells, Semiconductor and Magnetic core memory, ROM (its types), RAM, Cache and Virtual memory, Secondary storage devices and their organization (Hard disk, Floppy disk, CD, DVD).

UNIT-II (13Hrs.)

Operating Systems
Definitions, Need, Organization, Functions, Types of Operating Systems, DOS, Windows, Handling Drives, Directories and files, Commands (Internal & External), Icons, Clipboard, Folders, Major differences between DOS & Windows.
Communication Networks Hardware and software components, seven layers of OSI architecture, Network Topologies (Ring, Star, Fully Connected and Bus), LAN and WAN, Bounded and unbounded communication media, Internet, World Wide Web and I.T., Browsers, Important terminology regarding Internet applications.

UNIT-III(9Hrs.)

Computer Applications Word Processing
Techniques, File manipulation, Formatting, Printing setups Table handling, Mail merge, etc.using MS-Word.
Spreadsheet Package: Worksheets, formatting sheets, Calculations and graphing using formulae and functions, Import and export of data using MS-Excel.

UNIT- IV(10Hrs.)

Computer Applications Graphics
Objectives and types of graphics, Presentation packages, Slides designing, Diagrams and graphs, Import &Export data using MS-Power Point.
Data Security against Viruses: Definition of computer viruses, Detection, prevention and cure against viruses using anti-virus software packages.

Recommended Books

1. Rajaraman, ‘Fundamentals of Computers’, Prentice Hall of India.
2. N.K. Tiwari, ‘Computer Fundamental with Pharmacy Applications’, 1stEdn., Pharm. MedPress, **2008.**
3. Stultz, ‘Learn MS-Office 2000’, BPB Publications.
4. Ivens, ‘Using Microsoft Windows’, Prentice Hall of India, **1998.**
5. Stultz, ‘Learn DOS in a day’, BPB Publications.

MATHEMATICS

Subject Code:BFOTS1-103 **LTPC 3104** **Duration:42Hrs.**

UNIT-I(12Hrs.)

Mensuration: Mensuration of rectangles, easy examples of garden paths, cost of plantingtrees and fencing gardens. Area of right angled triangles area and height of isosceles andequilateral triangles, area of triangles in terms of sides, rent of field. Area of parallelograms,rhombus, quadrilateral and trapejoid.Regular polygons with emphasis on hexagon andoctagon.Simple cases of similar figures.Circumference and area of circles.Circular rings.Cost of fencing circular fields and paths.

UNIT-II (11Hrs.)

Mensuration: Volumes of cubes and rectangular solids. Cubic contents of tanks and cisterns, Volumes of triangular & rectangular prisms, right circular cylinders and segments of cylinders (Easy numerical examples based on Science only to be set Proofs of formulae).

UNIT-III (7Hrs.)

Algebra: Solution of quadratic equations and of those reducible to quadratic equation (One variable).Relation between roots and co-efficients.nth term and sum to n terms of an A. P. and G. P. nth term of an H. P.(excluding means and problems on numbers). Permutation and combinations: simple problems only. (Proofs of formulae not required).

UNIT-IV(12Hrs.)

Matrix and Determinant: Introduction matrices, Types of matrices, Operation of matrices, Transpose of matrix, Matrix multiplication, Determinants, Properties of determinants, Products of determinants, Minors and co-factors, Adjoint of a square matrix, Singular and non singular matrices, Inverse of Matrices.

Recommended Books

1. Algebra by D. C. Kapoor & Gurbax Singh.
2. Algebra by T. N. Nagpal& K.K. Gupta.
3. Comprehensive Calculus by R. S. Dehiya.
4. New Style Calculus for T. D. C. – I.

LIFE SCIENCES

Subject code:BPHAR0-002 **LTPC 3104** **Duration: 45Hrs.**

UNIT-I (10Hrs.)

Cell & Molecular Biology

Cell theory, Prokaryotic cell, eukaryotic cell, cell wall, cell membrane, cytoskeleton, nucleus, chloroplast, mitochondria, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, vacuoles and centrosomes. Cell cycle & division, amitosis, mitosis and meiosis.Study of genetic material, structure of DNA and RNA, replication, transcription, genetic code, translation & DNA repair.

UNIT- II (10Hrs.)

Human physiology

Digestion and absorption, breathing and respiration, circulation, excretory system, nervous system, skeletal and muscular systems.Locomotion and movement, growth, aging and death. Hormones - types of hormones, functions and disorders.

UNIT-III (12Hrs.)

Human health and diseases

Pathogens, Parasites causing human disease (malaria, dengue, chickenguinea, typhoid, pneumonia, common cold, ringworm) and their control.Basic concepts of immunology, vaccines, antibiotics, cancer, HIV and AIDS.Adolescence, drug and alcohol abuse.

UNIT-IV(13Hrs.)

Biochemistry

Structure and function of carbohydrates, lipids and proteins. Enzymes- types, properties and enzyme action, Metabolism- glycolysis, kreb cycle and pentose phosphate pathway.

Biotechnology and its applications

Recombinant DNA technology, applications in health, agriculture and industries, genetically modified organisms; Human insulin, vaccine and antibiotic production. Plant breeding, tissue culture, single cell protein, Transgenic plants and transgenic animals.

Recommended books:

1. Albert L.Lehninger, David L. Nelson and Michael M. Cox: Principles of Biochemistry, Worth Publishers, **1993**.
2. B.D. Singh: Biotechnology, Kalyani Publishers.
3. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Paul Matsudaria, Monty Krieger, Jems Darnell, Mathew P. Scott: Molecular Cell Biology, W.H. Freeman, **2004**.

GENERAL MICROBIOLOGY

Subject Code: BFOTS1-101 **LTPC 3 1 0 4** **Duration:46Hrs.**

UNIT-I (7Hrs.)

Introduction : Discovery of microbial world, theory of spontaneous generation, Germ theory of disease, Koch's postulates, Pure culture concept, Nature and properties of prokaryotic and eukaryotic micro-organisms.

UNIT-II (14Hrs.)

General characteristics and Nutritional requirements: General characteristics of bacteria, yeast, mold, viruses, algae. Types of bacteria, nutritional classification of bacteria.
Reproduction of micro-organisms: Brief account of bacteria, yeast and mold reproduction.

UNIT-III(12Hrs.)

Microbial Growth : Definition of growth, growth cycle, growth rate, generation time, measurement of growth, effect of environmental factors such as temperature, oxygen, moisture, salt, pH, oxidation- reduction potential and radiations on growth.

UNIT-IV (12Hrs.)

Cultivation of micro-organisms: Pour plate method, spread plate method and streak plate method.
Control of Micro-organisms: Control of micro-organisms by physical, chemical and other chemotherapeutic agents.

Recommended Books:

1. Pelczar M.J., Chan E.C.S. & Krieg N.R., Microbiology,5th Ed., McGraw Hill Co, Singapore, **1987**.
2. Stanier R.Y., Graham J.L., Wheelies M.L. & Painter P.R., General Microbiology, 5thEd.,The Macmillan Press Ltd., London,**1993**.
3. Cappuccino J.G. & Sherman N., Microbiology: A Laboratory Manual,Benjamine-Cummings Publishing Co., USA,**200**4.
4. Gunase Karan P., Laboratory Manual in Microbiology, New Age International (P) Ltd. New Delhi, **1996**.

INTRODUCTION TO FOOD TECHNOLOGY-I

Subject code: BFOTS1-102 **LTPC 3 1 0 4** **Duration:44Hrs.**

UNIT-I (8Hrs.)

Introduction

Introduction to various branches of Food Science and Technology

UNIT-II (14Hrs.)

Compositional, Nutritional and Technological aspects of Plant foods

Wheat: structure and composition, types (hard, soft/ strong, weak) Diagrammaticrepresentation of structure of wheat grain.

Rice: Structure and composition, parboiling of rice- advantages and disadvantages.

Malting, gelatinization of starch, types of browning- Maillard & caramelization.

Corn: Structure and composition, Dry and wet milling,.

Millets: Types of millets.

UNIT-III (8Hrs.)

Pulses

Structure and composition of pulses, toxic constituents in pulses, processing of pulses:soaking, germination, decortication, cooking and fermentation.

UNIT-IV (14Hrs.)

Fats and Oils

Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids,essential fatty acids, trans fatty acids. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

Recommended Books

1. Manay, S. &Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004.
2. B. Srilakshmi, Food science, New Age Publishers,2002.
3. Meyer, Food Chemistry, New Age,2004
4. Kenneth F. etal, edited-Vol-1, 2, The Cambridge World History of Food,
Cambridge Univ.Press, 2000.
5. Martin Eastwood, Second edition, Principles of Human Nutrition,Blackwell Publishing, 2003.

LAB-II GENERAL MICROBIOLOGY

Subject Code:BFOTS1-105 **LTPC**
0042

Practicals

1. To study different parts of a microscope.
2. Study of instruments (Autoclave, Hot air oven, Incubator, Laminar flow, pH meter, and spectrophotometer) of microbiology laboratory.
3. Preparation of nutrient agar and MacConkey's Agar plates, slants and broth.
4. To study the serial dilution method.
5. To perform pour plate, spread plate and streak plate methods for isolation and enumeration of micro-organisms.
6. To demonstrate acid fast staining.
7. To stain the given bacteria by Gram's staining method.
8. To measure the size of given micro-organisms by ocular and stage micrometer.
9. To determine the number of micro-organisms with a Haemocytometer.
10. To determine the motility of bacteria by hanging drop method.

SEMESTER II

INTRODUCTION TO FOOD TECHNOLOGY-II

Subject Code: BFOTS1-201 **LTPC** **Duration:45Hrs.**
3 1 0 4

UNIT-I (12Hrs.)

Fruits and Vegetables

Classification of fruits and vegetables, general composition, enzymatic browning, namesand sources of pigments, Dietary fibre.

Postharvest changes in fruits and vegetables-Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

UNIT-II (14Hrs.)

Compositional, Nutritional and Technological aspects of Animal foods

Flesh Foods - Meat, Fish, Poultry

Meat- Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

Fish- Classification of fish (fresh water and marine), aquaculture , composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical.

Poultry- Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

UNIT-III (8Hrs.)

Milk and Milk Products

Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization.An overview of types of market milk & milk products.

UNIT-IV (11Hrs.)

Food Spices and Condiments

Types and uses of spices and condiments, Chemical composition, Extraction, General processing, uses and special attributes of important Indian spices like pepper, cinnamon, clove, ginger, turmeric, cardamom, fenugreek and fennel etc., seasonings and condiments blends.

Recommended Books

1. Manay, S. &Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, **2004**.
2. B. Srilakshmi, Food science, New Age Publishers, **2002**.
3. Meyer, Food Chemistry, New Age, **2004**
4. Kenneth F. et.al, edited-Vol-1, 2, The Cambridge World History of Food,Cambridge Univ. Press, **2000**.
5. Martin Eastwood, Second edition, Principles of Human Nutrition,Blackwell publishing, **2003**.

PRINCIPLES OF FOOD PRESERVATION

Subject Code:BFOTS1-202 **LTPC 3104** **Duration:42Hrs**

Unit-I (7Hrs.)

Introduction: Historical developments of food preservation. Principles of Food preservation, Scope & its benefits. Chemical preservation: Class I and Class II preservatives.

Unit-II (11Hrs.)

Preservation by low temperature

Freezing and Refrigeration :Introduction, cold storage and freezing, freezing curve, changes during freezing, types of freezing; slow freezing, quick freezing, thawing, changes during thawing and its effects on food.

Unit-III (11Hrs.)

Preservation by high temperature

Thermal processing: Sterilization, commercial sterilization, pasteurization, and blanching. boiling, steam under pressure, canning, aseptic processing, thermal death time.

Unit-IV(13Hrs.)

Preservation by Drying: Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), factors affecting rate of drying, normal drying curve, Various types of driers used in food industry.

Irradiation: Units of radiation, Ultraviolet and ionizing irradiations, their effect on microorganisms & uses in food processing.

Recommended Books

1. Desrosier NW and Desrosier JN, The Technology of Food Preservation, CBSPublication, New Delhi, **1998**.
2. Paine FA and Paine HY, Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi,**1992**.
3. Potter NH, Food Science, CBS Publication, New Delhi, **1998.**
4. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press,**2006**.
5. Rao PG, Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, **2010.**
6. Toledo Romeo T, Fundamentals of Food Process Engineering, Aspen Publishers, **1999.**

ENVIRONMENTAL STUDIES

Subject Code:BFOTS1-203 **LTPC** **Duration:38Hrs.**
3003

UNIT-I (8Hrs.)

The multidisciplinary nature of environmental studies, Natural Resources,Renewable and non-renewable resources: Natural resources and associated problems.

UNIT-II (8Hrs.)

Forest Resources, Water Resources, Mineral Resources, Food resources, Energy resources, Land resources, Role of an individual in conservation of natural resources.

UNIT-III (14Hrs.)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT- IV(8Hrs.)

Environmental Pollution: Air pollution; Water pollution; Soil pollution.

Recommended Books

1. Y.K. Sing, 'Environmental Science', New Age International Pvt, Publishers, Bangalore.
2. K.C. Agarwal, 'Environmental Biology', Nidi Publ. Ltd. Bikaner, **2001**.
3. BharuchaErach, 'The Biodiversity of India,' Mapin Publishing Pvt. Ltd.
4. R.C. Brunner, 'Hazardous Waste Incineration', McGraw Hill Inc.
5. R.S. Clark, 'Marine Pollution', Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 'Environmental Encyclopedia', Jaico Publ. House, Mumbai, 1196p, **2001**.
7. A.K. De, 'Environmental Chemistry', Wiley Eastern Ltd.
8. 'Down of Earth', Centre for Science and Environment.

FOOD CHEMISTRY

Subject Code:BFOTS1-204 **LTPC 3104** **Duration:42Hrs.**

UNIT-I (8Hrs.)

Introduction to Food: Definition and Composition.
Water: Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging.

UNIT-II (10Hrs.)

Lipids: Classification, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.Chemical properties- reichertmeissel value, polenske value, iodine value, peroxide value, saponification value.
Changes in fats and oils- rancidity, lipolysis, flavor reversion, Fat Mimetics.

UNIT-III (12Hrs.)

Proteins: Protein classification and structure, Nature of food proteins (plant and animal proteins).Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation), Functional properties of proteins, organoleptic, solubility, viscosity, binding gelation/ texturization , emulsification , foaming.
Carbohydrates: Classification and Functions (monosaccharides, oligosaccharides and polysaccharides), Modified celluloses and starches.

UNIT-IV (12Hrs.)

Vitamin : Importance and Stability, Water soluble & Fat soluble vitamins.
Flavour: Definition and basic tastes, Description of food flavours, Flavour enhancers.

Recommended Books

1. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,**1996.**
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada,**2002.**
3. Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, **1995.**
4. Potter,N.N. & Hotchkiss,J.H, Food Science, 5th Ed., Chapman & Hall,**1995.**
5. DeMan, J.M., Principles of Food Chemistry, AVI, NewYork, **1980.**

LAB II INTRODUCTION TO FOOD TECHNOLOGY-II

Subject Code:BFOTS1-205 **LTPC**
0042

Practicals

1. Demonstration of the instruments used in food technology.
2. Determination of moisture content in different food samples.
3. Determination of ash content of different food samples.
4. Determination of TSS of ketchup by refractometer.
5. Determination of acidity of milk and juices.
6. To study the effect of blanching on vegetables.
7. Determination of specific gravity of oil and milk.
8. Determination of pH of food samples by pH meter.
9. Determination of sponification value and acid value.
10. Qualitative test for starch and protein.

LAB III PRINCIPLES OF FOOD PRESERVATION

Subject Code:**BFOTS1-206** **LTPC**
0042

Practicals

1. Cut out analysis of canned foods.
2. Preservation of fruits and vegetables by syruping and salting.
3. Preservation by paraffining.
4. Preparation of sauerkraut.
5. To determine the adequacy of blanching on vegetables.
6. To enhance the shelf life of eggs by oiling and pickling.
7. To study the curing of meat.
8. Preservative effect of honey and different concentrations.
9. Preservation of fruits and vegetables by salt, Oil and Vinegar.
10. Visit to food industry.

1st Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-101	Inorganic Chemistry	3	0	0	40	60	100	3
BBSC1-102	Organic Chemistry	3	0	0	40	60	100	3
BBSC1-103	Mathematical Physics	3	0	0	40	60	100	3
BBSC1-104	Mechanics-I	3	0	0	40	60	100	3
BBSC1-105	English	3	0	0	40	60	100	3
BBSC1-106	Solid Geometry	3	0	0	40	60	100	3
BBSC1-107	Differential Calculus	3	0	0	40	60	100	3
BBSC1-108	Punjabi/OR Punjab History & Culture	3	0	0	40	60	100	3
BBSC1-109	Chemistry Lab-I	0	0	4	60	40	100	2
BBSC1-110	Physics Lab-I	0	0	4	60	40	100	2
Total		**24**	**0**	**08**	**440**	**560**	**1000**	**28**

2nd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-201	Physical Chemistry-I	3	0	0	40	60	100	3
BBSC1-202	Inorganic Chemistry-II	3	0	0	40	60	100	3
BBSC1-203	Organic Chemistry-II	3	0	0	40	60	100	3
BBSC1-204	Special Theory of relativity	3	0	0	40	60	100	3
BBSC1-205	Electricity and Magnetism	3	0	0	40	60	100	3
BBSC1-206	Coordinate Geometry	3	0	0	40	60	100	3
BBSC1-207	Calculus-II	3	0	0	40	60	100	3
BBSC1-208	Environment Education	3	0	0	40	60	100	0
BBSC1-209	Chemistry Lab-II	0	0	4	60	40	100	2
BBSC1-210	Physics Lab-II	0	0	4	60	40	100	2
	Total	**24**	**0**	**08**	**440**	**560**	**1000**	**25**

3rd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-301	Physical Chemistry-II	3	0	0	40	60	100	3
BBSC1-302	Organic Chemistry-III	3	0	0	40	60	100	3
BBSC1-303	Vibration and Waves	3	0	0	40	60	100	3
BBSC1-304	Mechanic-II	3	0	0	40	60	100	3
BBSC1-305	Algebra-I	3	0	0	40	60	100	3
BBSC1-306	Analysis-I	3	0	0	40	60	100	3
BBSC1-307	Drug Abuse	3	0	0	40	60	100	0
BBSC1-308	Chemistry Lab-III	0	0	2	60	40	100	1
BBSC1-309	Physics Lab-III	0	0	2	60	40	100	1
	Total	**21**	**0**	**04**	**400**	**500**	**900**	**20**

4th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-401	Physical Chemistry-III	3	0	0	40	60	100	3
BBSC1-402	Inorganic Chemistry-III	3	0	0	40	60	100	3
BBSC1-403	Statistical Physics and Thermodynamics	3	0	0	40	60	100	3
BBSC1-404	Quantum Mechanics	3	0	0	40	60	100	3
BBSC1-405	Algebra-II	3	0	0	40	60	100	3
BBSC1-406	Analysis-II	3	0	0	40	60	100	3
BBSC1-407	Chemistry Lab-IV	0	0	2	60	40	100	1
BBSC1-408	Physics Lab-IV	0	0	2	60	40	100	1
BBSC1-409	Computer Programming Lab	0	0	4	60	40	100	2
	Total	**18**	**0**	**08**	**420**	**480**	**900**	**22**

5th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-501	Inorganic Chemistry-IV	3	0	0	40	60	100	3
BBSC1-502	Organic Chemistry-IV	3	0	0	40	60	100	3
BBSC1-503	Condensed Matter Physics	3	0	0	40	60	100	3
BBSC1-504	Laser and Optics	3	0	0	40	60	100	3
BBSC1-505	Differential Equation	3	0	0	40	60	100	3
BBSC1-506	Numerical Methods	3	0	0	40	60	100	3
BBSC1-507	Chemistry Lab-V	0	0	2	60	40	100	1
BBSC1-508	Physics Lab-V	0	0	2	60	40	100	1
	Total	**18**	**0**	**04**	**360**	**440**	**800**	**20**

6th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-601	Physical Chemistry-IV	3	0	0	40	60	100	3
BBSC1-602	Organic Chemistry-V	3	0	0	40	60	100	3
BBSC1-603	Electronics	3	0	0	40	60	100	3
BBSC1-604	Nuclear and Particle Physics	3	0	0	40	60	100	3
BBSC1-605	Number Theory	3	0	0	40	60	100	3
BBSC1-606	Mathematical Statistics	3	0	0	40	60	100	3
BBSC1-607	Chemistry Lab-VI	0	0	2	60	40	100	1
BBSC1-608	Physics Lab-VI	0	0	2	60	40	100	1
	Total	**18**	**0**	**04**	**360**	**440**	**800**	**20**

PHYSICAL CHEMISTRY-I

Subject Code: BBSC1-201 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Partial Molar Properties and Fugacity

Partial molar properties. Chemical potential of a perfect gas, dependence of chemical potential on temperature and pressure, Gibbs- Duhem equation, real gases, fugacity, its importance and determination, standard state for gases. Stability of phases, clapeyron equation. Clausius-clapeyron equation and its application to solid-liquid, liquid-vapour and solid-vapour equilibria.

Thermodynamics of Simple Mixtures

Thermodynamic functions for mixing of perfect gases. Chemical potential of liquids. Raoult's law, Henry's law. Thermodynamic functions for mixing of liquids (ideal solutions only). Mixtures of volatileliquids, vapour pressure diagrams. Lever's rule, distillation diagrams. Real solutions and activities, standard states for solvent and solute.

Unit-II

Physical Transformation of Pure Materials

First and second order phase transitions. Attainment of low temperature and energetics of refrigeration,adiabatic demagnetization.

Phase Equilibria

Phase rule and its thermodynamic derivation. One component systems-water, sulphur, carbon dioxide,helium. Two component systems, construction and interpretation of general phase diagrams for liquidvapour, liquid-liquid and liquid-solid systems. A simple system involving chemical reaction. Eutectics, freezing mixtures, ultra purity, zone refining.

Unit-III

Chemical Equilibrium

Direction of spontaneous change in a chemical reaction, extent of reaction, stoichiometric coefficients,equilibrium constant in terms of G. Temperature and pressure dependence of equilibrium constant, homogeneous & heterogeneous equilibria.

Thermodynamics of Electrolytic Solutions

Activities of ions in solutions, a model of ions in a solution, qualitative idea of Debye-Huckel theory,ionic strength, mean ionic activity coefficient and the Debye-Huckel limiting law for activity coefficients.

Unit-IV

Colligative Properties

Solutions of non-volatile solutes: colligative properties, elevation in boiling point, depression in freezingpoint, osmosis and osmotic pressure

Electrochemical Cells

Interfacial potential difference, the electrodes, potential at interfaces, electrode potentials, galvanic cells,emf, direction of spontaneous reactions. Concentration dependence of emf, equilibrium Constant fromelectrode potential, standard electrode potentials and their determination. Measuring activity co-efficient,thermodynamic data from cell emf. The temperature dependence of emf. Applications of emf. Measurements–solubility product, potentiometric titrations, pK and pH measurements of pK and pH.Acid-base titrations. Concentration cells with & without transference.

Recommended Books

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
5. Physical Chemistry by R. J. Silbey, R. A. Albert &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

INORGANIC CHEMISTRY-II

Subject Code: BBSC1-202 **L T P C** **3 0 0 3** **Duration: 45 Hrs.**

Unit-I

Chemical Bonding-II

Ionic bond

Factors affecting the stability of ionic compounds. Lattice energy, Born Lande equation and its applications, Madelung constant, Born-Haber cycle, applications of lattice energy, covalent character in ionic compounds, polarizing power and polarizability, Fazan's rules, Ionic radii, Factors affecting the radii of ions, Radii of polyatomic ions, Efficiency of packing and crystal lattices, Radius ratio rule, calculation of some limiting radius ratio values for different coordination members, Structure of crystal lattices, NaCl,CaCl, ZnS(Zinc blende and Wurzite), fluorite, rutile and cadmium iodide. Predictive powerof thermochemical calculations on ionic compounds.

Unit-II

Perfect and imperfect crystal

Intrinsic and extrinsic defects, point defects, line and plane defects, vacancies-Schottky and Frenkeldefects. Thermodynamics of Schottky and Frenkel defect formation, colourcentres, non-stoichiometryand defects. Metals insulators and semiconductors, Band theory, Band structure of metals, Insulators andsemiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, Hightemperature super conductors.

Intermolecular forces and metallic bond

Van der Waals forces (Keesom, Debye & London Interactions). Structure of metals, valence bond andbond model.

Unit-III

The *p*-block elements

Group III

(i) Boron, Al, Ga, In, Ti family: Chemical reactivity and trends.
   Boron : Structures of crystalline boron, electronic and/or crystal structures of borides, boranes and carboranes, metallo-carboranes and their chemistry. Boron halides. Boric acid, borates, boron-nitrogen compounds, $LiAlH_4$ – its uses as a reducing and hydrogenating reagent,

structure of alumina and aluminates. Chemistry of manufacture and setting of Portland cement, organometallic compounds of Al.

Unit-IV

Group IV

(ii) Carbon, Si, Ge, Sn, Pbfamily : Chemical reactivity and group trends
Carbon : Allotropic forms, graphitic compounds, graphite intercalation compounds, carbides.
Silicon : Silicon carbides, silicides, silanes and silylamines structures of silicate mineral, organosilicon compounds and silicones. Tin and lead oxides, halides, Pb accumulators, organometallic compounds of Sn and Pb.

Recommended Books

1. Cotton F.A., Wilkinson G.W. and Gaus P.L., Basic Inorganic Chemistry, Pubs: John Wiley & Sons ,1987.
2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS,1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition, Pubs: Butterworth/Heinemann, 1997.
5. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.
6. Shriver D.F., Atkins F.W. and Langford C.M., Inorganic Chemistry; 3rd Edition, Pubs: Oxford University Press, 1999.
7. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley,1987.
8. Gray H.B., Electrons and Chemical Bonding, Pubs: W.A., J Benjamin Inc.,1965.

ORGANIC CHEMISTRY-II

Subject Code: BBSC1-203	**L T P C** **3 0 0 3**	**Duration: 45 Hrs.**

Unit-I

Arenes and Aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure ofbenzene : molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene,resonance structure, MO picture. Aromatic electrophilic substitution – general pattern of the mechanism, role of σ-and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.

Unit-II

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms ofnucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.Polyhalogencompounds : chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative relativities of alkyl halides vs. allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Unit-III

Alcohols

Classification and nomenclature. Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HIO4 and pinacol-pinacolone rearrangement.

Trihydric alcohols – nomenclature and methods of formation, chemical reactions of glycerol.

Unit-IV

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character.

Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms ofFries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Ledrer-Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions – cleavage and autoxidation, Ziesel’s method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Recommended Books:

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 5th Edn., Pubs: Allyn and Bacon Inc., Boston (1992).
2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 1985.
3. Wade L.G.Jr., Organic Chemistry, Pubs:Prentice-Hall,1990.
4. Solomons G, Fundamentals of Organic Chemistry, Pubs: John Wiley,2002.
5. Carey F.A., Organic Chemistry, Pubs: McGraw-Hill, Inc, 2003.
6. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry, 3rd Edn., Pubs: MacMillan Pub. Co., N.Y,1992.

SPECIAL THEORY OF RELATIVITY

Subject Code: BBSC1-204 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Newton's Laws of Motion

Forces and equations of motion, Lorentz force, Motion of a charged particle in a uniform constant electric field, Charged particle in a uniform alternating electric field. Charged particle in a uniform magnetic field.

Galilean Transformation

Inertial reference frames, absolute and relative accelerations and velocity, Galilean Transformation, Foucault's pendulum, Conservation of Momentum, Fictitious Forces, Collisions, Velocity and Acceleration in Rotating coordinate systems.

Unit-II

Lorentz Transformations

Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations, Simultaneity and causality in relativity. Length contraction, Time dilation, Velocity Transformation, Space-like and time-like intervals, Aberration of light, relativistic Doppler effect.

Unit-III

Relativistic Dynamics

Conservation of Momentum, Relativistic momentum, Relativistic Energy, Transformation of Momentum and Energy, Equivalence of Mass and Energy. Particles with zero Rest mass. Transformation of force, Four vectors.

Unit-IV

Problems in Relativistic Dynamics

Acceleration of Charged Particle by constant, longitudinal electric field, Acceleration by a Transverse Electric field, charged particle in a magnetic field, centre of mass system and Threshold Energy. Energy available from Moving charge, Antiproton Threshold, Photoproduction of mesons.

Principle of Equivalence

Inertial and Gravitational Mass, Gravitational Mass of photons, Gravitational Red-Shift, Equivalence.

Recommended Books

1. Mechanics (Berkeley) Physics Course I : Charles Kittle, Walter D. Knight, M. Alvin and A. Ruderman (Tata McGraw Hill), 1981.
2. Mechanics : H.S. Hans and S.P. Puri (Tata McGraw Hill), 2003.
3. Introduction to Classical Mechanics : R.G. Takwale&P.S.Puranik (Tata-McGraw-Hill), 2000.

ELECTRICITY AND MAGNETISM

Subject Code: BBSC1-205 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Electric Fields in Matter

Dielectrics, Moments of a charge distribution, Potential and field of a dipole, Atomic and molecular dipoles, Induced dipole moments, Permanent dipole moments, electric field caused by polarized matter, field of a polarized sphere, dielectric sphere in a uniform field, Gauss's law and a dielectric medium, Electrical susceptibility and atomic polarizability, Energy changes in polarization, Polarization in changing fields.

Unit-II

The Fields of Moving Charges

Magnetic forces, Measurement of a charge in motion, invariance of charge, Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Field of a charge that starts or stops, Force on a moving charge, Interaction between a moving charge and other moving charges.

Magnetic Field

Definition, some properties of the magnetic field, Vector potential, Fieldof current carrying wire and solenoid, change in **B** at a current sheet; Transformations ofelectric and magnetic fields. Rowland's experiment, Hall effect.

Unit-III

Electromagnetic Induction

Universal law of induction, Mutual inductance, Reciprocity theorem, Self inductance, Energy stored in a Magnetic field. A circuit containing self inductance, Displacement current and Maxwell's equations.

Alternating Current Circuits

A resonance circuit, Alternating current, A.C. networks, Admittance and impedance, skin effect, power and energy in A.C. circuits, Anderson's Bridge, Q factor for series resonance.

Unit-IV

Magnetic Fields in Matter

Response of various substances to magnetic field, Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetic susceptibility.

Tutorials

Relevant problems given at the end of each chapter in books 1, 2 and 3.

Recommended Books

1. Mathematical Methods in the Physical Sciences :M.L.Boas (Wiley), 2002
2. Introduction to Mathematical Physics : C. Harper (Prentice Hall of India), 2004.
3. Electricity and Magnetism (Berkley, Phys. Course 2): E.M. Purcell (Tata McGraw Hill), 1981.
4. Elements of Electromagnetics : M.N.O. Sadiku (Oxford University Press), 2001.
5. Electricity and Magnetism : A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill), 1988.
6 Electricity and Magnetism : A.N. Matveev (Mir) (1986).

Coordinate Geometry

Subject Code: BBSC1-206 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Pair of Straight lines
Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

Circle
General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t circle, radical axis, co-axial family of circles ,limiting points.

Conic
General equation of conic, Tangents, normals, chord of contact, pole and polar, of tangents from a point, equation of chord in terms of midpoint, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

Transformation of axes in two dimensions
Shifting of origin, rotation of axes, the second degree equation S=ax2+2hxy+by2+2gx+2fy+c=0, its and O. Reduction of the second degree equation into standard□□invariantsform. Identification of curves represented by S=0 (including pair of lines)

Polar coordinates
Polar equations of straight lines ,circles and conics. Polar equation of chords, tangents normals only.

Calculus-II

Subject Code: BBSC1-207 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Vector Analysis
Vectors in the plane Cartesian Co-ordinates and vectors in spaces. Dot and cross products. Lines and planes in space, Cylinders and Quadric surfaces. Cylindrical and Spherical coordinates
Vector valued functions and space curves. Modelling Projectile Motion. Arc length and Unit Tangent vector curvature, Torsion and the TNB Frame. Line and Surface integrals. (Scope as in chapters 10, 11 and 14 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Multivariable Functions
Functions of several variables. Limits and continuity. Partial derivatives. Differentiability. The chain rule, Directional derivatives, Gradient vectors and tangent planes. Extreme values and saddle points. Lagrange multipliers Double integrals. Double integrals in Polar Form. Triple integrals in Rectangular co-ordinates. Triple integrals in Cylindrical and Spherical coordinates. (Scope as in Chapters 12 and 13 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition).

Recommended Books

1. Thomas and Finney: Calculus and Analytic Geometry, Ninth Edition.
2. Liefhold, Louis: Calculus and Analytic Geometry.
3. LipmenBers: Calculus.

ENVIRONMENT EDUCATION

Subject Code: BBSC1-208 **L T P C** **Duration: 45 Hrs.**
3 0 0 0

1. **Environment Concept**
   Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Natural resources - their need and types: Principles and scope of Ecology; concepts of ecosystem, populat ion, community, biotic interact ions, biomes, ecological, succession.
2. **Atmosphere**
   Parts of atmosphere, components of air: pollution, pollutants, their sources, permissible limits, risks and possible control measures.
3. **Hydrosphere**
   Types of aquatic systems; Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water. permissible limits, risks and possible control measures.
4. **Lithosphere**
   Earth crust, soil - a life support system, its texture, types, components. pollution and pollutants, reasons of soil erosion and possible control measures.
5. **Forests**
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, ChipkoAndolan.
6. **Conservation of Environment**
   The concepts of conservat ion and sustainable development, why to conserve, aims and object ives of conservat ion, policies of conservation; conservation of life support systems - soil, water, air, wildlife, forests.
7. **Management of Solid Waste**
   Merits and demerits of different ways of solid waste management - open dumping, landfill, incineration, resource reduction, recycling and reuse. vermicomposting and vermiculture, organic farming.
8. **Indoor Environment**
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles: possible adulterants of the food: uses and harms of plastics and polythene: hazardous chemicals, solvents and cosmetics.
9. **Global Environmental issues**
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity: Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment
Indian Laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity
What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution
Pollution due to noise and microbes and their effects.

13. Human Population and Environment
Population growth and family welfare, Human Health, HIV AIDS, Human Rights.

14. Social Issues
Environmental Ethics : Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. Local Environmental Issues:
Environmental problems in rural and urban areas. Problem of Congress Grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

Recommended Books

1. J.G. Henry and G.W. Heinke, ‘Environmental Sc. & Engineering’, Pearson Education, **2004**.
2. G.B. Masters, ‘Introduction to Environmental Engg. & Science’, Pearson Education, **2004**.
3. ErachBharucha, ‘Textbook for Environmental Studies’, UGC, New Delhi.

CHEMISTRY Lab-II

Subject Code: BBSC1-209 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. Qualitative Analysis
Qualitative analysis of inorganic mixtures containing not more than six radicals including interfering radicals like phosphate, oxalate, tartrate and similar radicals.

2. Quantitative Analysis

Volumetric Methods

(a) Acid-base titrations
Preparation of standard hydrochloric acid and sodium hydroxide solution. Preparation of some buffers and measuring their pH value, pH titration of unknown soda ash.

(b) Oxidation Reduction titrations
(i) Potassium permanganate and potassium dichromate titrations
(ii) Iodimetric and iodometric titrations
(iii) Potassium Iodate titrations.

(d) Precipitation titrations- Titrations involving silver nitrate.

Recommended Books

1. Svehla G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
2. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.
3. Palmer, W.G., Experimental Inorganic Chemistry; 1st edition, Pubs: Cambridge, 1954.

Physics Lab-II

Subject Code: BBSC1-210 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

List of Experiments

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurement of CDR (iii) Determine a high resistance by Leakage Method (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer Theorem.

Recommended Books

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

PHYSICAL CHEMISTRY-II

Subject Code: BBSC1-301 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Thermodynamics-I

Definition of thermodynamics terms: system, surroundings. Types of systems, intensive and extensive properties. State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermochemistry.First Law of Thermodynamics : statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Unit-II

Thermodynamics-II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy as a state function, entropy as a function of V &T, entropy as a function of P &T, entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Unit-III

Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Unit-IV

Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore-Clapeyron equation and Clausius-Claperyron equation.

Recommended Books

1. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.
2. University General Chemistry. C.N.R. Rao. Macmillan.
3. Physical Chemistry. R.A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P.W. Aikins, Oxford.

ORGANIC CHEMISTRY-III

Subject Code: BBSC1-302 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Alcohols

Classification and nomenclature. Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature,

Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [$Pb(OAc)_4$and HIO_4] and Pinacol-Pinacolone rearrangement. Trihydric alcohol-nomenclature, methods of formation and chemical reactions of glycerol.

Unit-II

Phenols

Nomenclature, structure and bonding. Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Hauben. Hostch reaction. Lederer-Mianasse reaction and Reimer-Tiemann reaction.

Unit-III

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3- dithianes, synthesis of ketones from nitrites and carboxylic acids.

Unit-IV

Some important reactions of aldehydes and ketones

Mechanism of nucleophillic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (MeerweinPondoroffVorley) reaction, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. An Introduction to α, β unsaturated aldehydes and ketones, Michael addition.

Recommended Books

1. Organic Chemistry. Morrison and Boyd, Prentice Hall.
2. Organic Chemistry. L.G. Wade lr.Prentice Hall.
3. Fundamentals of Organic Chemistry. Solomons, John Wiley.
4. Organic Chemistry. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).

VIBRATIONS AND WAVES

Subject Code: BBSC1-303 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Simple harmonic motion, energy of a Simple Harmonic Oscillation (SHO). Compound pendulum, Electrical oscillations. Transverse vibrations of a mass on a string, composition of two perpendicular SHM of same period and of period ratio 1 : 2. Anharmonic oscillations. Decay of free vibrations due to damping. Differential equation of motion, types of damping. Determination of damping co-efficient-logarithmic decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator).

Unit-II

Differential equation for forced mechanical and electrical oscillators. Transient and steady state oscillation. Displacement and velocity variation with driving force frequency, variation of phase with frequency resonance, Power supplied to an oscillator and its variation with frequency, Q value of a forced oscillator and band width. Q-value as an amplication factor of low frequency response.

Unit-III

Stiffness coupled oscillators. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators, Types of waves, Wave equation (transverse) and its solution, The string as a forced oscillator, Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy, Reflection and Transmission Energy, Reflection and transmission of string, wave and group velocity. Standing waves on a string of fixed length. Energy of vibrating energystring,wave and group velocity.

Unit-IV

Physical interpretation of Maxwell's equations. Electromagnetic waves and wave equation in a medium having finite permeability and permittvity but with conductivity σ=0. Pointing vector. Impedance of a dielectric to EM waves, EM waves in a conducting medium and skin depth. EM waves velocity in a conductor an anomalous dispersion. Response of a conducting medium of EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal incidence. Reflection of EM waves from the surface of a conductor at normal incidence.

Recommended Books

1. Fundamentals of Vibrations and Waves by S.P.Puri, Tata McGraw Hill, New Delhi.
2. Physics of Vibrations and Waves by H.J.Pain, Wiley & Sons, New Delhi
3. Waves and Oscillations, by E.Crawford, Berkeley Physics Course, McGraw-Hill Publications, New Delhi.
4. EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain, Prentice Hall of India, New Delhi.

MECHANIC-II

Subject Code: BBSC1-304 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle, Various forces in Nature(brief introduction), Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force,Equation of orbit in inverse square, Force field and turning points, Kepler laws and their derivations.

Unit-II

Relationship of conservation laws and symmetries of space and time. Inertial frame of reference. Coriolis force and its applications. Variation of acceleration due to gravity with latitude. Focault pendulum (qualitative). Elastic collision in Laboratory and C.M.system, velocities, angels and energies, Cross section of elastic scattering, Rutherford scattering (qualitative).

Unit-III

Rigid body motion: Rotational motion, principal moments and axes. Euler's equations; precession and elementary gyroscope. Galilean transformation and Invariance, Non-Inertial frames, concept of stationary universal frame of reference and ether. Michelson-Morley experiment and its result.

Unit-IV

Postulates of special theory of relativity. Lorentz transformations, Observer and viewer in relativity. Relativity of simultaneity. Length, Time, Velocities,Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelatic collision, Relativistic momentum and energy, their transformation, concepts of Minkowski space, four vector formulation.

Recommended Books

1. Mechanics: Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication.
2. Mechanics : H.S.Hans and S.P.Puri, Tata Mc Graw Hill Publication, New Delhi

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ALGEBRA-I

Subject Code: BBSC1-305 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

Unit-II

Circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Unit-III

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

Unit-IV

Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

RecommendedBooks

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993.**
6. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, **1976**.

ANALYSIS-I

Subject Code: BBSC1-306 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of BolzanoWeierstrass theorem.

Unit-II

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

Unit-IV

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, Mtest, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

RecommendedBooks

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5. ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

DRUG ABUSE

Subject Code: BBSC1-307	L T P C 3 0 0 0	Duration: 45 Hrs.

Unit-I

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

Unit-II

Consequences of Drug Abuse: Individual: Education, Employment, Income, Family: Violence. Society: Crime. Nation: Law and Order problem.

Unit-III

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

Unit-IV

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counseling, Behavioral and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

Recommended Books

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. IshwarModi and ShaliniModi, 'Addiction and Prevention', Rawat Publications, Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 & 2004.

CHEMISTRY LAB-III

Subject Code: BBSC1-308 **L T P C** **00 2 1** **Duration: 30 Hrs.**

Volumetric Analysis and TLC

Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH, Alkalinity of water sample.

(b) Determination of alkaline content of antacid.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry .

(d) Estimation of hardness of water by EDT A.

(e) Estimation of ferrous and ferric by dichromate method.

(f) Estimation of copper using sodium thiosulphate.

Organic Chemistry

Laboratory Techniques

Thin Layer Chromatography

Determination of R_f values of different components.

(a) Separation of green leaf pigments (spinach leaves may be used)

(b)Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenoneand cyclohexanone using toluene and light petroleum mixture (40 : 60).

(c) Separation of a mixture of dyes.

Recommended Books

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orienl P Longman.
2. Vogel's Text book of Quantitative Inorganic Analysis (revised), J.Bassett, R. C. Denney, G.H. Jeffery and J. Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W. W. Scott, The Technical Press.
4. Experimental Inorganic Chemistry, W. G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol. I & II, Brauer, Academic Press.
6. Inorganic Synthesis, Mc-Graw Hill.
7. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw Hill.

8. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.
Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS

PHYSICS LAB-III

Subject Code: BBSC1-309 **L T P C** **Duration: 30 Hrs.**
0 0 21

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures.
4. Determination of modulus of rigidity by (i) dynamic method Maxwell's needle/Torsional pendulum; (ii) Forced torsional oscillations excited using electromagnet.
5. Determination of coefficient of viscosity of a given liquid by Stoke's method. Study its temperature dependence.
6. To determine the Young's modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.
7. To study one dimensional collision using two hanging spheres of different materials.
8. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
9. To measure the coefficient of linear expansion for different metals and alloys.
10. Determination of E.C.E. of hydrogen and evaluation of Faraday and Avogadro constants.
11. To study the magnetic field produced by a current carrying solenoid using a pick-up coil/Hall sensor and to find the value of permeability of air.
12. To determine the frequency of A.C. mains using sonometer.
13. To study given source of electrical energy and verify the maximum power theorem.

Recommended Books

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

PHYSICAL CHEMISTRY-III

Subject Code: BBSC1-401 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag sytems, desilverisation of lead. Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCI-H_2O$), ($FeCI_3H_2O$) systems. Freezing mixtures, acetone-dry ice. Partially miscible liquids: Lower and upper consolute temperature, Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law, thermodynamic derivation & applications.

Unit-II

Electrochemistry-l (a)

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution. Migration of ions and Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elemental treatment only).

Unit-III

Electrochemistry-I (b)

Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.

Unit-IV

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode. potential, sign conventions, electrochemical series and its significance.Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations. Definition of pH and pK., determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiomentric methods. Buffers--mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of saits, Corrosion-types, theories and methods of combating it.

Recommended Books

1. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.
2. University General Chemistry. C.N.B. Rao. Macmillan.
3. Physical Chemistry. R.A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P.W. Aikins, Oxford.
5. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.

INORGANIC CHEMISTRY-III

Subject Code: BBSC1-402 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-II

Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability of water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Unit-III

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases.

Unit-IV

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Recommended Books

1.Basic Inorganic Chemistry. F.A. Cotton. G. Wilkinson and P.L..Gaus. Wiley.
2.Concise Inorganic Chemistry. J.D. Lee. ELBS.
3.Concepts of Models of Inorganic Chemistry. B. Doaglas. D. McDaniel and 1. Alexander,John Wiley.
4.Inorganic Chemistry. D.E. Shriver, P. W. Aikins and C.H. Langford. Oxford.
5. Inorganic Chemistry. A.G. Sharpe, ELBS.
6. Inorganic Chemistry. G.L. Miessler and O.A. Tarr, Prentice Hall.

STATISTICAL PHYSICS AND THERMODYAMICS

Subject Code: BBSC1-403 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Unit-II

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, ClausiusClapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, RayleighJeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Unit-III

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Unit-IV

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

Recommended Books

1. Statistical Physics, thermodynamics and kinetic theory by V.S.Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears&G.L.Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

QUANTUM MECHANICS

Subject Code: BBSC1-404 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Formalism of Wave Mechanics: Brief introduction to need and development of quantum mechanics, Wave-particle duality, de-Broglie hypothesis, Complimentarity and uncertainty principle, Gaussian wave-packet, Schrodinger equation for a free particle, operator correspondence and equation for a particle subject to forces. Normalization and probability Interpretation of wave function, Super position principle, Expectation value, probability current and conservation of probability, Admissibility conditions on the wave function. Ehrenfest theorem, Fundamental postulates of wave mechanics, Eigen functions and eigen values. Operator formalism, Orthogonal systems, Expansion in eigen functions, Hermitian operators. Simultaneous eigen functions. Equation of motion.

Unit-II

Problems in one and three dimensions: Time dependent Schrodinger equation. Application to stationary states for one dimension, Potential step, Potential barrier, Rectangular potential well, Degeneracy, Orthogonality, Linear harmonic oscillator, Schrodinger equation for spherically symmetric potential, Spherical harmonics. Hydrogen atom energy levels and eigen functions. Degeneracy, Angular momentum.

Unit-III

One Electron Atomic Spectra

Excitation of atom with radiation. Transition probability, Spontaneous transition, Selection rules and life time, Spectrum of hydrogen atom. Frank Hertz Experiment, Line structure, Normal Zeeman effect, Electron spin, Stern Gerlach experiment, Spin orbit coupling (electron magnetic moment, total angular momentum),Hyperfine structure, Examples of one electron systems, Anomalous,Zeeman effect, Lande-g factor (sodium D-lines).

Unit-IV

Many Electron System Spectra

Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling, Selection rules, Regularities in atomic spectra, Interaction energy, X-ray spectra, Mosley law, Absorption spectra, Auger effect. Molecular bonding, Molecular spectra, Selection rules, Symmetric structures, Rotational, vibrational electronic level and spectra of molecules, Raman spectra.

Recommended Books

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
4. Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.
5. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

6. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press.
7. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
8. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Edu.
9. Quantum Mechanics, Walter Greiner, 4thEdn., 2001, Springer.

ALGEBRA-II

Subject Code: BBSC1-405 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

Unit-II

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem

Unit-III

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Unit-IV

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

Recommended Books

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004.**
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993.**
3. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, **1976**.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

ANALYSIS-II

Subject Code: BBSC1-406 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem.

Unit-II

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic and trigonometric functions.

Unit-III

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

Unit-IV

Metric Spaces

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

Recommended Books

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5. Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

CHEMISTRY LAB-IV

Subject Code: BBSC1-407 **L T P C** **Duration: 30 Hrs.**
0 0 21

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

Recommended Books

1. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw Hill.
2. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V.
4. frogers, P.W.G. Smith and AR. Tatchell, ELBS
5. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
6. Experiments in Physical Chemistry, R.C. Das, and B. Behra, Tata Mc-graw Hill.
7. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

PHYSICS LAB-IV

Subject Code: BBSC1-408 **L T P C** **Duration: 30 Hrs.**
0 02 1

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Recommended Books

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

COMPUTER PROGRAMMING LAB

Subject Code: BBSC1-409 | **L T P C** **0 0 4 2** | **Duration: 60 Hrs.**

List of following programs are as follows:

1. **Operators:** Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. **Decision Making:** switch, if-else, nested if, else-if ladder, break, continue, go to
3. **Loops:** while, do-while, for
4. **Functions:** Definition, Declaration, call by value, Call by reference, Recursive Function
5. **Arrays:** Arrays declarations, Single and multi-dimensional, Strings and string functions
6. **Pointers:** Pointer declarations, Pointer to function, Pointer to array.

Recommended Books

1. ShubhnandanJamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

INORGANIC CHEMISTRY-IV

Subject Code: BBSC1-501 | **L T P C** **3 0 0 3** | **Duration: 45 Hrs.**

Unit-I

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Unit-II

Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-III

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes.

Unit-IV

Electronic Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for $d^1$and d^9 states, discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complexion.

Recommended Books

1. Basic Inorganic Chemistry, F.A. Cotton, G Willdson and P.L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Leee, ELBS.
3. Concept of models of Inorganic Chemistry, B. Douglas, D. McDaniel, and J. Alexander, Jolin Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield Addison-Welsey.
6. Inorganic Chemistry, A. G Sharpe, ELBS
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.

ORGANIC CHEMISTRY-IV

Subject Code: BBSC1-502	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Unit-I

Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromoethane, ethyl acetate, toluene and acetophenone.

Unit-II

Electromagnetic spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis of UV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Unit-III

Infrared (IR)

Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of lR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organic compounds. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR, and PMR spectroscopic techniques.

Unit-IV

Organometallic Compounds

Organomagnesium Compounds The Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithiumcompounds: formation and chemical reactions.

Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, and sulphonamides.

Recommended Books

1. Fundamentals of Organic Chemistry, Solomons, John Wiley.
2. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
3. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
4. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.

CONDENSED MATTER PHYSICS

Subject Code: BBSC1-503 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Unit-I

Crystal Structure. Symmetry operations for a two dimensional crystal. Two dimensional Bravais lattices, Three dimensional Bravais lattices" Basic primitive cells. Crystal planes and Miller indices. Diamond and NaCI structure. Packing fraction for Cubic and hexagonal closed packed structure.

Unit-II

Crystal Diffraction: Bragg's Law, Experimental methods for crystal structure studies, laue equations, Reciprocal lattices of SC, BCC and FCC, Bragg's Law in reciprocal lattice. Brillouin zones and its derivation in two dimensions, Structure factor and atomic form factor.

Unit-III

Lattice vibrations, Concepts of phonons, Scattering of protons by phonons. Vibration of mono-atomic, di-atomic, linear chains. Density of modes, Einstein and Debye models of specific heat, Free electron model of metals. Free electron, Fermi gas and Fermi energy.

Unit-IV

Band theory, Kronig-Penney Model. Metals and insulators, Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors, superconductivity, Magnetic field effect in superconductors, BCS theory. Thermal properties of superconductors

Recommended Books

1. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
2. Elements of Modern Physics by S. H. Patil (TMGH, 1985)
3. Solid State Physics by Puri and Babbar.

LASER AND OPTICS

Subject Code: BBSC1-504 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Interference: Concept of coherence, Spatial and temporal coherence. Coherence time, Coherence length, Area of coherence, Conditions for observing interference fringes, Interference by wave front division and amplitude division, Michelson's interferometer—working, Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings. Multiple beam interference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

Unit-II

Diffraction: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Retardation plates, Production and analysis of polarized light (quarter and half wave plates).

Unit-III

Laser Fundamentals

Derivation of Einstein's relations. Concept of stimulated emission and population inversion. Broadening of spectral lines, natural, collision and Doppler broadening. Line width, Line profile, Absorption and amplification of a parallel beam of light passing through a medium. Threshold condition, Introduction of three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.

Unit-IV

Laser Systems

types of lasers, Ruby and Nd: YAG lasers, He-Ne and CO_2 lasers-construction, mode of creating population inversion and output characterstics. Semiconductor lasers, Dye lasers, Q-switching, Mode locking, Applications of lasers–a general outline. Basics of holography

Recommended Books

1. Fundamentals of Optics, F.A. Jenkins and Harvery E. White (McGraw Hill) 4th edition, 2001.
2. Optics, AjoyGhatak (McMillan India) 2nd edition, 7th reprint 1997.
3. Introduction to Atomic Spectra, H.E. White (McGraw Hill Book Co.)
4. Optics, Born and Wolf (Pergamom Press), 3rd edition, 1965.

5. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi,1996.
6. Lasers and Non-linear Optics, B.B. Laud (New Age Pub.), 2002.
7. Lasers, Svelto (Plenum Press), 3rd Ed., New York.

DIFFERENTIAL EQUATIONS

Subject Code: BBSC1-505 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.

Unit-II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation, Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

Unit-IV

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Recommended Books

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

NUMERICAL METHODS

Subject Code: BBSC1-506 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, GaussJacobi, Gauss-Siedel and SOR iterative methods.

Unit-II

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulaewith error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

Unit-III

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

Unit-IV

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, **1980.**
4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., **2001.**

CHEMISTRY LAB-V

Subject Code: BBSC1-507 **L T P C** **Duration: 30 Hrs.**
00 21

Synthesis and Analysis

(a) Preparation of sodium trioxalatoferrate(III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.
(b) Preparation of Ni-DMG complex, $[Ni\ (DMG)_2]^{2+}$
(c) Preparation of copper tetra-ammine complex. $[Cu\ (NH_3)_4]\ SO_4$.
(d) Preparation of cis-and trans-bis(oxalato)diaquachromate(III) ion.

Synthesis or Organic Compounds

(a) Iodoform from ethanol and acetone
(b) Aromatic electrophlic substitution of benzene
1. p-nitroacetanilide
2. 2,4,6-tribromophenol Diazotization/Coupling

3. Preparation of methyl orange and methyl red
4. Preparation of benzoic acid from toluene
5. Preparation of m-nitroaniline from m-dinitrobenzene

Recommended Books

1. Experimental Inorganic Chemistry, W. G. Palmer, Cambridge.
2. Handbook of Preparative Inorganic Chemistry, Vol. I & II, Brauer, Academic Press.
3. Inorganic Synthesis, Mc-Graw Hill.
4. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw Hill.
5. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.

Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS Experiments in General Chemistry C.N.R. Rao and U.C. Agarwal, East-West Press.

PHYSICS LAB-V

Subject Code: BBSC1-508 **L T P C** **0 0 2 1** **Duration: 30 Hrs.**

1. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
2. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
3. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
4. To determine the value of Cauchy Constants of a material of a prism.
5. To determine the Resolving Power of a Prism.
6. To determine wavelength of sodium light using Fresnel Biprism.
7. To determine wavelength of sodium light using Newton's Rings.
8. To determine the wavelength of Laser light using Diffraction of Single Slit.
9. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating .
10. To determine the Resolving Power of a Plane Diffraction Grating.
11. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.
12. Familiarization with Schuster`s focussing; determination of angle of prism.

Recommended Books

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

PHYSICAL CHEMISTRY-IV

Subject Code: BBSC1-601 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Raman Spectrum

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Unit-II

Electronic Spectrum

Concept of potential energy curves for bonding and antibondingmolecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and n M.O.their energy levels and their respective transitions.

Unit-III

Solid State

Definition of space lattice and unit cell.

Laws of crystallography-(i) Law of constancy of interfacial angles. (ii) Law of rationality of indices (iii) Law of symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl, KCI and CsCI (Laue's method and powder method).

Unit-IV

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry: Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, non-radiative processes (internal conversion, intersystem crossing), quantumyield, photosensitized reactions-energy transfer processes (simple examples). Basic concepts of Laser and Maser. Photochemistry of vision and colour.

Recommended Books

1. Physical Chemistry, G.M. Barrow, International Student edition, McGraw Hill.
2. University General Chemistry, C.N.R. Rao. Macmillan.
3. Physical Chemistry, R.A Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P. W. Atkins, Oxford.
5. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Willey Eastern Ltd.
6. Fundamentals of Photochemistry, Rohtga and Mukherji.

ORGANIC CHEMISTRY-V

Subject Code: BBSC1-602 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophlic substitution. Mechanism of nucleophlic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles.Preparation and reactions of indole, quinoline and isoquinolinewith special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophlic substitution reactions of indole, quinoline and isoquinoline.

Unit-II

Synthesis of Polymers

Ziegler-Natta polymerziation and vinyl polymers. Condensation or step growth polymerziation. Urea formaldhehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Organic Synthesis ViaEnolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate. Alkylation and acylation of enamines.

Unit-III

Carbohydrates

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.

Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers, and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch and cellulose without involving structure determination.

Unit-IV

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, Constituents of nucleic acids Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Recommended Books

1. Fundamentals of Organic Chemistry, Solomons, John Wiley.
2. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
3. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
4. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.

ELECTRONICS

Subject Code: BBSC1-603 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Concept of current and voltage sources, p-n junction, Biasing of diode, V-A characteristics. Diode equation, Breakdown diodes: Zener breakdown and avalanche breakdown, Zener diode. Rectification: half wave, full wave rectifiers and bridge rectifiers, Qualitative analysis of Filter circuits (RC LC and π filters) Efficiency, Ripple factor, Voltage regulation. Voltage multiplier circuits.

Unit-II

Junction transistor: structure and working, relation between different currents in transistors, Sign conventions. Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics.Structure, Characteristics, operation of FET, JFET and MOSFET,Pinch off voltage, Enhancement and Depletion mode, Comparison of JFETs and MOSFETs, Difference in field effect transistor and junction type transistor.Photo-conductive devices: Photo-conductive cell, Photodiode, Solar cell, LED, LCD.

Unit-III

Thyristor, SCR, TRIAC, DIAC: Construction, Characteristics and Operation; Comparison between transistors and thyristors; Difference between SCR and TRIAC. UJT: its construction, Equivalent circuit, Characteristics and parameters, uses.Thermistor: Types, Construction, Characteristics, Uses, Advantages over other temperature sensing devices. IMPATT and TRAPATT devices, PIN diode: Construction, Charatersitics, Applications.

Unit-IV

Gunn effect and diodes: Mechanism, Characteristic, Negative differential resistivity and Domain formation. Tunnel diode: Tunneling Phenomenon, Operation, Applications. Merits and Drawbacks, Transistor biasing: Stabilization of operating point, Fixed bias, Collector to base bias, Bias circuit with emitter resistor, Voltage divider biasing circuit.CE amplifier: Working and analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier: Voltage, Current and Power gainFeed back in amplifiers: Types & advantage of negative feedback. Emitter follower as negative feed back circuit.

Recommended Books

1. Basic Electronics and Linear Circuits by N. N. Bhargave, D.C. Kulshreshtha and S. C. Gupta.
2. Electronic Devices and Circuits: J. B. Gupta (Publ. KATARIA & SONS)

3. Electronic Devices and Circuits: G. K. Mithal, Khanna Publishers
4. Fundamentals of Electronics by D. Chatopadhyay, P.C. Rakshit, B. Saha and N.N.Purkit.
5. Basic Electronic by D.C.Tayal (Himalaya Pub.)

NUCLEAR AND PARTICLE PHYSICS

Subject Code: BBSC1-604 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

General Properties of Nuclei and Nuclear Models: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Unit-II

Radioactive decay and Nuclear Reactions: Alpha decay: basics of α-decay processes, theory of αemission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

Unit-III

Interaction of Nuclear Radiations with matter and detection of Nuclear radiations: Energy loss due to ionization (BetheBlock formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility).

Unit-IV

Particle Physics and Particle Accelerators: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular. momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

Recommended Books

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).

2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
5. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
8. Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

NUMBER THEORY

Subject Code: BBSC1-605 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

Unit-II

Modular arithmetic, Basic properties of congruence's, linearcongruence's, Simultaneous linear congruence's, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

Unit-III

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

Unit-IV

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler's Phi function, Euler's theorem, someproperties of the Phi Function.

Recommended Books

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, 'Introduction to Analytic Number Theory', Springer.
4. Paul T. Bateman, 'Analytic Number Theory', World scientific.
5. H. Rosen Kenneth, 'Elementary Number Theory', 6th Edn.

6. G.H. Hardy, 'An Introduction to the Theory of Numbers', 6th Edn.

MATHEMATICAL STATISTICS

Subject Code: BBSC1-606 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem, Random variable, function of random variable, and their distributions, probability mass function, probability density function, cumulative distribution function.

Unit-II

Concept of random variables and probability distributions: Two dimensional random variables, Joint, Marginal and conditional distributions, Independence of random variables, Expectation, Conditional expectation, Moments, Product moments, Probability generating functions, Moment generating function and its properties.

Unit-III

Study of various discrete and continuous distributions: Binomial, Poison, Negative binomial distributions.

Unit-IV

Concept of sampling distribution and its standard error, Derivation of sampling distributions of Chisquare, t and F distribution of sample mean and variance Testing of hypotheses, fundamental notions important tests based on normal distributions, Tests of significance: tests based on normal distribution, Chi-square, t and F statistic.

Recommended Books

1. R.V. Hogg &Craige, 'Introduction to Mathematical Statistics', 7th Edn.,2005
2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, 1990.
3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, 1975.
4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', 2009.
5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, 1975.

CHEMISTRY LAB-VI

Subject Code: BBSC1-607 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

Laboratory Techniques

1. Column Chromatography
2. Separation of fluorescein and methylene blue.

3. Separation of leaf pigments from spinach leaves.
4. Physical Experiments

(a) To determine the strength of the given acid conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a given sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To determine the strength of the given acid solution pH- metrically by using standard alkali solution.
(f) To determine the molar refraction of methanol, ethanol and propanol.
(g) To study the distribution of benzoic acid between benzene and water, and ether and water.
(h) Knowledge of Stereochemical Study of Organic Compounds.
Rand S configuration of optical isomers.
E, Z configuration of geometrical isomers.
Conformational analysis of cyclohexanes and substituted cyclohexanes.

Recommended Books

1. Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS
2. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
3. Experiments in Physical Chemistry, R.C. Das, and B. Behra, Tata Mc-graw Hill.
4. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
5. Advanced Exp. Chemistry, Vol. I-Physical, J.N. Gurutu and R. Kapoor, S. Chand & Co.

PHYSICS LAB-VI

Subject Code: BBSC1-608 | **L T P C 0 0 21** | **Duration: 30 Hrs.**

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder
5. Adder-Subtractor using Full Adder I.C.

6. To design an astablemultivibrator of given specifications using 555 Timer.
7. To design a monostablemultivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.

12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.

13. To study a precision Differential Amplifier of given I/O specification using Opamp.
14. 14. To investigate the use of an op-amp as a Differentiator
13. To design a Wien Bridge Oscillator using an op-amp.

Recommended Books

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

1st Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BSNMS1-101	English (Ability Enhancement Compulsory Course –I)*	2	0	0	40	60	100	2
BSNMS1-102	Mechanics (Core Course-I)*	4	0	0	40	60	100	4
BSNMS1-103	Inorganic Chemistry-I (Core Course-II A)*	3	0	0	40	60	100	3
BSNMS1-104	Organic Chemistry-I (Core Course-II B)*	3	0	0	40	60	100	3
BSNMS1-105	Differential Calculus-I (Core Course-III A)*	3	0	0	40	60	100	3
BSNMS1-106	Differential Calculus-II (Core Course-III B)*	3	0	0	40	60	100	3
BSNMS1-107	Mechanics Lab (Core Course-I Practical)*	0	0	4	60	40	100	2
BSNMS1-108	Chemistry Lab- I (Core Course-II Practical)*	0	0	4	60	40	100	2
Total		**18**	**0**	**08**	**360**	**440**	**800**	**22**

2nd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMS1-201	Environmental Science (Ability Enhancement Compulsory Course –II)*	2	0	0	40	60	100	2
BSNMS1-202	Electricity, Magnetism and EMT (Core Course-IV)*	4	0	0	40	60	100	4
BSNMS1-203	Physical Chemistry-I (Core Course-V A)*	3	0	0	40	60	100	3
BSNMS1-204	Organic Chemistry-II (Core Course-V B)*	3	0	0	40	60	100	3
BSNMS1-205	Differential Equations-I (Core Course-VI A)*	3	0	0	40	60	100	3
BSNMS1-206	Differential Equations-II (Core Course-VI B)*	3	0	0	40	60	100	3
BSNMS1-207	Electricity, Magnetism and EMT Lab (Core Course-IV Practical)*	0	0	4	60	40	100	2
BSNMS1-208	Chemistry Lab-II (Core Course-V Practical)*	0	0	4	60	40	100	2
Total		**18**	**0**	**08**	**360**	**440**	**800**	**22**

3rd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BSNMS1-301	Thermal Physics and Statistical Mechanics (Core Course-VII)*	4	0	0	40	60	100	4
BSNMS1-302	Thermal Physics and Statistical Mechanics Lab (Core Course-VII Practical)*	0	0	4	60	40	100	2
BSNMS1-303	Inorganic Chemistry-II (Core Course-VIII A)*	3	0	0	40	60	100	3
BSNMS1-304	Physical Chemistry-II (Core Course-VIII B)*	3	0	0	40	60	100	3
BSNMS1-305	Chemistry Lab III (Core Course-VIII Practical)*	0	0	4	60	40	100	2
BSNMS1-306	Real Analysis-I (Core Course IX A)*	3	0	0	40	60	100	3
BSNMS1-307	Real Analysis-II (Core Course IX B)*	3	0	0	40	60	100	3
BSNMS1-308	Computational Physics Skills (Skill Enhancement Course-1)*	0	0	4	60	40	100	2
Total		**16**	**0**	**12**	**380**	**420**	**800**	**22**

4Th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMS1-401	Waves and Optics (Core Course-X)*	4	0	0	40	60	100	4
BSNMS1-402	Waves and Optics Lab (Course-X Practical)*	0	0	4	60	40	100	2
BSNMS1-403	Organic Chemistry-III (Core Course-XI A)*	3	0	0	40	60	100	3
BSNMS1-404	Physical Chemistry-III (Core Course-XI B)*	3	0	0	40	60	100	3
BSNMS1-405	Chemistry Lab-IV (Core Course-XI Practical)*	0	0	4	60	40	100	2
BSNMS1-406	Algebra-I (Core Course-XII A)*	3	0	0	40	60	100	3
BSNMS1-407	Algebra-II (Core Course-XII B)*	3	0	0	40	60	100	3
BSNMS1-408	Basic Analytical Chemistry (Skill Enhancement Course-II)*	0	0	4	60	40	100	2
Total		**16**	**0**	**12**	**380**	**420**	**800**	**22**

5Th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMD1-511	Digital Analog and Instrumentation (Discipline Specific Elective-I)*	4	0	0	40	60	100	4
BSNMD1-521	Chemistry of Main group elements (Discipline Specific Elective-II)*	4	0	0	40	60	100	4
BSNMD1-531	Matrices (Discipline Specific Elective-III A)*	3	0	0	40	60	100	3
BSNMD1-532	Linear Algebra (Discipline Specific Elective-III B)*	3	0	0	40	60	100	3
BSNMD1-512	Digital Analog and Instrumentation Lab (Discipline Specific Elective Lab-I)*	0	0	4	60	40	100	2
BSNMD1-522	Chemistry of Main group elements Lab (Discipline Specific Elective Lab-II)*	0	0	4	60	40	100	2
BSNMS1-533	Computer Programming Lab (Skill Enhancement Course-3)*	0	0	4	60	40	100	2
Total		**14**	**0**	**12**	**340**	**360**	**700**	**20**

6Th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMD1- 611	Elements of Modern Physics (Discipline Specific Elective-4)*	4	0	0	40	60	100	4
BSNMD1-612	Elements of Modern Physics Lab (Discipline Specific Elective Lab-4) *	0	0	4	60	40	100	2
BSNMD1-621	Comprehensive Chemistry (Discipline Specific Elective-V)*	4	0	0	40	60	100	4
BSNMD1-622	Comprehensive Chemistry Lab (Discipline Specific Elective Lab-V)*	0	0	4	60	40	100	2
BSNMD1-631	Numerical Methods (Discipline Specific Elective-VI A)*	3	0	0	40	60	100	3
BSNMD1-632	Complex Analysis (Discipline Specific Elective-VI B)*	3	0	0	40	60	100	3
BSNMS1-633	Numerical Analysis Lab (Skill Enhancement Course-4)*	0	0	4	60	40	100	2
	Total	**14**	**0**	**12**	**340**	**360**	**700**	**20**

ENGLISH

Subject Code:BSNMS1-101 **L T P C** **Duration:30 Hrs.**
2 0 0 2

UNIT-I

Introduction:
Theory of Communication, Types and modes ofCommunication
Language of Communication:
Verbal and Non-verbal, (Spoken and Written), Personal, Social and Business, Barriers and StrategiesIntra-personal, Inter-personal and Group communication

UNIT-II

Speaking Skills:
Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

UNIT-III

Reading and Understanding
Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Indian language to English and vice-versa), Literary/Knowledge Texts.

UNIT-IV

Writing Skills
Documenting, Report Writing, Making notes, Letter writing

Recommended Books:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul,Dr Brati Biswas

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MECHANICS

Subject Code:BSNMS1- 102 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

UNIT-I

Vector Calculus and Laws of Motion
Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. Momentum and Energy: Conservation of momentum. Work and energy.

Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque, Conservation of angular momentum.

UNIT-II

Gravitation

Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

UNIT-III

Oscillations

Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Elasticity: Hooke's law, Stress-strain diagram, Elastic moduli-Relation between elastic constants, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia, q, η and σ by Searles method.

UNIT-IV

Special Theory of Relativity

Concept of Inertial and non-inertial frames, Concept of ether, Constancy of speed of light, Michelson-Morley Experiment, Galilean transformation, Postulates of Special Theory of Relativity, Lorentz transformation, Length contraction. Time dilation, Relativistic addition of velocities.

Recommended Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. AddisonWesley
2. Mechanics Berkeley Physics course,volume.1: Charles Kittel, et. Al. 2007, Tata McGrawHill.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6.

MECHANICS LAB

Subject Code:BSNMS1- 107 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.

4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell’s needle.
6. To determine the Elastic Constants of a Wire by Searle’s method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater’s Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

INORGANIC CHEMISTRY-I

Subject Code:BSNMS1- 103 **L T P C** **3 0 0 3** **Duration: 45 Hrs.**

Unit-I

Atomic Structure:

de Broglie equation, Heisenberg’s Uncertainty Principle and its significance. Schrödinger’s wave equation and its derivation, significance of ψ and ψ^2. Quantum numbers. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions and distribution curves. Shapes of s, p, d and f orbitals.

Pauli’s Exclusion Principle, Hund’s rule of maximum multiplicity, Aufbau principle and its limitations.

Unit-II

Chemical Periodicity:

Effective nuclear charge, shielding or screening effect (Slater rules), variation of effective nuclear charge in periodic table.

Atomic and ionic radii, Ionization enthalpy, Electron gain enthalpy and their trend in groups and periods.

Electronegativity and various scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.

Unit-III

Chemical Bonding-I:

Ionic bond: General characteristics of ionic compounds, size effects, radius ratio rule and its limitations. Efficiency of packing, Hexagonal close packing, Cubic close packing. Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.

Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Unit-IV

Chemical Bonding-II:

Covalent bond: Lewis structure, Valence Bond theory, VSEPR theory (Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory), Hybridization, Molecular orbital theory (LCAO method). Molecular orbital diagrams of diatomic and simple polyatomic molecules (Be_2, N_2, O_2, F_2, LiH, NO, CO, HCl, NO_2, BeH_2, NO_2^-), Formal charge, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds (Bond moment, dipole moment, Percentage ionic character)

Metallic Bond: Valence bond and band theories. Semiconductors and insulators, defects in solids.

Weak Interactions: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.

Recommended Books:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford, **1991**.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry', 4th Edn., Pearson Education, Singapore, **1999**.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford, **1994**.

ORGANIC CHEMISTRY-I

Subject Code:BSNMS1-104	L T P C 3 0 0 3	Duration: 45Hrs.

Unit-I

Structure and Bonding:

Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions:

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes). Assigning formal charges on intermediates and other ionic species.
Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Unit-II

Alkanes and Cycloalkanes:
Introduction, IUPAC nomenclature, Isomerism and classification of carbon atoms of alkanes.
Sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes.
Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.
Cycloalkanes - nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds.

Unit-III

Alkenes, Cycloalkenes, Dienes and Alkynes:
Alkenes Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikiff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation,

ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.
Cycloalkenes Methods of formation, conformation and Chemical reactions of cycloalkenes.
Dienes Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 additions, Diels-Alder reaction.
Alkynes Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.

Unit-IV

Aromatic hydrocarbons
Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.
Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and

sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Recommended Books:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', John Wiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill, Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

CHEMISTRY LAB-I

Subject Code:BSNMS1-108 **L T P C** **0 0 4 2** **Duration: 60Hrs.**

Inorganic Chemistry:
Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Organic Chemistry Laboratory Techniques:
Detection of various functional groups in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
Identify and separate the components of a given mixture of two dyes (red and blue ink, fluorescent and methylene blue) by paper chromatography

Recommended Books:

1.H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,1996.
2.G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books,1999.
3.G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education,2006.
5.G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, 2006.

DIFFERENTIAL CALCULUS-I

Subject Code:BSNMS1-105 **L T PC** **3 0 0 3** **Duration: 45 Hrs.**

Unit-I

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

Unit-II

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, ex , log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms.

Unit-III

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

Unit-IV

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative,

Differentiation of implicit functions and composite functions, Jacobians and its properties.

RecommendedBooks:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

DIFFERENTIAL CALCULUS-II

Subject Code:BSNMS1-106 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function z= f (x, y), Lagrange's method of undetermined multipliers.

Unit-II

Arc formula for the Cartesian equation y=f(x), other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves.

Unit-III

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

Unit-IV

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds.

Recommended Books:

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

ENVIRONMENTAL SCIENCES

Subject Code: BSNMS1-201 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

UNIT-I

Natural Resources

Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefitsand problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

UNIT-II

Ecosystems

(a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

Biodiversity and its Conservation: (a) Introduction – Definition: genetic, species and ecosystem diversity. (b) Biogeographically classification of India. (c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic.

UNIT-III

Environmental Pollution

Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT-IV

Social Issues and the Environment

(a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. Case studies. (e) Environmental ethics: Issues and possible solutions (f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Recommended Books:

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.
3. ErachBharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

ELECTRICITY, MEGNETISM AND EMT

Subject Code:BSNMS1- 202 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

UNIT-I

Vector Analysis

Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

UNIT-II

Electrostatics

Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

UNIT-III

Magnetism

Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

UNIT-IV

Maxwell`s equations and Electromagnetic wave propagation

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Recommended Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Mechanics Berkeley Physics course,volume.1: Charles Kittel, et. Al. 2007, Tata McGrawHill.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

ELECTRICITY, MEGNETISM AND EMT LAB

Subject Code:BSNMS1- 207 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurement of CDR (iii) Determine a high resistance by Leakage Method (iv) To determine Self Inductance of a Coil by Rayleigh’s Method.
3. To compare capacitances using De’Sauty’s bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.

6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer Theorem.

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

PHYSICAL CHEMISTRY-I

Subject Code:BSNMS1-203 | **L T P C** **3 0 0 3** | **Duration: 45 Hrs.**

Unit-I

Evaluation of Analytical Data

Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test and Q-test) numerical problems related to evaluation of analytical data.

Unit-II

Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and eholestric phases. Thermography and seven segment cell.

Unit-III

Gaseous State

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquifacation of gases (based on Joule-Thomson effect).

Unit-IV

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.

Recommended Books:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

ORGANIC CHEMISTRY-II

Subject Code:BSNMS1-204	**L T P C** **3 0 0 3**	**Duration: 45 Hrs.**

Unit-I

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogenic centrec, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & Land R & S systems of nomenclature. Geometric isomerism-determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

Unit-II

Arenes and Aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula vand Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram, the Huckel rule, aromatic ions..

Unit-III

Aromatic Electrophilic Substitution:

Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism or nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes alkynyl benzenes.

Unit-IV

Alkyl and aryl halides

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $S_N2$and S_N1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

Recommended Books:

1. Morrison and Boyd, ‘Organic Chemistry’, Prentice Hall.
2. Solomons, ‘Fundamentals of Organic Chemistry’, John Wiley.
3. F.A. Carey, ‘Organic Chemistry’, McGraw Hill, Inc.
4. L.G. Wade Jr., ‘Organic Chemistry’, Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, ‘Organic Chemistry’, Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

CHEMISTRY LAB-II

Subject Code:BSNMS1-208	L T P C 0 0 4 2	Duration: 60 Hrs.

Laboratory Techniques

1. Checking the calibration of the thermometer

2. Purification of organic compounds by crystallization using the following solvents:
a. Water
b. Alcohol
c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

Physical Chemistry Experiment
Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To determine the viscosity and surface tension of C_2H_5OH and glycerine solution in water
4. Calculation of the enthalpy of ionization of ethanoic acid.

Recommended Books:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH, 1996.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education, 2006.
3. G. Svehla, 'Vohel's Textbook of Quantitative Analysis', Pearson Education, 2006.

DIFFERENTIAL EQUATIONS-I

Subject Code:BSNMS1-205	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Unit-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.

Unit-II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation, Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

Unit-IV

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Recommended Books:

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,**1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

DIFFERENTIAL EQUATIONS-II

Subject Code:BSNMS1-206	L T P C 3 0 0 3	Duration: 45 Hrs.

Unit-I

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-II

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Bessel equation and Legendre equation, its properties and their recurrence relations, Hyper geometric equation, Bessel function and their recurrence relations, Strum liouville boundary values.

Unit-III

Separation of variables in a PDE, Laplace equation: mean value property, Weak and strong maximum principle, Green's function, Poisson's formula, Dirichlet's principle, Existence of solution using Perron's method (without proof).

Unit-IV

Heat equation: Initial value problem, Fundamental solution, Weak and strong maximum principle and uniqueness results, Wave equation: uniqueness, D'Alembert's method, method of spherical means and Duhamel's principle.

Recommended Books:

1. W.E.Boyce and P.C.Diprima : Elementary Differential Equations and Boundary value problems, John Wiley, **1986.**
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,**1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

THERMAL PHYSICS AND STATISTICAL MECHANICS

Subject Code:BSNMS1- 301 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

UNIT-I

Laws of Thermodynamics

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT-II

Thermodynamic Potential and Theory of Radiation

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, ClausiusClapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, RayleighJeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

UNIT-III

Kinetic Theory of Gases

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT-IV

Statistical Mechanics

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

Recommended Books:

1. Statistical Physics, thermodynamics and kinetic theory by V.S.Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

THERMAL PHYSICS AND STATISTICAL MECHANICSLAB

Subject Code:BSNMS1- 302 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

INORGANIC CHEMISTRY-II

Subject Code:BSNMS1-303 **L T P C 3 0 0 3** **Duration: 45 Hrs.**

Unit-I

s-Block Elements

Comparative studies, diagonal relationship, salient features of hydrides, salvation and complexation tendencies.

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Unit-II

p–Block Elements–I

Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–16, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

Unit-III

p–Block Elements-II

Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide ,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

Unit-IV

Chemistry of Transition Elements

Characteristic properties of *d*–block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their *3*d analogues in respect of ionic radii, oxidation states, magnetic behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

Recommended Books:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.

4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

PHYSICAL CHEMISTRY-II

Subject Code:BSNMS1-304	L T P C 3 0 0 3	Duration: 45 Hrs.

Unit-I

Thermodynamics-I

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics:

Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry:

Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit-II

Thermodynamics-II & III

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy : Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

Unit-III

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of K_p, K_c, K_a and their relationship, Clausius-Clapeyron equation, applications.

Unit-IV

Introduction to Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O), $FaCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H_2O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Recommended Books:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

CHEMISTRY LAB-III

Subject Code:BSNMS1-305 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Quantitative Analysis

Volumetric Analysis

a. Determination of acetic acid in commercial vinegar using NaOH.
b. Determination of alkali content-antacid tablet using HCI.
c. Estimation of calcium content in chalk as calcium oxalate by permanganometry.
d. Estimation of hardness of water by EDTA.
e. Estimation of ferrous and ferric by dichromate method.
f. Estimation of copper using sodiumthiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

Organic Chemistry Laboratory Techniques

Thin Layer Chromatography

Determination of Rf values and identification of organic compounds.
a. Separation of green leaf pigments (spinach leaves may be used).
b. Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
c. Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Recommended Books:

1.H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,1996.
2.G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books,1999.
3.G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education,2006.
5.G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, 2006.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,
7. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

REAL ANALYSIS-I

Subject Code:BSNMS1-306 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of BolzanoWeierstrass theorem.

Unit-II

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof), Definition and examples of absolute and conditional convergence.

Unit-IV

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, Mtest, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

RecommendedBooks:

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5. ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

REAL ANALYSIS-II

Subject Code:BSNMS1-307 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem.

Unit-II

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic and trigonometric functions.

Unit-III

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

Unit-IV

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

RecommendedBooks:

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5. Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

COMPUTATIONAL PHYSICS SKILLS

Subject Code:BSNMS1-308 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Introduction

Importance of computers in Physics, paradigm for solving physics problems for solution. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart:

Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

Scientific Programming

Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic.

Control Statements

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DOWHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines.

Visualization

Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data.

Programming:

1. To print out all natural even/ odd numbers between given limits.
2. To find maximum, minimum and range of a given set of numbers.
3. Calculating Euler number using exp(x) series evaluated at x=1.
4. To compile a frequency distribution and evaluate mean, standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices
7. To find a set of prime numbers and Fibonacci series.
8. To write program to open a file and generate data for plotting using Gnuplot.
9. Plotting trajectory of a projectile projected horizontally.
10. Plotting trajectory of a projectile projected making an angle with the horizontally.
11. To find the roots of a quadratic equation.
12. Motion of a projectile using simulation and plot the output for visualization.
13. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
14. Motion of particle in a central force field and plot the output for visualization

Recommended Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
4. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
5. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi (1999)
6. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning

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WAVES AND OPTICS

Subject Code:BSNMS1-401	**L T P C** **4 0 0 4**	**Duration: 60 Hrs.**

UNIT-I

Harmonic oscillators and Wave Motion

Superposition of two collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

UNIT-II

Sound

Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria

UNIT--III

Wave optics and Interference

Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

UNIT--IV

Diffraction and Polarization

Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

Recommended Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young1986. Addison-Wesley.

WAVES AND OPTICS LAB

Subject Code:BSNMS1- 402 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ2 – T Law.
3. To study Lissajous Figures.
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating .
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

ORGANIC CHEMISTRY-III

Subject Code:BSNMS1-403 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Carboxylic Acids Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

Unit-II

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxiedes.

Organic Compounds of Nitrogen

preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilc substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

Unit-III

Organometallic Compounds

Organomagnesium Compounds: The Grignard reagentsformation, structure and chemical reactions.

Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

Unit-IV

Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Recommended Books:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

PHYSICAL CHEMISTRY-III

Subject Code:BSNMS1-404	L T P C 3 0 0 3	Duration: 45 Hrs.

Unit-I

Electrochemistry-I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit-II

Electrochemistry – II

Types of reversible electrodes-gas metal ion, metal ion, metal insolblue salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreverisible cells, conventional representation of electrochemi cells.

EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (ΔG ΔH and K), polarization, over potential and hydrogen overvoltage. Concentration cells with and without transport, liquid junction potential, application
of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

Unit III

Nuclear Chemistry

Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

Unit-IV

Spectroscopy

Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of s, p, and n M.O., their energy levels and the respective transitions

Recommended Books:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Companies Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd, 2002.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.
10. Friedlander, Kennedy, Miller and Macias Nuclear and Radio Chemistry : John Wiley & Sons Inc.
11. Choppin, Lijenzin, Rydberg and Ekberg Radio Chemistry and Nuclear Chemistry Pubs Elsevier.

CHEMISTRY LAB-IV

Subject Code:BSNMS1-405 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

(I) Synthesis and Analysis

(a) Preparation of Sodium trioxalatoferrate (III)
(b) Preparation of Ni-DMG Complex
(c) Preparation of Copper tetrammine complex
(d) Preparation of cis-bisoxalatodiaquachromate (III) ion

(II)Physical Chemistry

(a) Conductometric Titrations

(i) Determine the end point of the following titrations by the conductometric methods.
Strong acid-Strong base
Strong acid-Weak base
Weak acid-Strong base
Weak acid-Weak base
(ii) Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.
(b) (i) Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent **(Rast's methods).**
(ii) To determine the molecular weight of a polymer by viscosity measurements.
(c) Adsorption (i) To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.
(d) Phase Equilibria to determine the distribution coefficient of iodine between CCI_4 and water.
(e) Refractometry
(i) Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
(ii) To determine the composition of unknown mixture of two liquids by refractive index measurements.
(f) Determining the half life of radio isotope using GEIGER-MULLER COUNTER.

Recommended Books:

1.H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH,1996.
2.G. Marr and B.W. Rocket,’Practical Inorganic Chemistry’, University Science Books,1999.
3.G. Pass and H. Sutcliffe, ‘Practical Inorganic Chemistry’, 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, 5thEdn., Pearson Education,2006.
5.G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education, 2006.

ALGEBRA-I

Subject Code:BSNMS1-406 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

Unit-II

circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Unit-III

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

Unit-IV

Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

RecommendedBooks:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993.**
6. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, **1976**.

ALGEBRA-II

Subject Code:BSNMS1-407 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

Unit-II

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

Unit-III

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Unit-IV

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

Recommended Books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004.**
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993.**
3.Herstein, I.N., 'Topics in Algebra.'2^{nd} Ed, Vikas Publishing House, **1976**.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

BASIC ANALYTICAL CHEMISTRY

Subject Code:BSNMS1-408 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Introduction

Introduction to Analytical Chemistry and its interdisciplinary nature.
Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil

Composition of soil, Concept of pH and pH measurement,
Complexometric titrations, Chelation, Chelating agents, use of indicators
a. Determination of pH of soil samples.
b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.
a. Determination of pH, acidity and alkalinity of a water sample.
b. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products

Nutritional value of foods, idea about food processing and food preservations and adulteration.
a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

Chromatography

Definition, general introduction on principles of chromatography,
paper chromatography, TLC etc.
a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
b. To compare paint samples by TLC method.

Ion-exchange

Column, ion-exchange chromatography etc.
Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics

Major and minor constituents and their function
a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one)

a. To study the use of phenolphthalein in trap cases.
b. To analyze arson accelerants.
c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in

Soft Drink.

Recommended Books:

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods ofAnalysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA,1988.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis,Cengage Learning India Ed.
3. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of AnalyticalChemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
7. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y.USA (1982).
8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16(1977).

9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
11. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc.,New York (1995).

DIGITAL ANALOG AND INSTRUMENTATION

Subject Code:BSNMD1-511 **L T P C 4 0 0 4** **Duration: 60 Hrs.**

UNIT-I

Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method. Binary Addition. Binary Subtraction using 2's Complement Method).

UNIT-II

Semiconductor Devices

Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT-III

Amplifiers

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q point. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.

UNIT-IV

Instrumentation

Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers. Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Timer IC: IC 555 Pin diagram and its application as Astable & Monostable Multivibrator

Recommended Books:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.

3. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed.,2011, Tata McGraw Hill
5. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
6. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
7. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.

DIGITAL ANALOG INSTRUMENTATION LAB

Subject Code:BSNMD1- 512 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder
5. Adder-Subtractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
13. To study a precision Differential Amplifier of given I/O specification using Opamp.
14. 14. To investigate the use of an op-amp as a Differentiator
16. To design a Wien Bridge Oscillator using an op-amp.

Recommended Books:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

CHEMISTRY OF MAIN GROUP ELEMENTS

Subject Code:BSNMD1- 521 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Unit-I

Acids and Bases

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

Unit-II

***s*- and *p*-Block Elements**

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale). General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of *s*- and *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of *s* block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

Unit-III

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable:

Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH3), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S (PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2) Interhalogen compounds. A brief idea of pseudohalides.

Unit-IV

Noble gases

Rationalization of inertness of noble gases, clathrates, preparation and properties of XeF_2, XeF_4 and XeF_6 ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

Inorganic Polymers

Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$.

Recommended Books:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed.,Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models inInorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning IndiaEdition, 2002.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson,2010.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford UniversityPress (2010).

CHEMISTRY OF MAIN GROUP ELEMENTS LAB

Subject Code:BSNMD1-522	**L T P C**	**Duration: 60 Hrs.**
	0 0 4 2	

1.Iodometric estimation of potassium dichromate and copper sulphate
2.Iodimetric estimation of antimony in tartaremetic
3.Estimation of amount of available chlorine in bleaching powder and household bleaches
4.Estimation of iodine in iodized salts.
5.Iodimetric estimation of ascorbic acid in fruit juices.
6.Estimation of dissolved oxygen in water samples.
7.Gravimetric estimation of sulphate as barium sulphate.
8.Gravimetric estimation of aluminium as oximato complex
9.Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

Recommended Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.

MATRICES

Subject Code:BSNMD1-531 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

R, R^2 , R^3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R^2 , R^3 .

Unit-II

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

Unit-III

Types of matrices Rank of a matrix, Invariance of rank under elementary transformations, Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns up-to four.

Unit-IV

Matrices in diagonal form, Reduction to diagonal form up-to matrices of order 3, Computation of matrix inverses using elementary row operations, Rank of matrix. Solutions of a system of linear equations using matrices, Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

RecommendedBooks:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

LINEAR ALGEBRA

Subject Code:BSNMD1-532 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit-II

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

Unit-III

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

Unit-IV

Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

RecommendedBooks:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

COMPUTER PROGRAMMING LAB

Subject Code:BSNMS1-533	**L T P C** **0 0 4 2**	**Duration: 60 Hrs.**

List of following programs are as follows:

1. **Operators:** Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. **Decision Making:** switch, if-else, nested if, else-if ladder, break, continue, go to
3. **Loops:** while, do-while, for
4. **Functions:** Definition, Declaration, call by value, Call by reference, Recursive Function
5. **Arrays:** Arrays declarations, Single and multi-dimensional, Strings and string functions
6. **Pointers:** Pointer declarations, Pointer to function, Pointer to array.

Recommended Books:

1. Shubhnandan Jamwal, ‘Programming in C’, 3rd Edn., Pearson.
2. E. Balagurusamy, ‘Programming in ANSI C’, 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, ‘Fundamentals of Computers’, 3rd Edn., PHI.
4. P.K. Sinha, ‘Computer Fundamentals’, 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, ‘C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, ‘Programming with C’, 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, ‘Let us C’, 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, ‘Application Programming in C’, 2nd Edn., Khanna Book Publishing.

ELEMENTS OF MODERN PHYSICS

Subject Code:BSNMD1-611 **L T P C 4 0 0 4** **Duration: 60 Hrs.**

UNIT-I

Crystal structure and lattice vibrations:

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell, Types of Lattices. Miller Indices. Reciprocal Lattice. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Lattice Vibrations in Linear Monoatomic and Diatomic Chains. Concept of phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

UNIT-II

Introduction to Quantum Mechanics:

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson- German experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

UNIT-III

Nuclear Physics :

Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Radioactive decay: alpha, beta and gamma decay, internal conversion, positron emission, electron capture, neutrino hypothesis. Interaction of Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter.

UNIT-IV

Particle Physics :

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity,baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

Recommended Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009.
3. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw Hill Co.
4. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
5. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics, Walter Greiner, 4thEdn., 2001, Springer.

ELEMENTS OF MODERN PHYSICS LAB

Subject Code:BSNMD1-612 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. Photo-electric effect: photo current versus intensity and wavelength of light;maximum energy of photo-electrons versus frequency of light.
8. To determine the value of e/m by magnetic focusing.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source – Na light.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition,2011, Kitab Mahal, New Delhi.

COMPREHENSIVE CHEMISTRY

Subject Code:BSNMD1-621 **L T P C** **Duration: 60 Hrs.**

4 0 0 4

Unit-I

Chemistry of 3d

Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

Unit-II

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones).

Unit-III

Polynuclear and heteronuclear aromatic compounds:

Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine.

Active methylene compounds:

Preparation: Claisen ester condensation. Keto-enol tautomerism. *Reactions:* Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

Unit-IV

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Recommended Books:

1. James E. Huheey, Ellen Keiter & Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
2. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
5. I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
6. John R. Dyer: Applications of Absorption Spectroscopy of OrganicCompounds, Prentice Hall.
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification ofOrganic Compounds, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
9. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.

COMPREHENSIVE CHEMISTRY LAB

Subject Code:BSNMD1-622	**L T P C** **0 0 4 2**	**Duration: 60 Hrs.**

Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}

2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Recommended Books:

1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
2. A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,
4. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
5. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman,1960.

NUMERICAL METHODS

Subject Code:BSNMD1-631 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Rate of Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, GaussJacobi, Gauss-Siedel and SOR iterative methods.

Unit-II

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

Unit-III

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

Unit-IV

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, **1980.**
4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., **2001.**

COMPLEX ANALYSIS

Subject Code:BSNMD1-632 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit-II

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

Unit-III

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

Unit-IV

Liouville's theorem and the fundamental theorem of algebra, Convergence of sequences and series, Taylor series and its examples, Laurent series and its examples, absolute and uniform convergence of power series.

RecommendedBooks:

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2. 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
3. E.T. Capson,, An Introduction to the Theory of functions of a complex Variable, Oxford university press, **1995.**
4. R. Churchill, J.W. Brown, 'Complex Variables and Applications', 6th Edn., New York, McGraw-Hill, **1996.**
5. A.R. Shastri, 'An Introduction To Complex Analysis', Macmillan India Ltd., **2003**.
6. S. Ponnusamy, Foundation of Complex Analysis, Narosa Book Distributors, **2011.**

NUMERICAL ANALYSIS LAB

Subject Code:BSNMS1-633	**L T P C** **0 0 4 2**	**Duration: 60 Hrs.**

The following programs of following methods are to be practiced:

1. To find a real root of an algebraic/ transcendental equation by using Bisection method.
2. To find a real root of an algebraic/ transcendental equation by using Regula-Falsi method.
3. To find a real root of an algebraic/ transcendental equation by using Newton-Raphson method.
4. To find a real root of an algebraic/ transcendental equation by using Iteration method.
5. Implementation of Gauss- Elimination method to solve a system of linear algebraic equations.
6. Implementation of Jacobi's method to solve a system of linear algebraic equations.
7. Implementation of Jacobi's method to solve a system of linear algebraic equations.
8. Implementation of Gauss-Seidel method to solve a system of linear algebraic equations.
9. To find differential coefficients of 1st and 2nd orders using interpolation formulae.
10. To evaluate definite integrals by using Newton - Cotes integral formulae.

11. To evaluate definite integrals by using Gaussian Quadrature.
12. To evaluate double integrals by using Trapezoidal and Simpson method.
13. To compute the solution of ordinary differential equations with Taylor's series method.
14. To compute the solution of ordinary differential equations by using Euler's method.
15. To compute the solution of ordinary differential equations by using Runge -Kutta methods.
16. To compute the solution of ordinary differential equations by using Milne-Simpson method.

Recommended Books:

1. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill, New Delhi, 1999.
2. J N Sharma, Numerical Methods for engineers and Scientists (2nd Edn) Narosa Publishing House, NewDelhi/ Alpha Science International Ltd. Oxford UK, 2007.
3. Conte and de Boor, Numerical Analysis, McGraw Hill, New York, 1990
4. John H. Mathews, Numerical Methods for Mathematics, Science and Engineering (2nd Edn.), PrenticeHall, New Delhi, 2000.

Course scheme B Sc (Hons.) Agriculture - VIIth sem.

Elective Specialized Courses (NOTE: Student will select ANY ONE GROUP of Elective Specialized Courses out of the following five groups of elective specialized courses as per his / her choice.)

1. Natural Resource Management (Soil , Agronomy & Agro-forestry)

34 Hrs.

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Natural Resource Management (Soil , Agronomy & Agro-forestry)								
BAGE2-701	Soil Physical and Biological Environment	2	0	0	40	60	100	2
BAGE2-702	Analytical Techniques in Soils, Plants, Fertilizers and Water	2	0	0	40	60	100	2
BAGE2-703	Weed Management	2	0	0	40	60	100	2
BAGE2-704	Farming Systems and Sustainable Agriculture	2	0	0	40	60	100	2
BAGE2-705	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops	2	0	0	40	60	100	2
BAGE2-706	Production Technology of Economic Forest Trees	2	0	0	40	60	100	2
BAGE2-707	Soil Survey, Classification and Mapping (Practical)	0	0	2	20	30	50	1
BAGE2-708	Soil Physical and Biological Environment (Practical)	0	0	2	20	30	50	1
BAGE2-709	Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)	0	0	6	60	90	150	3
BAGE2-710	Weed Management (Practical)	0	0	2	20	30	50	1
BAGE2-711	Farming Systems and Sustainable Agriculture (Practical)	0	0	2	20	30	50	1
BAGE2-712	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)	0	0	2	20	30	50	1
BAGE2-713	Production Technology of Economic Forest Trees (Practical)	0	0	2	20	30	50	1
	Total	14	0	20	480	720	1200	24

2.Horticulture (Pomology, Olericulture & Floriculture)

32 Hrs.

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Horticulture (Pomology, Olericulture & Floriculture)								
BAGE3-701	Nursery Management of Horticultural Crops	2	0	0	40	60	100	2
BAGE3-702	Commercial Fruit Production	2	0	0	40	60	100	2
BAGE3-703	Processing and Value Addition of Horticultural Crops	2	0	0	40	60	100	2
BAGE3-704	Commercial Vegetable Production	2	0	0	40	60	100	2
BAGE3-705	Vegetable Breeding and Seed Production	2	0	0	40	60	100	2
BAGE3-706	Forcing Techniques in Vegetable Production	2	0	0	40	60	100	2
BAGE3-707	Commercial Floriculture and Landscaping	2	0	0	40	60	100	2
BAGE3-708	Nursery Management of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BAGE3-709	Commercial Fruit Production (Practical)	0	0	2	20	30	50	1
BAGE3-710	Processing and Value Addition of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BAGE3-711	Commercial Vegetable Production (Practical)	0	0	2	20	30	50	1
BAGE3-712	Vegetable Breeding and Seed Production (Practical)	0	0	2	20	30	50	1
BAGE3-713	Forcing Techniques in Vegetable Production (Practical)	0	0	2	20	30	50	1
BAGE3-714	Commercial Floriculture and Landscaping (Practical)	0	0	2	20	30	50	1
	Total	16	0	16	480	720	1200	24

3. CROP IMPROVEMENT (Plant Breeding, Genetics and Biotechnology) 31 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Crop Improvement								
BAGE4-701	Genetics of Crop Plants	2	0	0	40	60	100	2
BAGE4-702	Cytogenetics of Crop Plants	2	0	0	40	60	100	2
BAGE4-703	Theory and Practice of Plant Breeding	3	0	0	60	90	150	3
BAGE4-704	Breeding of Field Crops	3	0	0	60	90	150	3
BAGE4-705	Crop Experimentation	1	0	0	20	30	50	1
BAGE4-706	Plant Tissue Culture and Transformation	2	0	0	40	60	100	2
BAGE4-707	Molecular Biotechnology and Genomics	2	0	0	40	60	100	2
BAGE4-708	Genetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BAGE4-709	Cytogenetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BAGE4-710	Theory and Practice of Plant Breeding(Practical)	0	0	2	20	30	50	1
BAGE4-711	Crop Experimentation (Practical)	0	0	2	20	30	50	1
BAGE4-712	Plant Tissue Culture and Transformation (Practical)	0	0	2	20	30	50	1
BAGE4-713	Molecular Biotechnology and Genomics (Practical)	0	0	2	20	30	50	1
	Total	17	0	14	480	720	1200	24

4.Agri-Economics, Extension & Business Management

29 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology	0	0	2	20	30	50	1
Elective courses: Agri-Economics, Extension & Business Management								
BAGE5-701	Visual and Graphic Communication	1	0	0	20	30	50	1
BAGE5-702	Communication and Information Technology	2	0	0	40	60	100	2
BAGE5-703	Behavioural Skills for Human Resource Development	2	0	0	40	60	100	2
BAGE5-704	Micro Economic Analysis	3	0	0	60	90	150	3
BAGE5-705	Macro Economic Analysis	3	0	0	60	90	150	3
BAGE5-706	Financial and Project Management	3	0	0	60	90	150	3
BAGE5-707	Retailing and Supply Chain Management	3	0	0	60	90	150	3
BAGE5-708	Visual and Graphic Communication (Practical)	0	0	2	20	30	50	1
BAGE5-709	Communication and Information Technology (Practical)	0	0	2	20	30	50	1
BAGE5-710	Micro Economic Analysis (Practical)	0	0	2	20	30	50	1
BAGE5-711	Financial and Project Management (Practical)	0	0	2	20	30	50	1
	Total	19	0	10	480	720	1200	24

5.Plant Protection (Entomology, Plant Pathology and Nematology)

36 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology	0	0	2	20	30	50	1
Elective courses: Plant Protection (Entomology, Plant Pathology and Nematology)								
BAGE6-701	Apiculture	1	0	0	20	30	50	1
BAGE6-702	Biocontrol and Integrated Pest Management	2	0	0	40	60	100	2
BAGE6-703	Pesticides and Plant Protection Equipment	2	0	0	40	60	100	2
BAGE6-704	Biocontrol and Integrated Disease Management	2	0	0	40	60	100	2
BAGE6-705	Post Harvest Diseases & their Management	2	0	0	40	60	100	2
BAGE6-706	Plant Nematology	1	0	0	20	30	50	1
BAGE6-707	Plant Disease Diagnosis (Practical)	0	0	4	40	60	100	2
BAGE6-708	Apiculture (Practical)	0	0	4	40	60	100	2
BAGE6-709	Biocontrol and Integrated Pest Management (Practical)	0	0	4	40	60	100	2
BAGE6-710	Pesticides and Plant Protection Equipment (Practical)	0	0	2	20	30	50	1
BAGE6-711	Biocontrol and Integrated Disease Management (Practical)	0	0	4	40	60	100	2
BAGE6-712	Post Harvest Diseases & their Management (Practical)	0	0	2	20	30	50	1
BAGE6-713	Plant Nematology (Practical)	0	0	2	20	30	50	1
	Total	12	0	24	480	720	1200	24

<u>Course Scheme - B Sc (Hons.) Agriculture 8th Semester</u>

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-880	On-campus learning	0	0	16	600	-	600	8
BAGE1-881	Industrial attachments (Off campus)	0	0	10	300	-	300	5
BAGE1-882	Rural Experiences	0	0	6	200	-	200	3
BAGE1-883	Documentation, reporting and presentation	0	0	2	100	-	100	1
				34	**1200**		**1200**	**17**

1. Natural Resource Management (Soil , Agronomy & Agro-forestry)

Introduction to Molecular Biotechnology
Subject Code: BAGE1- 780 LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology.Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses.Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches.DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics.Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D.Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifielde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Soil Physical & Biological Environment
Subject Code: BAGE2- 701 LT P C 2 0 0 2

Unit - I

Soil physical properties in relation to crop production.Soil thermal regime and its management.

Unit - II

Soil air - composition, renewal, characterization of soil aeration in relation to plant growth. Movement of water in soil. Infiltration and redistribution of water in soil.

Unit - III

Evaporation from soils and its management. Runoff from the agricultural fields and factors affecting.

Unit – 1V

Soil organisms and their distribution, Ecology, classification and activities in soil.Microbiological transformations of C, N and S in soils.

Books Recommended

1. Introductory to Soil Science by D.K. Das

2. Soil Nutrient by M. Miransari
3. Soil Science and Environment by henry Wang

Analytical Techniques in Soils, Plants, Fertilizers and Water

Subject Code: BAGE2- 702 LT P C 2 0 0 2

Unit - 1

Colorimetric and flame photometric methods, Atomic absorption spectrophotometry.

Unit - II

Cation and Anion exchange phenomenon and their importance. Ionadsorption, desorption and fixation in soils.

Unit - II

Methods of soil fertility evaluation. Fertilizer control order.

Unit - III

Acid, saline, sodic, calcareous soils and their amelioration.

Unit – 1V

Planning and formulation of project on establishment of soil water and plant testinglaboratory.

Books Recommended

1. A Handbook of Soil-Plant-Water-Fertilizer and Manure Analysis by M.V. Durai
2. Soil-Plant-Water-Fertilizer and Fertilizer Analysis by P K Gupta

Weed Management

Subject Code: BAGE2- 703 LT P C 2 0 0 2

Unit - 1

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Weed biology and ecology. Crop weeds association, competition and allelopathy.

Unit - II

Concepts of weed prevention, control and eradication. Methods of weed control. Physical, cultural, chemical, biological and integrated weed management.

Unit - III

Herbicides: classification, formulation, advantages, disadvantages and methods of application. Introduction to adjuvants and their use in herbicides. Introduction to selectivity of herbicides. Mode of action and fate of herbicides in soil.Compatibility of herbicides with other agrochemicals.

Unit - IV

Weed management in major field and non cropped areas. Shift in weed flora in cropping systems. Classification, useful and harmful aspects and control measures of aquatic weeds. Problematic weeds and their control.

Books Recommended

1. Weed Management by US Walia
2. Principle of Agronomy by S.R. Reddy

Farming System & Sustainable Agriculture

Subject Code: BAGE2- 704 LT P C 2 0 0 2

Unit - 1

Farming systems: definition, principles and components.Farming System models for irrigated, dryland, situations and modules for marginal, small and large farmers. Farming systems of the world-arable, pastoral, lay farming, shifting cultivation, and ranching.

Unit - I1

Agro-forestry systems Energy and fuel wood plantations. Specialized and diversified farming, family co-operative and collective farming: their occurrence, adaptations and weaknesses. Factors affecting choice of farming systems.

Unit - II1

Cropping systems, their characteristics and management. Cropping patterns. Agro-ecosystem and agro-ecological zones of Punjab and India. Efficient food producing systems.

Unit - IV

Sustainable agriculture- Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures, land degradation and conservation of naturalresources.

Books Recommended

1. Farming System & Sustainable Agriculture by S.R. Reddy
2. Farming System & Sustainable Agriculture by Aniket Kalhapure, Madhukar Dhonde and Balasaheb Shete

Production Technology of Spices, Aromatic, Medicinal and Plantation Crops

Subject Code: BAGE2- 705 LT P C 2 0 0 2

Unit - 1

Important Spice crops- Ginger, Turmeric, Dill Seed, Pepper, Cardamom, Coriander, Cumin, Fennel, Celery and Fenugreek with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - I1

Aromatic crops: Mentha, Lemongrass, Citronella, Palmarosa, Vetiver and Geranium with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - II1

Medicinal plants: Dioscoria, Rauvolfia, Opium, Periwinkle, Guggal, Belladonna, Nuxvomica, Solanumnigrum, Senna, Amla, Isabgol, Coleus, Acorus and Pipli (mug) with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - IV

Plantation crops: Coconut, Arecanut, Betelvine, Cashew, Cocoa and Coffee with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects anduses.

Books Recommended

1. Production Technology of Spices, Aromatic, Medicinal and Plantation Crops by TNAU
2. Production Technology of Spices, Aromatic, Medicinal and Plantation by Prasad S,Bhardwaj RL

Production Technology of Economic Forest Trees

Subject Code: BAGE2- 706 LT P C 2 0 0 2

Unit - I

Plantation Silviculture: native versus exotics; even-aged versus uneven-aged; monoculture versus mixed culture. Plantation technology and tending operations of economically important tree species.

Unit - I1

Agroforestry concept and suitable agroforestry systems models for different regions. Economic and ecological aspects of agroforestry systems. Importance of superior phenotypes, their evaluation and use in plantations.

Unit - II1

Climate change and forests, Forest regeneration, productivity and rotation. Desertification and rehabilitation of waste lands. Short rotation intensive management of forest plantations.Trees outside forests, energy, industrial plantation and dendro-remediation. Production and marketing of forestry produce.

Unit - IV

Forest fire and its management. Wood based industries and importance of non timber forest produce. Frame work for forestry extension: participatory rural appraisal and joint forestmanagement.

Books Recommended

1. Transfer of Tree cultivation technologies by Dr. C.Buvaneswaran, Dr. V. Sivakumar, Mr. R.S. Prasanth, IFS, Dr. N. Krishna Kumar, IFS.
2. Shifting Cultivation by L.K.Jha

Introduction to Molecular Biotechnology (Practical)

Subject Code: BAGE1- 781 LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Soil Survey, Classification and Mapping (Practical)

Subject Code: BAGE2- 707 LT P C 0 0 2 1

Application and use of global positioning system (GPS) for soil survey. Macro-orphological study of soils. Classification of soils developed on different land forms.

Study of base maps-cadastralmaps, toposheets, aerial photographs and satellite imageries. Soil survey of project area- preparation of base maps, analysis of soil characteristics, classification of surveyed soils, mapping and report writing. Interpretation of soil survey data for land capability and crop suitability classifications. Use of geographical information system (GIS) for preparing thematic Maps

Soil Physical & Biological Environment (Practical)

Subject Code: BAGE2- 708 LT P C 0 0 2 1

Determination of dry and wet stability of aggregates. Measurement of insitu soil bulkdensity and filling of soil columns with a particular bulk density. Measurement of soil porosity. Determination of consistency limits of soils. Soil moisture characteristics. Measurement of soil temperatureusing thermocouples.Determination of infiltration rate under different surface conditions.In situ measurement of soil moisture by neutron probe and Time Domain Reflectrometry.In situ measurement of soil matric potential using tensiometers.Enumeration of soil bacteria, fungi and actinomycetes.Isolation of Rhizobium and Azotobacter and measurement of respirationrate.

Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)

Subject Code: BAGE2- 709 LT P C 0 0 6 3

Preparation of standard solutions.Collection of soil, water, plant and fertilizer samples. Analysis of soil samples for fertility and quality evaluation for field crop sand orchard plantations. Analysis of irrigation water for quality appraisal.Fertilizers analysis for quality control. Soil, water and fertilizer analysis reports for recommendation purposes. Analysis of forms of nitrogen, phosphorous, potassium and sulphurin soils. Determination of DTPA-extractablemicronutrients. Plant analysis for total N, P, K and micro-nutrients.Determination of CEC and AEC of soils.Nutrient adsorption and fixation capacities ofsoils.

Weed Management (Practical)

Subject Code: BAGE2- 710 LT P C 0 0 2 1

Identification of weeds and weed seeds. Survey of weeds in crop fields and other habitats. Preparation of weed herbarium. Computation of herbicide doses, weed control efficiency and weed index. Methods of recording weed intensity under different situations. Herbicide label information of commonly available herbicides.Herbicide application equipments and their calibration.Diagnosis of herbicide toxicity symptoms in different crops and weeds.Visits to problemareas.

Farming System & Sustainable Agriculture (Practical)

Subject Code: BAGE2- 711 LT P C 0 0 2 1

Preparation of cropping scheme and integrated farming system models for irrigated and dryland situations.Preparation of enriched Farm Yard Manure and Vermicompost. Visit to urban waste recycling unit, organic farm and model farmers' field. Preparation of farm lay out plans, different intensity crop rotations and cropping schemes. Estimating crop yields. Energy budgeting in different crops and cropping systems. Working out ecological optimum crop zones. Project making exercises for establishment of crop production farms under differentsituation.

Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)

Subject Code: BAGE2- 712 LT P C 0 0 2 1

Identification of crops based on morphological and seed characteristics. Propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

Production Technology of Economic Forest Trees (Practical)

Subject Code: BAGE2- 713 LT P C 0 0 2 1

Nursery management: propagation methods, quality planting stock, preparation of nursery and plantation schedule. Layout and establishment of agroforestry models. Estimation of tree volume and biomass; enumeration and vegetation survey. Methods of vegetation analysis: measurement of biomass and productivity. Visit to commercial plantations, wood based industries and forestry institutes.

2.Horticulture (Pomology, Olericulture & Floriculture)

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780 LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology.Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses.Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches.DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics.Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

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2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifielde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Nursery Management of Horticultural Crops

Subject Code: BAGE3- 701 LT P C 2 0 0 2

Unit-I

Principles of plant propagation. Seed dormancy and germination.

Unit-II

Selection of rootstock and scion. Stock scion relationship. Factors affecting propagation. Physiology of rootstock.

Unit-III

Different methods of propagation like division, cutting, layering, budding and grafting, and tissue culture. Types of Containers, media and mixtures. Propagation structures. Nursery act, quarantine and certification.

Unit-IV

Nutrient management and plant protection measures in nursery. Economics of raising fruit plant nursery.

Books Recommended

1. Fruit Growing by J.S. Bal
2. Propagation of Horticultural Crops by R.R. Sharma
3. Plant propagation by Hartman and Kester
4. Basic Horticulture by Jetender singh

Commercial Fruit Production

Subject Code: BAGE3- 702 LT P C 2 0 0 2

Unit-I

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horti-agri techniques, production, plant protection measures and special problems in fruits such as citrus, mango

Unit-II

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horti-agri techniques, production, plant protection measures and special problems in fruits such as, guava, apple, pear,

Unit-III

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horti-agri techniques, production, plant protection measures and special problems in fruits such as peach, plum, ber, litchi, grapes,

Unit-IV

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horti-agri techniques, production, plant protection measures and special problems in fruits such as pomegranate, papaya, pineapple, , banana ,sapota, apricot and almond.

Books Recommended

1. Fruits by Ranjit Singh
2. Fruit Growing by J.S. Bal
3. Commercial Fruits by S.P. Singh
4. Post harvest handling of Fruits and Vegetable by A.S. Sandhu and J.S. Bal
5. Propagation of Horticultural Crops by R.R. Sharma

Processing and Value Addition of Horticultural Crops

Subject Code: BAGE3- 703 LT P C 2 0 0 2

Unit-I

Scope of fruit preservation industry in India, present status, constraints and prospects. Importance, principles and practices of fruit processing.

Unit-II

Maturity indices, harvesting, transportation and quality parameters of fruits. Pre and post harvest factors affecting processing quality of fruits.

Unit-III

Commercial processing technologies for fruits like mango, citrus, guava, grapes, ber, apple, pear, peach, plum, phalsa, litchi, pomegranate and papaya etc.

Unit-IV

Packing technology for export andvalue addition.

Books Recommended

1.Preservation of fruits and vegetables by Lal Girdhari and Siddappe Tandon

2. Home preservation of Fruits and vegetables by Nagi Malkiat

Commercial Vegetable Production

Subject Code: BAGE3- 704 LT P C 2 0 0 2

Unit-I

Role of soil, climatic and agronomic factors in vegetable production.

Unit-II

Principles of cultivation including direct sowing, nursery management, transplanting, hardening of seedlings and vegetable forcing.

Unit-III

Weeds and their control. Rotation and Intercropping in vegetable crops.

Unit-IV

Export potentiality, post harvest handling, processing, storage and marketing of vegetables.

Books Recommended

1. Vegetable crops production technology by Fageria and Dhaka
2. Vegetable crops by T.K Boss I,II,III volume.
3. A text book of Vegetable production by G.S. Saini
4. Vegetables for Tropical Regions by Prem Nath
5. Vegetable seed production principles by Prem Singh Arya
6. Hand book of vegetable crops by M.S.Dhaliwal
7. Text book of vegetable,tuber crops and spices by S.S. Thumuburaj

Vegetable Breeding and Seed Production
Subject Code: BAGE3- 705 LT P C 2 0 0 2

Unit-I

Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources.

Unit-II

Principles and methods of breeding self-pollinated, often cross-pollinated and cross- pollinated vegetable crops. Plant introduction, selection, hybridization population improvement, mutation and polyploidy.

Unit-III

Seed production of conventional varieties. Production of F1 hybrids using male sterility, self-incompatibility, various sex-forms etc.

Unit-IV

Methods of production of nucleus, breeder, foundation and certified seeds isolation, pollination, seed harvesting, processing and storage. Seed testing and certification. Seed Act. Vegetable seed industry and its problems.

Books Recommended

1. Plant breeding:Theory and Practice by V. L. Chopra
2. Seed technology by R. L. Aggrawal
3. Principles and procedures of plant breeding by Chahal and Gosal
4. Plant breeding and Genetics by B. D. Singh
5. Vegetable breeding Principles and practices by Hari Har Ram
6.Breeding cross pollinated crops by Vishnu Swarup

Forcing Techniques in Vegetable Production

Subject Code: BAGE3- 706 LT P C 2 0 0 2

Unit-I

Objectives, importance and scope of protected cultivation. Nursery raising techniques. Environmental factors. Vegetable growing media. Irrigation and fertigation. Sustainable land use systems for maximising land use efficiency in protected structures.

Unit-II

Problems of growing vegetables in protected structures,. Soil sterilization techniques.

Unit-III

Hydroponics cultivation. . Pest management in green house/glass house. Crops and varieties suitable for protected cultivation.

Unit-IV

Specific technology for raising tomato, sweet pepper, cucumber and high value crops in off season. Cladding material for protected structures - use of mulches. Seed production of vegetables.

Books Recommended

1. Vegetable forcing by Ralph L.Watts
2. Production technologies of vegetable crops by Fageria and Dhaka
3. Protected Cultivation of vegetable crops by Balraj

Commercial Floriculture and Landscaping

Subject Code: BAGE3- 707 LT P C 2 0 0 2

Unit-I

Scope, importance and export potential of floriculture, environment factors influencing plant growth and flower production in cut flowers.

Unit-II

Production technology including varieties, propagation, soil, nutrition, disease and pests of important cut flowers (Rose, Gladiolus, Carnation, Gerbera and Chrysanthemum. Post harvest handling, grading and packing cut flowers, pot and bedding plants.

Unit-III

Flower seed production. History of gardening, characteristics of Hindu, Mughal , Japanese and English gardens. Principle groups of plants like trees, shrubs, climbers, shade loving plants, ground covers, their analysis and use in landscape composition.

Unit-IV

Principles of landscaping. Preparation of landscape plans for homes, farm complexes, small parks and institutions. Development and maintenance of rock, water and terrace gardens. Bonsai gardens, project formulation and evaluation.

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Books Recommended

1. Beautiful gardens by M.S. Randhawa
2. Introduction to Floriculture by Roy A. Larson
3. Complete Gardening in India by K.S. Gopalswamienger
4. Floriculture at Glance by Raj D.
5. Flowering shrubs for seasonal Ornamentals by S.K. Bhattacharjee

Introduction to Molecular Biotechnology (Practical)

Subject Code: BAGE1- 781 LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Nursery Management of Horticultural Crops(Practical)

Subject Code: BAGE3- 708 LT P C 0 0 2 1

Raising of root stock. Methods to break seed dormancy. Propagation techniques.Lifting and packing of nursery plants. Preparation of media and mixtures,and raising nursery in poly bags.Project formulation after valuation of nursery raising.

Commercial Fruit Production (Practical)

Subject Code: BAGE3- 709 LT P C 0 0 2 1

Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation of orchard management.

Processing and Value Addition of Horticultural Crops (Practical)

Subject Code: BAGE3- 710 LT P C 0 0 2 1

Judging of maturity of different fruits. Methods of preparation of jam, jelly, ready to serve, squash, nectar, canning, chutteny, pickle and marmalade etc. Packing technologies. Drying and dehydration of fruits. Visit to local processing unit.

Commercial Vegetable Production (Practical)

Subject Code: BAGE3- 711 LT P C 0 0 2 1

Sowing and transplanting of vegetable crops. Effect of soil conditions on seedling emergence and plant growth. Nutrient deficiency symptoms. Common weeds, their identification and control. Project formulation and evaluation for vegetable nursery production and vegetable forcing techniques.

Vegetable Breeding and Seed Production (Practical)

Subject Code: BAGE3- 712 LT P C 0 0 2 1

Study of inflorescence and flower structures. Practice in emasculation and artificial pollination. Inspection and rouging. Testing of seeds for purity and germination. Project formulation and evaluation for seed production of vegetable crops.

Forcing Techniques in Vegetable Production (Practical)
Subject Code: BAGE3- 713 LT P C 0 0 2 1

Study of various types of structures. Methods to control temperature, CO_2, light. Demonstration for sanitation measures. Hydroponics. Maintenance of parental lines and hybrid seed production in glasshouse. Fertigation and nutrient management. Control of diseases and insect pests in glasshouse. Visit to established greenhouses in the region.

Commercial Floriculture and Landscaping (Practical)
Subject Code: BAGE3- 714 LT P C 0 0 2 1

Planning and layout of gardens. Identification of planting material and commercial varieties of flowers. Seed collection, germination tests and storage. Harvesting and post harvest handling of cut flowers. Judging of flowers and pot plants. Visit to local nurseries and florist centers

3.Crop Improvement (Plant Breeding , Genetics and Biotechnology)

Introduction to Molecular Biotechnology
Subject Code: BAGE1- 780 LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology.Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses.Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches.DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics.Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D.Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifielde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Genetics of Crop Plants

Subject Code: BAGE4- 701 LT P C 2 0 0 2

Unit-I

Genetic analysis in different systems. Genetic recombination in prokaryotes and eukaryotes. Genetic material - organization, structure and replication.

Unit-II

Genetics of qualitative traits. Detection and estimation of linkage from test cross and F_2 data. Extra nuclear inheritance.

Unit-III

Genetics of quantitative traits. Genetic equilibrium and forces changing gene frequency. Induction, detection and uses of mutations.

UNIT-IV

Gene function. Gene expression. Gene regulation. Environmental influence on gene expression. Gene cloning. Genetic transformation.

Books Recommended:

1. Fundamentals of Genetics by G.S. Miglani
2. Fundamentals of Genetics by B.D.Singh
3. Genetics by P.K. Gupta
4. Principles of Genetics by E.J. Gardner and M.J. Simmons
5. Laboratory Exercises in Genetics by G.S. Miglani, D.R. Satija and Sudagar Singh

Cytogenetics of Crop Plants

Subject Code: BAGE4- 702 LT P C 2 0 0 2

Unit-I

Structure and function of cell organelles.Cell cycle.

Unit-II

Chromosomal theory of inheritance. Morphology, ultra-structure and differential staining of chromosomes. Unusual chromosomes. Cytological, genetic and morphological effects of chromosomal aberrations.

Unit-III

Classification, induction, characterization and utilization of haploids, euploids and aneuploids. *In situ* hybridization. Evolution of karyotype.

Unit-IV

Genome analysis in wheat, cotton, Brassica species.

Books Recommended:

1. Elements of Cytology by N.S. Cohn
2. Cytogenetics by P.K. Gupta
3. Plant Cytogenetics by Ram J Singh

Theory and Practice of Plant Breeding

Subject Code: BAGE4- 703 LT P C 3 0 0 3

Unit-I

Role of plant breeding.Centres of origin of crop plants. Plant genetic resources and their utilization.

Unit-II

Breeding systems. Breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops and their genetic basis.

Unit-III

Heterosis and its exploitation. Male sterility and self-incompatibility. Mutation and polyploidy. Breeding for quality traits. Breeding for abiotic and biotic stresses. Wide hybridization.

Unit-IV

Procedures for the release of new varieties. Plant Variety Protection and Breeders' Rights. Seed Production Procedures and Practices

Books Recommended:

1. Principles and Procedure of Plant Breeding by G.S. Chahal and S.S. Gosal, Narosa Publishing House.
2. Principal of Cultivar Development by Watler R. Fehr
3. Plant Breeding: Principles and Methods by B.D. Singh, Kalyani Publishers.
4. Plant Breeding: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
5. Breeding Field Crops: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
6. Practicals in Introductory Plant Breeding by G.S. Chahal, M.S. Gill, G.S. Nanda and S.B. Singh

Breeding of Field Crops

Subject Code: BAGE4- 704 LT P C 3 0 0 3

Unit-I

Application of genetic, cytogenetic and biotechnological techniques in crop breeding.

Unit-II

Breeding for major cereals & millets, their origin and germplasm sources: wheat, triticale, rice, maize, barley, pearlmillet.

Unit-III

Breeding,their origin and germplasm sources for oilseeds and pulses: Rapeseed-mustard, soybean, groundnut, pigeonpea, moongbeen, lentil and urdbean etc.;Cash crops and fodder crops: cotton, sugarcane, sorghum, barseem, oats etc.

Unit-IV

Problems and present status of crop improvement in India with emphasis on the work done in Punjab. National and International centres of crop improvement.

Books Recommended:

1. Plant Breeding: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
2. Breeding Field Crops: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Principles and Procedure of Plant Breeding by G.S. Chahal and S.S. Gosal, Narosa Publishing House.
4. Plant Breeding: Principles and Methods by B.D. Singh, Kalyani Publishers
5. Principal of Cultivar Development by Watler R. Fehr

Crop Experimentation

Subject Code: BAGE4- 705 LT P C 1 0 0 1

Unit-I

Experiments in Plant Breeding - objectives, analysis and interpretation of results.Statistics in relation to crop experimentation.

Unit-II

Principles of experimental designs. Uniformity trials, progeny rows trials, compact family block design, completely randomized block design, randomized block design, incomplete block 145 designs.

Unit-III

Simple lattice. Augmented design. Split plot design

Unit-IV

Varietal trials over years and locations. G x E and estimation of genetic components. Analysis of co-variance. Determination of yield through its components.

Books Recommended:

1. Statistical Procedures for Agricultural Research by K A. Gomez and A.A. Gomez
2. Statistical Methods for Agricultural Workers (Fourth Edition) by V.G. Panse and P.V. Sukhatme

Plant Tissue Culture and Transformation

Subject Code: BAGE4- 706 LT P C 2 0 0 2

Unit-I

Concepts of plant tissue culture and transformation. Various aspects of plant tissue culture. GMO's / LMO's/ transgenics.

Unit-II

Gene transfer methods. Agrobacterium mediated plant transformation. Particle gun mediated plant transformation.

Unit-III

Molecular characterization of transgenic plants using PCR, Southern and Western analysis. Bioassays with transgenic plants.

Unit-IV

Genetic engineering of crop plants for useful traits. Foods for the future. Biosafety concerns and regulatory mechanisms. Commercialization of transgenic products.

Books Recommended:

1. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
2. Plant Biotechnology by Jayabalan.
3. Methods in Plant Tissue Culture by U. Kumar.
4. Introduction to Plant Tissue Culture by M. K. Razdan.

Molecular Biotechnology and Genomics

Subject Code: BAGE4- 707 LT P C 2 0 0 2

Unit-I

Classification, properties and uses of restriction endonucleases. Characteristics and uses of plasmids in molecular biology. Recombinant DNA technology.

Unit-II

Construction and uses of genomic and cDNA libraries. Genome organization of prokaryotes and eukaryotes. Southern, Northern and Western hybridization.

Unit-III

Polymerase chain reaction. Molecular markers, their classification (PCR/Non-PCR based) and use: RFLP, AFLP RAPD, SSR, ISSR, STS, SCAR.

Unit-IV

Generation of molecular maps. DNA sequencing. Gene cloning approaches. Introduction to Omic approach, Functional genomics, proteomics and bioinformatics.Applications of biotechnology in crop improvement.

Books Recommended:

1. Elements of Biotechnology by P.K. Gupta
2. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
3. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.
4. Plant Biotechnology by Jayabalan.
5. Molecular plant Breeding by Yunbi Xu

Introduction to Molecular Biotechnology(Practical)

Subject Code: BAGE1- 781 LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Genetics of Crop Plants (Practical)

Subject Code: BAGE4- 708 LT P C 0 0 2 1

Study of autosomal monogenic and digenic inheritance. Three point test cross and gene mapping. Detection and estimation of linkage using test cross and F2 data. Segregation in corn. Gene frequency analysis - autosomal, sex-linked and multiple allelic traits. Genetic equilibrium. Demonstration of quantitative inheritance.

Cytogenetics of Crop Plants (Practical)

Subject Code: BAGE4- 709 LT P C 0 0 2 1

Microscopy. Techniques of cytological preparations. Fixation of material for mitosis and meiosis. Preparation of permanent slides of cell division. Karyotype analysis. Production and study of polyploids and haploids. Identification of aneuploids.

Theory and Practice of Plant Breeding (Practical)

Subject Code: BAGE4- 710 LT P C 0 0 2 1

Emasculation, crossing and selfing in various crops. Collection, viability and germination of pollen. Handling of breeding materials. Study of variability, male sterility and selfincompatibility. Quality testing in crop plants. Screening for disease resistance.

Crop Experimentation (Practical)

Subject Code: BAGE4- 711 LT P C 0 0 2 1

Statistical parameters and tests of significance. Use of computer packages/softwares for data analysis. Layout of field experiments. Analysis of experimental designs. Character association. Analysis of varietal trials and G x E interactions.

Plant Tissue Culture and Transformation (Practical)

Subject Code: BAGE4- 712 LT P C 0 0 2 1

Establishment of direct and indirect *in vitro* plant regeneration methods for genetic transformation. Gene constructs and their maintenance. Agrobacterium mediated genetic transformation. Particle mediated genetic transformation. Histochemical GUS assays. PCR screening of putative transgenic plants. Raising transgenic plants under contained conditions.

Molecular Biotechnology and Genomics (Practical)

Subject Code: BAGE4- 713 LT P C 0 0 2 1

Isolation, purification and fractionation of DNA and proteins. Isolation and purification of plasmids. Quantification of protein and nucleic acid concentration using spectrophotometer. DNA amplification using RAPD/SSR primers and its fractionation in agarose gel. Generation of linkage maps and mapping of qualitative genes using important web sites on computer.

4. Agri-Economics, Extension & Business Management

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780 LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology.Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses.Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches.DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics.Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D.Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifielde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Visual and Graphic Communication

Subject Code: BAGE5- 701 LT P C 1 0 0 1

Unit I

Definition, characteristics, classification, principles and role of visuals in communication; Contribution of visual perception in learning process

Unit II

Planning, preparation, presentation and evaluation of visual aids; low cost visuals, photographs and pictures

Unit III

Computer based digitized visual materials; Use of drawing techniques for visuals

Unit IV

Selection and use of animation tools in transfer of technology; Preparation and use of resource map for extension work; Designing of visuals for print and electronic media; Scope and importance of journalism in agriculture

Books Recommended

1.Visual Communication Design: An Introduction to Design Concepts in Everyday Experience by Meredith Davis and Jamer Hunt

2.Notes on Graphic Design and Visual Communication 3rd Edition by Gregg Berryman

Communication & Information Technology

Subject Code: BAGE5- 702 LT P C 2 0 0 2

Unit I

Introduction to communication. Problems in communication and feedback. Role of information and communication technology in agriculture and rural development

Unit II

Extension teaching methods and their use. Trends in agriculture information management system. Need and scope of cyber extension

Unit III

Importance of kiosks, agri- portal, internet café, community and FM radio in villages. Privatization of cyber extension

Unit IV

Public-private partnership. Development of Information Communication Technology (ICT) in changing the agricultural scenario.

Books Recommended

1.Information & Communication Technology (ICT) In EducationPaperback – 2016 by Prof. T. Mrunalini and Prof. A. Ramakrishna

2.Information Technology Infrastructure and Its ManagementPaperback – 2014 by Munesh Chandra Trivedi

Behavioural Skills for Human Resource Development

Subject Code: BAGE5- 703 LT P C 2 0 0 2

Unit I

Concept of human behaviour. Taxonomy of behavioural domains. Human needs and their hierarchy. Attitude, its characteristics and measurement. Perception and its principles, selectivity in perception.

Unit II

Motivational skills for attitudinal and perceptional changes. Problem-solving skills. Innovativeness in human behaviour, response and resistance to change.

Unit III

Concept of self, Johari's window model. Defence mechanism. Group dynamics. Group behaviour and conflict management. Decision-making process. Theories of leadership.

Unit IV

Concept of human resource development and human relations. Human interaction, its importance and types. Interpersonal perception and social behavior

Books Recommended

1.Human Resource Management, 11ed, ISV Paperback – by David A. Decenzo, Stephen P. Robbins and Susan L. Verhulst

2.Fundamental of human resource Management by Neeru Vasishth

Micro Economic Analysis

Subject Code: BAGE5- 704 LT P C 3 0 0 3

Unit I

Micro Economics: meaning, definition, importance, nature and scope. Theory of consumer behavior: marginal utility analysis and indifference curve analysis. Demand analysis: meaning, definition, derivation of demand curve.

Unit II

Firm and industry: meaning, types, difference between firm and industry, equilibrium conditions, short-run and long-run analysis. Production: meaning, process and factors of production, relationship between production and different factors, production lags.

Unit III

Theory of producer behaviour: production function, costs, optimization of inputs use and product combinations, maximization of returns, specialization and diversification and supply analysis. Product market: meaning, types, assumptions, conditions of perfect and imperfect markets.

Unit IV

Equilibrium of a firm and industry, determination of price and output of commodities under different market situations. Factor pricing: meaning, different theories for determination of rent, wages, interest and profit.

Books Recommended

1.Advanced Economic Theory Paperback – by H L Ahuja

2.Economic Theory by Vaish and Sundharam

Macro Economic Analysis

Subject Code: BAGE5- 705 LT P C 3 0 0 3

Unit I

Macro Economics: meaning, definition, importance, limitations, scope and integration of micro and macro analysis. Basic macro economic concepts. National income: meaning, definition, types, measurement and social accounting

Unit II

Circular flow of money. Simple Keynesian model of income determination, shifts in aggregate demand. Multiplier. Theories of consumption and investment. Income determination model including money and interest. Monetary policy: meaning, instruments, indicators, lags and effectiveness

Unit III

Fiscal policy: meaning, definition, different tools and limitations. Wage and employment policies: meaning, need, demand and supply of labour, measures of full employment, relationship between level of employment and output. Inflation and recession: process, causes, types and remedies

Unit IV

Introduction to Indian economy and comparison with other related economies. Significant economic problems in Indian agriculture relating to agricultural production and productivity, credit, marketing, labour and environment

Books Recommended

1.Economic Theory by Vaish and Sundharam

2.A text book of economic theory by Stonier and Hague

3.Macroeconomic Analysis Hardcover –by Edward Shapiro

Financial & Project Management

Subject Code: BAGE5- 706 LT P C 3 0 0 3

Unit I

Importance, need, scope and functions of finance. Concept of time value of money. Capital budgeting concept and steps in capital budgeting

Unit II

Appraisal criteria- payback period, average rate of return, net present value, benefit cost ratio and internal rate of return.

Unit III

Working Capital Management- concept, determinants and need for working capital in agribusiness. Introduction, objectives and techniques of inventory management for agribusiness.

Unit IV

Introduction to cost of capital and capital structure. Project management- concept, characteristics and types of projects. Project feasibility- market, technical, financial and economic feasibility. Project risk analysis. Estimating financial requirements of projects and sources of finance.

Books Recommended

1. Project Appraisal & Management by Rashmi Agrawal Yogieta S
2. Financial Management by R.P Rustagi

Retailing and Supply Chain Management

Subject Code: BAGE5- 707 LT P C 3 0 0 3

Unit I

Introduction to retailing- definition, concept and overview. Types of retail institutions related to agri- business. Changing food consumption patterns in India.

Unit II

Store location and site selection. Managing retail operationsprocurement and inventory management. Store design- the exterior, interior, layout and display.

Unit III

Promoting store. Introduction to customer relationship management in retail business.

Unit IV

Supply chain management concept, definition and importance. Elements of physical distribution systems, building and operating supply chains in agribusiness. Role of IT in supply chain management

Books Recommended

1. Managing the Retail Supply Chain by Glenn Taylor and James Topps
2. Retail Supply Chain Management by James Ayers and Mary Ann Odegaard

Introduction to Molecular Biotechnology(Practical)

Subject Code: BAGE1- 781 LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Visual and Graphic Communication (Practical)

Subject Code: BAGE5- 708 LT P C 0 0 2 1

Preparation and use of visual aids. Generating computer aided presentation of graphics. Scanning of visuals, image editing and script writing for radio & TV. Developing agricultural video films. Visit to animation, print and electronic media centers. Writing of news items, articles, success stories etc. for print and electronic media. Presentation and evaluation of visuals.

Communication & Information Technology (Practical)

Subject Code: BAGE5- 709 LT P C 0 0 2 1

Studying problems faced by farmers at Agri-clinic and analyzing communication problems of extension personnel. Use of different extension teaching methods in field and simulated conditions. Practice in planning and conducting video- conferencing. Visit to information kiosks. Identifying problems in agriculture information management system.

Micro Economic Analysis (Practical)

Subject Code: BAGE5- 710 LT P C 0 0 2 1

Practical training to study consumer behavior in relation to demand of various commodities, consumer survey. Economic analysis of a firm and industry. Working knowledge of relationship between production and different factors of production, production costs and optimum input use. Product market survey. Practical training of price determination in different types of markets

Financial & Project Management (Practical)

Subject Code: BAGE5- 711 LT P C 0 0 2 1

Case studies related to financial management and project management. Visits to agri-business industrial houses. Numerical problems based on capital budgeting. Preparation of project report for various agri-business ventures

5.**Plant Protection (Entomology, Plant Pathology and Nematology**

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780 LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology.Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses.Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches.DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics.Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D.Watson
2. Gene VIII, Benjamin Lewin

3. Molecular biology, David Freifielde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Apiculture

Subject Code: BAGE6- 701 LT P C 1 0 0 1

Unit-I

Indian history of beekeeping. Species and races of honey bees. Morphology and anatomy of honey bee.

Unit-II

Colony organization, life cycle and division of labour in Apis mellifera. Seasonal management of honey bee colonies; swarming, drifting and curbing drone population.

Unit-III

Management of queenless and laying worker colonies. Colony multiplication. Bee enemies and diseases. Protection from pesticidal hazards. Maximizing honey production. Bee flora.

Unit-IV

Managed bee pollination of crops. Colony migration. Apicultural diversification. Honey and its quality. Economics of beekeeping.

Books Recommended

1. Integrated pest management by G. S. Dhaliwal
2. Biopesticides and pest management by G. S. Dhaliwal
3. A text book of applied Entomology by K. P. Srivastava
4. Agricultural insect pests of Crops and their control by V. P. S. Panwal
   Hand book of Pest management by S. F. Hameed

Biocontrol and Integrated Pest Management

Subject Code: BAGE6- 702 LT P C 2 0 0 2

Unit-I

History and concept of biological control, different groups of biological control agents and biopesticides macrobials (parasitoids and predators), microbials (bacteria, viruses, fungi, protozoa and nematodes) and botanical- neem, pyrethrum, nicotine, rotenone and others, their use in pest management along with advantages and limitations.

Unit-II

Methods of mass production for each of these groups. National and international agencies dealing with biological control. IPM-history, definition and concept. Concept of economic threshold. Pest monitoring and surveillance.

Unit-III

Different tools of IPM including physical, mechanical, cultural, biological (parasite and predators, microbial agents), host plant resistance, botanical, chemical, biorationals and biotechnological approaches. Integration of different IPM tactics.

Unit-IV

Decision making systems. Potential of IPM, its implementation and constraints. Successful example in IPM.

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Books Recommended

1. Applied Entomology by D.K. Verma
2. Applied Entomology by M. Yadav
3. Essentials of Agricultural Entomology by G. S. Dhaliwal
4. Entomology by M.S. Nalina Sundar
5. Insects Pests of cereal and their Management by Sandhya Aggarwal

Pesticides and Plant Protection Equipment

Subject Code: BAGE6- 703 LT P C 2 0 0 2

Unit-I

Pesticides- classification, properties, entry and mode of action. Formulations and toxicity of pesticides.

Unit-II

Factors affecting toxicity of pesticides.Compatibility and synergism. Antidotes. Problems associated with the use of pesticides.

Unit-III

Role of repellents, attractants, pheromones, hormones, chemosterilants and antifeedants in pest control.

Unit-IV

Pest control equipment - history of development, classification, constructional features, principles of working, operation, maintenance and selection. Planning of pest control operations.

Books Recommended

1. Text Book of applied Entomology I by K. P. Srivastava
2. Text Book of applied Entomology II by K. P. Srivastava
3. Bio pesticides and Pest Management by G. S. Aulakh
4. Atwal A.S.& G.S.Dhaliwal by *Insect Pests of South East Asia*, Kalyani Publishers, New Delhi

Biocontrol and Integrated Disease Management

Subject Code: BAGE6- 704 LT P C 2 0 0 2

Unit-I

History and principles underlying host resistance, chemical, physical, cultural, biological and legislative measures of plant disease management.

Unit-II

Scope and factors affecting biological control. Mechanisms of bio-control. Characterization of bioagents and their commercial formulations. Limitations of biocontrol.

Unit-III

Commercial production and distribution system. Integrated disease management. Historical developments and classification of fungicides and antibiotics. Mode ofaction, uptake , translocation, disease control and factors affecting their efficacy and field performance. Registration, commercial development and compatibility of fungicides with other chemicals.

Unit-IV

General account of plant protection appliances. Development of resistance in pathogens against fungicides .Non-target effects of fungicide use. Methods of screening for disease resistance. Seed certification standards and phytosanitory measures.

Books Recommended

1. Text Book of applied Entomology I by K. P. Srivastava
2. Text Book of applied Entomology II by K. P. Srivastava
3. Bio pesticides and Pest Management by G. S. Aulakh

Post Harvest Diseases and their Management

Subject Code: BAGE6- 705 LT P C 2 0 0 2

Unit-I

Importance of post-harvest diseases. Important post-harvest diseases of fruits and vegetables.

Unit-II

Factors affecting ripening of fruits and vegetables. Factors favoring development of post-harvest diseases.

Unit-III

Effect of handling and storage practices on the development of post-harvest diseases. Storage methods and conditions.

Unit-IV

Disease management strategies for post-harvest diseases.

BOOKS RECOMMENDED

1. Introductory Mycology by Alexopolues,
2. Fungi and Plant Diseases by Mundkur, C.T. B.B. & Chattopadhyaya, SB
3. Plant Diseases by R.S Singh
4. Plant Pathology by R.P. Singh
5. Fungi by G.L. Chopra
6. Plant Pathology by B.P. Pandey

Plant Nematology

Subject Code: BAGE6- 706 LT P C 1 0 0 1

Unit-I

History and economic importance of plant parasitic nematodes. General characteristics, identification, their classification and relationship with other organisms.

Unit-II

Morphology and biology of important genera, namely Meloidogyne, Heterodera, Globodera, Anguina, Rotylenchulus, Ditylenchus,

Unit-III

Morphology and biology of important genera, namely Tylenchulus, Pratylenchus, Radopholus and virus vectors.

Unit-IV

Principles and methods of control.

Books recommended

1. Plant Nematology: R. N. Perry and M. Moens (2013, 2nd Edition)
2. Plant parasitic nematodes in temperate agriculture: K. Evans, D. Trudgill and J. Webster (1993)
3. Plant parasitic nematodes in subtropical and tropical agriculture: R. Sikora, D. Coyne, J. Hallmann and P. Timper (2018, 3rd Edition)
4. Practical plant nematology: A field and laboratory guide: D. Coyne, J. Nicol and B Claudius-Cole

Introduction to Molecular Biotechnology(Practical)

Subject Code: BAGE1- 781 LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Plant Disease Diagnosis (Practical)

Subject Code: BAGE6- 707 LT P C 0 0 4 2

Field diagnosis of important diseases of Rabi and Kharif crops, vegetables, fruits , forest and ornamental plants. Estimation of losses and methods for assessing the intensity of diseases like angular leaf spot of cotton, Tikka disease of groundnut, yellow mosaic of beans , downy mildew of bajra, rusts and loose smut of wheat, Alternaria blight, downy mildew of mustard and powdery mildew of pea. Methods of soil sterilization for raising healthy nursery plants. Solar- heat treatment. Methods of producing virus-free citrus and potato. Diagnosis and differentiation of disorders due to viruses, nutritional imbalances, genetic variations and toxaemias. Types of chemicals used for the control of plant diseases and methods of their application. Cultural and biological methods of plant disease control.

Apiculture (Practical)

Subject Code: BAGE6- 708 LT P C 0 0 4 2

Important species of honey bees, castes differentiation and body structure. Handling of colonies. Colony organization and food storage pattern. Langstroth hive, apicultural equipment and machinery. Bee flora. Seasonal management practices. Colony division. Mass queen bee rearing techniques. Queen introduction, clipping and marking. Bee pollination of crops. Management of bacterial, viral and fungal diseases of honey bees. Identification and management of parasitic mites, wax moths, ants, wasps and predatory birds. Honey extraction. Pollen, propolis and bee venom collection. Processing of bees wax. Royal jelly production and collection. Honey processing and packaging. Honey testing. Visit to beekeeping industry (Hive manufacturing, equipment manufacturing, honey processing and exporting commercial units).

Biocontrol and Integrated Pest Management (Practical)

Subject Code: BAGE6- 709 LT P C 0 0 4 2

Identification of important groups of parasitoids, predators and microbial control agents. Laboratory multiplication of parasitoids, predators and microbial control agents. Determination of economic threshold 100 levels. Demonstration of cultural and mechanical control measures of different pests. Use of pheromones, colour, sticky and light traps for monitoring and surveillance of pests. Study of IPM module in cotton, rice, sugarcane, maize, fruits and vegetables

Pesticides and Plant Protection Equipment (Practical)

Subject Code: BAGE6- 710 LT P C 0 0 2 1

Familiarization with different formulations of pesticides, their preparation and use. Toxicity to insects and plants. Calculation of dosages of pesticides and fumigants. Practice in the use of various types of pest-control equipments. Study of factors affecting efficacy of pesticide spray. Calibrations of plant protection equipments. Common troubles in the use of pest-control equipment and their remedies. Estimation of pesticide residue in food commodities.

Biocontrol and Integrated Disease Management (Practical)

Subject Code: BAGE6- 711 LT P C 0 0 4 2

Isolation and Identification of bio-control agents. Evaluation of bio-control agents against plant pathogens in vitro and in vivo. Production and application procedures. Laboratory evaluation of fungicides and antibiotics by various methods against different groups of pathogens. Methods of application of fungitoxicants. Absorption, translocation and persistence of different fungitoxicants. Integration of bio-control agents with other methods of plant disease control.

Post Harvest Diseases and their Management (Practical)

Subject Code: BAGE6- 712 LT P C 0 0 2 1

Important post-harvest diseases of fruits and vegetables like mango, citrus, guava, grapes, pear, cucurbits, chilli, tomato and potato. Study of factors favouring development of post-harvest di seases. Disease development under different storage conditions. Demonstration of various methods of disease management. Visit to a packing house.

Plant Nematology (Practical)

Subject Code: BAGE6- 713 LT P C 0 0 2 1

Methods of survey, collection of soil and plant samples. Extraction of nematodes and population estimation. Preparation of temporary and permanent mounts. Study of morphological characteristics and disease symptoms. Application of nematicides.

Eigth Semester

On-campus learning

Subject Code: BAGE1- 880 LT P C 0 0 16 8

After attaining the rural experience, for about 12 weeks, on-campus learning will be planned. Detailed Practical Field Learning Programme of each specialization is given below;

Industrial attachments (Off-campus)

Subject Code: BAGE1- 881 LT P C 0 0 10 5

Students from each stream will be divided into groups each having 5 to 10 students and each group will visit an agro-industrial (processing) unit with the help of extension agencies and prepare a report of the organizational set-up, operational working and performance of the unit with SWOT analysis. Next 4 weeks are to be devoted to this activity.

Rural experiences

Subject Code: BAGE1- 882 LT P C 0 0 6 3

A coordinator from the department of Extension Education will handle this course. For practically showing, he will take the students to an average village and make them aware the socio-economic structure of the villager such as sources of livelihood and occupational pattern, village infrastructure in terms of health, education, vety services, cooperative societies, banks, marketing facilities, farming conditions with reference to cropping pattern & livestock situation etc. The time allocated to this activity is three weeks in the beginning of semester.

Documentation, reporting and presentation

Subject Code: BAGE1- 883 LT P C 0 0 2 1

Each group of students will write a detailed report of their rural and specialized practical training taken and give a Power Point Presentation in the presence of concerned teachers who will evaluate the performance of the students. It will be completed in one week.

Details of On-campus and off-campus Practical Field Learning Programme

Title of Module (on-campus)	Industrial attachment (Off-campus)
1.Natural Resource Management (Soil , Agronomy & Agro-forestry	
Module for evaluating soil health and irrigation water quality (Deptt. of Soil Science)	• Fertilizer industries • Vermi-compost units • Bio-fertilizer units • Mineral mines • Organic Farming
Practical seed production (Deptt. of Agronomy)	• Seed industries / companies • Herbicide formulators • Agro-processing units such as Mentha distillation plants, Soybean processing units, Rice Shelling, Sugar Mill
2.Horticulture (Pomology, Olericulture & Floriculture)	
Nursery production of fruit crops	Commercial fruit nurseries
(Deptt. of Fruit Science)	Orchards of Progressive growers
Nursery raising techniques and protected cultivation of Vegetables (Deptt. of Vegetable Science)	Commercial vegetable nurseries
Mushroom production (Deptt. of Microbiology)	Farms of Progressive vegetable and flower growers Vegetables seed production units Mushroom production units
3. **CROP IMPROVEMENT (Plant Breeding, Genetics and Biotechnology)**	
Hybrid seed production of sunflower	Commercial hybrid seed production units Maintaining parental lines Hybrid Seed production units at private farm
Biotechnological tools in crop improvement	Biotechnological and tissue culture labs
Breeder seed production	Breeding material and varietal trials

4.Agri-Economics, Extension & Business Management

Designing and preparation of facilitating material and organizing activities (Deptt. of Extension Education)	• Mandate, activities and problems of extension services provided by extension system of Agriculture, Horticulture, AH, Soil Conservation, PAMETI, ATMA, IFFCO, KRIBHCO, MARKFED, DRDA, Zila Prishad etc.
Marketing of agricultural produce, preparing enterprise & financial budgets and identification of adoption gaps (Deptt. of Agric. Economics)	• Structure & functioning of Agricultural Financial Institutions - Commercial Banks, Co-operative Societies • Market channels and functionaries in foodgrain/vegetable market • Estimating economics of crop and livestock enterprises, preparing project reports
Case studies related to financial, project, retail and supply chain management, and preparation of project profile (Deptt. of Business Management)	• Study of Successful ventures of Agri-management such as milk plant and associated dairy units, poultry farms, mushroom/fruit/vegetable/ flower units for project evaluation and marketing

Elective: **5.Plant Protection (Entomology, Plant Pathology and Nematology)**

Production of bio-agents against plant pathogens (Deptt. of Plant Pathology/ Entomology)	• Pesticide and bio-pesticide industries • Bio-control agents production units • Plant Quarantine Station • Virus free potato tubers production units

1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-101	Calculus-I	4	1	0	40	60	100	5
BMAT1-102	Algebra-I	4	1	0	40	60	100	5
BMAT1-103	Analysis-I	4	1	0	40	60	100	5
BHUM1-101	English	4	0	0	40	60	100	4
BCAP1-101	Fortran Programming	4	0	0	40	60	100	4
BCAP1-102	Fortran Programming Lab.	0	0	2	60	40	100	1
Total		**20**	**3**	**2**	**260**	**340**	**600**	**24**

2nd Semester		Contact Hrs.			Marks			Credits
Subject	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-204	Calculus-II	4	1	0	40	60	100	5
BMAT1-205	Algebra-II	4	1	0	40	60	100	5
BMAT1-206	Analysis-II	4	1	0	40	60	100	5
BHUM1-202	Environmental Science	4	0	0	40	60	100	4
BCAP1-203	Fundamentals of Computers and C^{+} Programming	4	0	0	40	60	100	4
BCAP1-204	C^{+} Programming Lab.	0	0	2	60	40	100	1
Total		**20**	**3**	**2**	**260**	**340**	**600**	**24**

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-307	Differential Equations-I	4	1	0	40	60	100	5
BMAT1-308	Mathematical Statistics	4	1	0	40	60	100	5
BMAT1-309	Geometry	4	1	0	40	60	100	5
BMAT1-310	Number Theory	4	1	0	40	60	100	5
BCAP1-305	Object Oriented Programming	3	0	0	40	60	100	3
BCAP1-306	Object Oriented Programming Lab.	0	0	2	60	40	100	1
Total		**19**	**4**	**2**	**260**	**340**	**600**	**24**

4th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-410	Differential Equations-II	4	1	0	40	60	100	5
BMAT1-411	Linear Algebra	4	1	0	40	60	100	5
BMAT1-412	Mechanics-I	4	1	0	40	60	100	5
BMAT1-413	Numerical Methods	4	1	0	40	60	100	5
BCAP1-407	Latex and R	3	0	0	40	60	100	3
BCAP1-408	Latex and R Lab.	0	0	2	60	40	100	1
Total		**19**	**4**	**2**	**260**	**340**	**600**	**24**

5th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-514	Mechanics-II	4	1	0	40	60	100	5
BMAT1-515	Mathematical Methods	4	1	0	40	60	100	5
BMAT1-516	Differential Geometry	4	1	0	40	60	100	5
BMAT1-517	Finite Element Methods	4	1	0	40	60	100	5
BCAP1-509	MATLAB	3	0	2	40	60	100	3
BCAP1-510	MATLAB Lab.	0	0	2	60	40	100	1
Total		**19**	**4**	**2**	**260**	**340**	**600**	**24**

6th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT1-618	LPP	4	1	0	40	60	100	5
BMAT1-619	Ring Theory	4	1	0	40	60	100	5
BMAT1-620	Mathematical Modelling	4	1	0	40	60	100	5
BMAT1-621	Discrete Mathematics	4	1	0	40	60	100	5
BMAT1-622	Financial Mathematics	4	1	0	40	60	100	5
Total		**20**	**5**	**0**	**200**	**300**	**500**	**25**

Overall

Semester	Marks	Credits
1st	600	24
2nd	600	24
3rd	600	24
4th	600	24
5th	600	24
6th	500	25
Total	**3500**	**145**

CALCULUS-I

Subject Code: BMAT1-101 **L T P C** **Duration: 55 Hrs.**
4 1 0 5

UNIT-I (14 Hrs.)

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

UNIT-II (14 Hrs.)

Concavity, Convexity, Points of inflexion, Increasing and decreasing function, Asymptotes, Polar curves, Multiple points, Tracing of Cartesian curves, Idea of some well-known parametric and polar curves, Curvature of a curve at a point, Radius of curvature for Cartesian, Parametric, Polar forms, Centre of curvature.

UNIT-III (15 Hrs.)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

UNIT-IV (12 Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, working rule to find the extreme values of a function z= f (x, y), Lagrange's method of undetermined multipliers, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative.

Recommended Textbooks/References:

1. G.B. Thomas, M.D. Weir, J. Hass Thomas, 'Calculus', 12th Edn., Pearson Education.
2. Gorakh Prasad, 'Integral Calculus', 14th Edn., Pothishala Private Ltd., Allahabad, Reprint **2007**.
3. Zafar Ahsan, 'Differential Equations and their Applications', 2nd Edn., Prentice Hall of India Pvt. Ltd., New Delhi.
4. B.S. Grewal, 'Higher Engineering Mathematics', 35th Edn., Khanna Publishers, **2000**.
5. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley & Sons, **2006**.

ALGEBRA-I

Subject Code: BMAT1-102 **L T P C** **Duration: 55 Hrs.**
4 1 0 5

UNIT-I (14 Hrs.)

Matrices, Row and Column Space of Matrix, Row reduction and echelon forms, Rank, Systems of linear equations, Gaussian elimination, Determinants and their properties, Cramer's rule, Vector equations, The matrix equation AX = B, Solution sets of linear systems (Homogeneous & Non-homogeneous), Applications of linear systems.

UNIT-II (14 Hrs.)

Eigenvalues, Eigenvectors, Characteristic polynomial, Minimal polynomial, Characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Diagonalization, Linear transformations, Representation of linear transformations by matrices, Change of basis, Rank-nullity theorem, Minimal polynomial.

UNIT-III (14 Hrs.)

Binary space, Definition of group, Ring and field, Vector space, Subspace, Linear combination, Linear span, Dimension of vector space, Direct sum of spaces, Quotient space, Homomorphism & Isomorphism of vector space.

UNIT-IV (13 Hrs.)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non-singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation.

Recommended Books:

1. Chandrika Prasad, 'Text Book on Algebra and Theory of Equations', Pothishala Pvt. Ltd.
2. I.N. Herstein, 'Topics in Algebra', 2nd Edn., Vikas Publishing House, **1976**.
3. 'Linear Algebra', Schaum Outline Series.
4. H.S. Hall and S.R. Knight, 'Higher Algebra', H.M. Publications, **1994**.
5. Shanti Narayan, 'A Text Books of Matrices'.

ANALYSIS-I

Subject Code: BMAT1-103 | **L T P C 4 1 0 5** | **Duration: 55 Hrs.**

UNIT-I (14 Hrs.)

Real Numbers and Sequences of Real Numbers

Preliminaries: Sets and Functions, Mathematical induction, Finite and infinite sets.

Algebraic and order properties of R, Absolute value and the real line, Completeness property of R, Applications of supremum property, Archimedean property, Density of rational numbers in R, Intervals- Characterization theorem, Nested intervals, Nested interval property, The unaccountability of R, Binary and decimal representation of real numbers.

A sequence in R, The limit of a sequence, Convergence of a sequence, Uniqueness of limits, Limit theorems, Monotone sequence, Euler's number, Subsequence, Divergent criteria, Monotone subsequence theorem, Bolzano-Weierstrass theorem, Cauchy sequence, Cauchy convergence criterion, Properties of divergent sequences.

UNIT-II (14 Hrs.)

Infinite Series

Infinite series- partial sums, Convergence of infinite series, the nth term test, Cauchy criterion for series, Examples including the geometric series, The harmonic series, P- series, The alternating harmonic series, Comparison test and limit comparison test.

Absolute convergence, Grouping and rearrangements of series, Tests for absolute convergence- The root test, the ratio test, the integral test, The Rabbe's test, alternating series, Alternating series test, Dirichlet test, Abel's test.

UNIT-III (14 Hrs.)

Limits and Continuous Functions

Cluster point of a subset of R, Limit of a function at a cluster point of a set, Sequential criterion for the limits, Divergence criterion, Limit theorems, squeeze theorem, left handed and right handed limits, Infinite limits.

Continuous functions, Sequential criterion of continuity, Discontinuity criterion, Combinations of continuous functions- sum, Difference, Product and quotient and compositions.

Continuous functions on intervals, Boundedness theorem, Maximum-Minimum theorem, Bolzano's Intermediate value theorem, Preservation of intervals theorem,

Uniform continuity, Non-uniform continuity criteria, Uniform continuity theorem, Lipschitz functions, Continuous Extension theorem, Approximations of continuous functions by step functions and by piecewise linear functions, Weierstrass Approximation theorem. Monotone and inverse functions, The nth root function and rational powers.

UNIT-IV (13 Hrs.)

Differentiation

Differentiability and Derivatives of real functions, Differentiability and Continuity, Basic properties of the derivatives, Caratheodory theorem, Chain rule, Inverse functions and their derivatives, Rolle's theorem, Mean Value theorem, Applications of mean value theorem, Intermediate value property of derivatives, Darboux's theorem, L'hospital rules, Taylor's theorem, Applications of Taylor's theorem, Convex functions, Newton's method, Differentiation of vector valued functions.

Recommended Books:

1. Robert G. Bartle and Donald R. Sherbert, 'Introduction to Real Analysis', 3rd Edn., John Wiley & Sons, Inc., **2000**.
2. Walter Rudin, 'Principles of Mathematical Analysis', 3rd Edn., McGraw Hill, **1976**.
3. S.C. Malik and Savita Arora, 'Mathematical Analysis', New Age International Publisher, **Reprint 2008**.
4. T.M. Apostol, 'Mathematical Analysis', 2nd Edn., Narosa Publishing House, **Reprint 2002**.

ENGLISH

Subject Code: BHUM1-101	**L T P C**	**Duration: 55 Hrs.**
	4 0 0 4	

UNIT-I (8 Hrs.)

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

UNIT-II (8 Hrs.)

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

Communication Styles: Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

UNIT-III (8 Hrs.)

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations.

Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication.

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message.

UNIT-IV (12 Hrs.)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview

Giving Presentations: Dealing with Fears, planning your Presentation, structuring your Presentation, Delivering your Presentation, Techniques of Delivery

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Recommended Books:

1. Stephen. P. Robbins, 'Organizational Behaviour', 1st Edn., Pearson, **2013.**
2. Gopala Swamy Ramesh, 'The Ace of Soft Skills: Attitude, Communication and Etiquette for Success', 5th Edn., Pearson, **2013.**
3. Deborah Dalley, Lois Burton, Margaret, Green Hall, 'Developing Your Influencing Skills', 1st Edn., Universe of Learning Ltd., **2010.**
4. Barun K. Mitra, 'Personality Development and Soft Skills', 1st Edn., Oxford Press, **2011.**
5. Butter Field, 'Soft Skill for Everyone', 1st Edn., Cengage Learning India Pvt. Ltd., **2011.**
6. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edn., McGraw Hill Education, **2011.**
7. John Adair, 'Effective Communication', 4th Edn., Pan MacMillan, **2009.**

8. Aubrey Daniels, 'Bringing out the Best in People', 2nd Edn., McGraw Hill, **1999.**

FORTRAN PROGRAMMING

Subject Code: BCAP1-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction to Computing, Introduction to Digital Computers, Operating Systems, Linux, Windows and other Operating Systems, Open Source Foundation and GNU, Programming and Problem Solving.

UNIT- II (13 Hrs.)

Basic FORTRAN, Introduction to FORTRAN, Data Types, Constants, and Variables, Operation and Intrinsic Functions, Expressions and Assignment Statements, Simple Input/Output, Program Structure, Example: Simple Unit Conversion.

UNIT- III (12 Hrs.)

Control Constructs, Logical Operators and Logical Expression, If Constructs, The Case Construct, Do Loops, Programming Units, Types of Programming Units, Main Program, External Procedures, Internal Procedures, Modules, Subroutines, Functions, Arguments of Procedures, Scope of Variables, Recursion, Arrays and Array Operations, Arrays in Fortran, Array Processing, Array Constructors, Mask Array.

UNIT- IV (10 Hrs.)

Fortran I/O and External Files, Formatted Output, Formatted Input, File Processing User Defined Types and Structures, Derived Types, Type Bound Procedures, Polymorphism Graphics (Gnu plot), The Gnu plot Scientific Graphic Library, Linking Fortran Programs to Gnu Plot Graphic Library.

Recommended Books:

1. Jane Sleightholme, Ian Chivers, 'Introduction to Programming with FORTRAN', Springer, **2003**.
2. V. Rajaraman, 'Computer Programming in FORTRAN 77', PHI Learning Pvt. Ltd., **1997**.

FORTRAN PROGRAMMING LAB.

Subject Code: BCAP1-102 **L T P C**
0 0 2 1

Operational Knowledge and Implementation of numerical methods & statistical Techniques using FORTRAN Programming Language.

1. **Input-output statements:** formatted and non-formatted statements
2. **Decision Making:** switch, if-else, nested if, else-if ladder
3. **Jumping Statements:** break, continue, goto
4. **Loops:** while, do-while, for
5. **Functions:** definition, declaration, variable scope, parameterized functions, return statement.
6. Call by value, call by reference, recursive functions.
7. **Arrays:** Array declarations, Single and multi-dimensional.
8. Strings and string functions.

CALCULUS-II

Subject Code: BMAT1-204 **L T P C** **Duration: 55 Hrs.**
4 1 0 5

UNIT-I (11 Hrs.)

Arc formula for the Cartesian equation y=f(x), other expressions for lengths of Arcs, Areas under Curves, Area formulas for parametric, polar equation, Area of the closed curve, Volume and surfaces of Revolution of curves, Area of the surface of the Frustum of a cone, Area of the surface obtained by Revolving the curve about axes.

UNIT-II (11 Hrs.)

Integration by Partial fractions, integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic function and of their combinations.

UNIT-III (12 Hrs.)

Definite integrals and their properties, Reduction formulae for integral of the form $\int_0^{\frac{\pi}{2}} \sin^n \theta \, d\theta$, $\int_0^{\frac{\pi}{2}} \cos^n \theta \, d\theta$, $\int_0^{\frac{\pi}{2}} \sin^m \theta \cos^n \theta \, d\theta$, Improper Integral and special function- Beta and Gamma functions and their properties.

UNIT-IV (12 Hrs.)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity, Triple integrals (Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Recommended Textbooks/References:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, **2008**.
3. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, **2010**.
4. B.S. Grewal, 'Higher Engineering Mathematics', 35th Edn., Khanna Publishers, **2000**.
5. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley & Sons, **2006**.

ALGEBRA-II

Subject Code: BMAT1-205	**L T P C**	**Duration: 55 Hrs.**
	4 1 0 5	

UNIT-I (12 Hrs.)

Definition of a group, with examples and simple properties, Abelian Group, Groups of transformations. Subgroups, Generation of groups and cyclic groups, Order of Group, Coset decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems.

UNIT-II (12 Hrs.)

Normal Subgroup, Quotient Groups, Homomorphism, Isomorphism, Automorphism, Permutation of Group, Even and Odd Permutation, Cayley Theorem, Sylow's Theorem

UNIT-III (12 Hrs.)

Definition and examples of a ring and its properties, Subrings, Integral domains, Characteristics of ring, Division rings and Fields, Ring homomorphism and isomorphism, Ideals and Quotient rings.

UNIT-IV (12 Hrs.)

Inner product, length, orthogonality, orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, inner product spaces.

Recommended Books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004.**
2. Surjeet Singh and Qazi Zameeruddin, 'Modern Algebra.' 7th Edn., Vikas Publishing House, New Delhi, **1993.**
3. I.N. Herstein, 'Topics in Algebra', 2nd Edn., Vikas Publishing House, **1976**.
4. John B. Fraleigh, 'A First Course in Abstract Algebra', 7th Edn., Pearson, **2002**.

5. M. Artin, 'Abstract Algebra', 2nd Edn., Pearson, **2011**.
6. Joseph A. Gallian, 'Contemporary Abstract Algebra', 4th Edn., Narosa, **1999**.
7. George E. Andrews, 'Number Theory', Hindustan Publishing Corporation, **1984**.

ANALYSIS-II

Subject Code: BMAT1-206 | **L T P C** **4 1 0 5** | **Duration: 55 Hrs.**

UNIT-I (12 Hrs.)

Riemann Integral:
Definition, Examples and Properties of Riemann Integral, Bounded Theorem, Riemann Integrable Functions, Cauchy Criterion, The Squeeze Theorem, Classes of Riemann Integrable Functions, Additivity Theorem, Fundamental theorem- First and Second Form, Substitution Theorem, Lebesgue integrability Criterion, Composition theorem, Product Theorem, Taylor's Theorem with Remainder, Approximate integration, The Trapezoidal Rule, The Mid Point Rule, Simpson's Rule.

UNIT-II (10 Hrs.)

Sequences of Functions:
Pointwise and Uniform Convergence, Interchange of Limit and Continuity, Interchange of Limit and Derivatives, Interchange of Limit and Integral, Bounded Convergence Theorem, Dini's Theorem. The exponential Functions Logarithmic Functions, The Trigonometric Functions.

UNIT-III (10 Hrs.)

Series of Functions:
Absolutely and uniformly convergent series of functions defined on a domain, Interchange of Integral and Summation, Tests for Uniform Convergence—Cauchy Criterion, Weirstrass M- Test, Power Series, Radius of Convergence, Cauchy Hadamard Theorem, Term by Term differentiation, Taylor's Series.

UNIT-IV (12 Hrs.)

Metric Spaces:
Metric spaces, Examples of Metric Spaces, Neighborhood of a point, Limit point and isolated points of a set, Closed Set, Interior Point of a Set, Open Set, Perfect Set, Bounded Set, Dense Set, Union and Intersection of Open Sets, Closure of a Set, Subspaces of a Metric Space, Compact Sets, k-Cells, Compactness of a k-Cells, Weierstrass Theorem, Perfect Sets in R^k, Connected Sets in R, Images of Compact and Connected Sets under Continuous Functions, Compactness and Uniform Continuity of Functions.

Recommended Books:

1. Robert G. Bartle and Donald R. Sherbert, 'Introduction to Real Analysis', 3rd Edn., John Wiley & Sons, Inc. **2000**.
2. Walter Rudin, 'Principles of Mathematical Analysis', 3rd Edn., McGraw Hill, **1976**.
3. S.C. Malik and Savita Arora, 'Mathematical Analysis', New Age International Publisher, Reprint **2008**.
4. S. Shirali & H.L. Vasudeva, 'Metric Spaces', Springer, **2006**.
5. T.M. Apostol, 'Mathematical Analysis', 2nd Edn., Narosa Publishing House, Reprint **2002**.

ENVIRONMENTAL SCIENCES

Subject Code: BHUM1-202 | **L T P C** **4 0 0 4** | **Duration: 45 Hrs.**

UNIT-I (12 Hrs.)

Natural Resources: Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

UNIT-II (11 Hrs.)

Ecosystems: (a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

Biodiversity and its Conservation: (a) Introduction – Definition: genetic, species and ecosystem diversity. (b) Biogeographically classification of India. (c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic.

UNIT-III (12 Hrs.)

Environmental Pollution: Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT-IV (12 Hrs.)

Social Issues and the Environment: (a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. Case studies. (e) Environmental ethics: Issues and possible solutions (f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Recommended Books:

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.
3. ErachBharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

FUNDAMENTALS OF COMPUTER AND C$^+$ PROGRAMMING

Subject Code: BCAP1-203 **L T P C** **4 0 0 4** **Duration: 45 Hrs.**

UNIT-I (10 Hrs.)

Computer Fundamentals: Block diagram of a computer, Characteristics of computers, Hardware-input devices, Output devices, Memories, Software, System software, Application software, Compiler, Interpreter, utility program, Introduction to operating Systems-Windows based/MACOS/LINUX, Significance and advantages of operating systems.

UNIT-II (12 Hrs.)

C$^+$ Programming: Introduction to C language, Evolution and characteristics of C language, Character set, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions, Type conversion and type casting, Overview of pre-processors, Structure of a C program, Input and output statements. Control Statements: Basic programming constructs, 'if', 'if-else', 'nested-if' statements, Conditional operator, 'for', 'while', 'do - while', Switch, Break, Continue.

UNIT-III (11 Hrs.)

Arrays and strings Need for an array, Declaration and initialization, Basic operation on arrays, Multidimensional array, Structures, Union, Introduction to strings, String handling. Pointers Introduction, Declaration and initialization, Pointers and arrays: Similarities and advantages/disadvantages of using pointers.

UNIT-IV (12 Hrs.)

Functions and Storage Classes Need for functions, Prototype, Function definition, Function call, return type and return statement, Passing arguments, Functions and arrays, Functions and pointers, Recursive functions, Difference between recursion and iteration storage classes. Files Introduction, File Operations, Character I/O, String I/O, Numeric I/O, Formatted I/O, Block I/O.

Recommended Books:

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.

2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

C+ PROGRAMMING LAB.

Subject Code: BCAP1-204 **L T P C**
0 0 2 1

List of following programs are as follows:
1. **Operators:** Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. **Decision Making:** switch, if-else, nested if, else-if ladder, break, continue, go to
3. **Loops:** while, do-while, for
4. **Functions:** Definition, Declaration, call by value, Call by reference, Recursive Function
5. **Arrays:** Arrays declarations, Single and multi-dimensional, Strings and string functions
6. **Pointers:** Pointer declarations, Pointer to function, Pointer to array.

Recommended Books:
1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

Differential Equations– I

Subject Code- BMAT1-307

L T P C	University Exam: 60
4 1 0 5	Internal Assessment: 40
Time Allowed: 3 hours	Total: 100

UNIT-I (8 hours)

Elementary Methods in Ordinary Differential Equations, Formation of a differential equation, Solutions: General, particular, and singular, First order exact equations and integrating factors, Degree and order of a differential equation, Equations of first order and first degree, Equations in which the variable are separable, Homogeneous equations, Linear equations and equations reducible to linear form.

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UNIT-II (9 hours)

First order higher degree equations solvable for x, y, p. Clairaut's form and singular solutions, Orthogonal trajectories, Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order.

UNIT-III (8 hours)

General solution of homogeneous equation of second order, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

UNIT-IV (10 hours)

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Series solutions of Bessel equation and Legendre equation, Bessel function and their Integral expression & recurrence relations, Legendre Polynomials , Rodrigue's formula, Recurrence relations, generating functions and orthogonal properties.

Recommended books:

1. W.E.Boyce and P.C.Diprima : Elementary Differential Equations and Boundary value problems, John Wiley, **1986.**
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,**1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

MATHEMATICAL STATISTICS

Subject Code- BMAT1-308

L	T	P	C	
				University Exam: 60
4	1	0	5	Internal Assessment: 40

Time Allowed: 3 hours Total: 100

UNIT-I (8 hours)

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem, Random variable, function of random variable and their distributions, probability mass function, probability density function, cumulative distribution function.

UNIT-II (9 hours)

Concept of random variables and probability distributions: Two dimensional random variables, Joint, Marginal and conditional distributions, Independence of random variables, Expectation, Conditional expectation, Moments, Product moments, Probability generating functions, Moment generating function and its properties.

UNIT-III (10 hours)

Study of various discrete and continuous distributions: Binomial, Poisson, Negative binomial distributions.

UNIT-IV (11 hours)

Concept of sampling distribution and its standard error, Derivation of sampling distributions of Chisquare, t and F distribution of sample mean and variance Testing of hypotheses, fundamental notions important tests based on normal distributions, Tests of significance: tests based on normal distribution, Chi-square, t and F statistic.

Recommended Books:

1. R.V. Hogg & Craige, 'Introduction to Mathematical Statistics', 7th Edn.,2005

2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, 1990.

3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, 1975.

4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', 2009.

5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, 1975.

Geometry (Co-ordinate and Solid)

Subject Code- BMAT1-309

L	T	P	C	
4	1	0	5	

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

Section-A

Transformation of axes, Shifting of origin, Rotation of axes, Reduction of the second degree equation into standard forms by transformation of co-ordinates, Intersection of three planes, Condition for three planes to intersect in a point or along a line or to form a prism.

Section-B

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in $x, y, z,$ Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, Right circular and elliptic cones.

Section-C

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms.

Section-D

Sphere, Section of a sphere by a plane, Spheres of a given circle, Intersection of a line and a sphere, Tangent line, Tangent plane, Power of a point w.r.t. a sphere, Radical planes.

Books Recommended

1. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
2. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry

Number Theory

Subject Code- BMAT1-310

L	T	P	C	University Exam: 60
4	1	0	5	Internal Assessment: 40

Time Allowed: 3 hours Total: 100

Section-A

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

Section-B

Modular arithmetic, Basic properties of congruence’s, linear congruence’s, Simultaneous linear congruence’s, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

Section-C

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

Section-D

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler’s Phi function, Euler's theorem, some properties of the Phi Function.

Books Recommended:

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, ‘Introduction to Analytic Number Theory’, Springer.
4. Paul T. Bateman, ‘Analytic Number Theory’, World scientific.
5. H. Rosen Kenneth, ‘Elementary Number Theory’, 6th Edn.
6. G.H. Hardy, ‘An Introduction to the Theory of Numbers’, 6th Edn.

OBJECT ORIENTED PROGRAMMING LANGUAGE USING C++

Subject Code- BCAP1-305

L	T	P	C	University Exam: 60
3	0	0	3	Internal Assessment: 40
Time Allowed: 3 hours				Total: 100

UNIT- I (10 Hrs.)

Characteristics of Object Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types. Introduction to C++: Identifier, Keywords, Constants, And Operators: Arithmetic, relational, logical, And conditional and assignment. size of operator, Operator precedence and associativity.

UNIT- II (13 Hrs.)

Classes and Objects: Class Declaration and Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. this pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member functions.

Constructors and Destructor: properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes, Virtual destructors. Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes.

UNIT- III (12 Hrs.)

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class. Types of Inheritance: Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability.

UNIT- IV (10 Hrs.)

Polymorphism and Operator Overloading: Methods of achieving polymorphic behavior. Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class. Introduction to File Handling.

Recommended Books:

1. E. Balagurusamy, ‘Object Oriented Programming with C++’, Tata McGraw Hill.
2. Deitel and Deitel, ‘C++ How to Program’, Pearson Education.
3. Herbert Schildt, ‘The Complete Reference C++’, Tata McGraw Hill.
4. Robert Lafore, ‘Object Oriented Programming in C++’, Galgotia Publications.
5. Bjarne Straustrup, ‘The C++ Programming Language’, Addition-Wesley Publication Co.

6. Stanley B. Lippman, JoseeLajoie, ‘C++ Primer’, Pearson Education, 2002.

SOFTWARE LAB (BASED ON C++)

Operational Knowledge and Implementation of numerical methods & statistical Techniques using C++ Language.

Differential Equations– II

Subject Code- BMAT1-410

L	T	P	C	
4	1	0	5	

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

Section-A

Formation of partial differential equations, PDEs of the first order, Lagrange's method, determination of integral surfaces of linear first order partial differential equations passing through a given curve, surfaces orthogonal to given system of surfaces, non-linear PDE of first order, Cauchy's method of characteristic, compatible system of first order PDE, Charpit's and Jacobi's general method of solution.

Section-B

Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Characteristic curves of the second order PDE, Monge's method of solution of non-linear PDE of second order.

Section –C

Method of Solution: Separation of variables in a PDE, Laplace, wave and diffusion equations, Elementary solutions of Laplace equations.

Section –D

The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions, one dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Recommended books:

1. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.

2. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011
3. Elements of Partial Differential Equation (3rd edition) – I. N. Sneddon, McGraw Hill Book Company, 1998.
4. Partial Differential Equations (2nd edition) – E. T. Copson, Cambridge University Press, 1995.
5. J.N. Sharma and K. Singh, Partial differential equations for engineers and scientists, 2nd Edition, Narosa Publication House, New Delhi, 2009
6. Sankara Rao, Introduction to partial differential equations, PHI,2010.

LINEAR ALGEBRA

Subject Code- BMAT1-411

L	T	P	C	
4	1	0	5	University Exam: 60
				Internal Assessment: 40

Time Allowed: 3 hours | Total: 100

UNIT-I (8 hours)

Vector spaces, Subspaces, algebra of subspaces, Quotient spaces, linear combination of vectors, Linear span, linear independence, Basis and dimension, dimension of subspaces.

UNIT-II (10 hours)

Linear transformations, Range, Null space, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, algebra of linear transformations.

UNIT-III (9 hours)

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

UNIT-IV (7 hours)

Isomorphisms, Isomorphism theorems, Invertibility and Isomorphisms, Change of coordinate matrix.

Books Recommended

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.

2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

MECHANICS

Subject Code- BMAT1-412

L	T	P	C	
4	1	0	5	

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

UNIT-I (8 hours)

Generalized coordinates, Holonomic and non-holonomic systems scleronomic and rhenomic systems, Generalized potential, Lagrange's equation of first kind and second kind uniqueness of solution.

UNIT-II (10 hours)

Hamilton canonical equation, cyclic coordinates, Routh's equation , Poisson bracket , Poisson's identity , Jacobi -Poisson theorem, Hamilton's principle, Principle of least action.

UNIT-III (8 hours)

Small oscillations of conservative system, Lagrange's equation for small oscillations, Nature of roots of frequency equation, Principle oscillations. Normal coordinates, Canonical transformations, Hamilton- Jacobi equation.

UNIT-IV (8 hours)

Method of separation of variables, Lagrange's bracket condition of Canonical character of transformation in terms of Lagrange's bracket and Poisson's Bracket.

Recommended Books

1. F. Gantmacher, 'Lectures in Analytic Mechanics', Mir Publisher, Moscow,1975.

2. H. Goldstien, C. Ppoole and J.L. Sofco, 'Classical Mechanics', 3rd Edn., Addison Wesely, 2002.

3. L.D. Landau and E.M. Lipshitz, 'Mechanics', Pergamon Press, Oxford, 1976.

4. J.E. Marsden, 'Lectures on Mechanics', Cambridge University Press, 1992.

NUMERICAL METHODS

Subject Code- BMAT1-413

L	T	P	C	
				University Exam: 60
4	1	0	5	Internal Assessment: 40

Time Allowed: 3 hours   Total: 100

UNIT-I (8 hours)

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss Jacobi, Gauss-Siedel and SOR iterative methods.

UNIT-II (10 hours)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

UNIT-III (8 hours)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

UNIT-IV (9 hours)

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.

3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, **1980.**

4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., **2001.**

LATEX and R

Subject Code- BCAP1-407

L	T	P	C	
3	0	0	3	

University Exam: 60
Internal Assessment: 40
Time Allowed: 3 hours
Total: 100

Unit-I

Introduction to Latex, Typical Latex input file, Basic Conventions: Spacing, Line breaking, page breaking, Modes and Environments, Forbidden characters.

Unit II

Basic tools for Formatting text: Structuring, Changing Fonts, Paragraph Justification etc

Unit III

Producing Mathematical Formulae using Latex: Mathematical Mode, Characters in Mathematical Mode, Superscripts and Subscripts, Greek letters, Mathematical Symbols and formulae, Changing the mathematical style, Matrices, arrays and tables in Latex

Unit IV

Introduction and preliminaries of R : R commands, R and Statistics, Simple manipulations: numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and Matrices, Lists and Data frames

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Recommended books:

1. Lesile Lamport, **Latex: A document preparation system**, User's guide and reference manual, 2nd ed.,1994, Addison Wesley

2. F. Mittelbach, M Goosens, Johaaes Braams, D Carlisle, Chris Rowley**, Latex Companion**, 2nd ed., 2004, Addison-Wesley Professional

3. Norman Matloff, **The art of R programming**: no starch press

4. W.N Venables and B.D Ripley: **Modern Applied Statistics with S**, Springer – Verlag 4th ed.

LAREX and R LAB

Subject Code- BCAP1-408

L	T	P	C
0	0	2	1

1. Writing articles with Latex
   1.1 Creating latex file
   1.2 Writing mathematical symbols in text
   1.3 Creating arrays and matrices
   1.4 Writing references using latex
   1.5 Presentation of articles using beamer class

2. Programming with R

2.1 Loops and vectorization

2.2. Writing a program in R

2.3. Creating own functions

2.4. Using R in Statistics

Study Scheme - B.Sc. (Hons.) Physics

1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BHUMA0 -001	Communicative English	2	0	0	40	60	100	2
BMATH5-101	Mathematics-I	4	1	0	40	60	100	5
BMATH5-102	Basic Mathematics-I*							
BPHYS1-101	Electricity and Magnetism	4	0	0	40	60	100	4
BPHYS1-102	Mechanics	4	0	0	40	60	100	4
BCHMS1-101	Inorganic Chemistry - I	4	0	0	40	60	100	4
BPHYS1-104	Electricity and Magnetism Lab	0	0	4	60	40	100	2
BPHYS1-106	Mechanics Lab	0	0	4	60	40	100	2
BCHMS1-103	Inorganic Chemistry – I Lab	0	0	2	60	40	100	1
BPHYS1-108	SEC – I Computational Physics Skills	0	0	4	60	40	100	2
Total		**18**	**1**	**14**	**440**	**460**	**900**	**26**

*Students from Medical stream will study Basic Mathematics – I and Students from Non Medical stream will study Mathematics - I

2nd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMNCC0-002	Environmental Sciences	2	0	0	40	60	100	2
BMATH5-201	Mathematics-II	4	1	0	40	60	100	5
BMATH5-202	Basic Mathematics-II*							
BPHYS1-201	Thermal Physics	4	0	0	40	60	100	4
BPHYS1-202	Waves and Optics	4	0	0	40	60	100	4
BCHMS1-201	Organic Chemistry - I	4	0	0	40	60	100	4
BPHYS1-204	Thermal Physics Lab	0	0	4	60	40	100	2
BPHYS1-205	Waves and Optics Lab	0	0	4	60	40	100	2
BCHMS1-203	Organic Chemistry – I Lab	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	40	60	100	
Total		**20**	**1**	**10**	**420**	**480**	**900**	**24**

*Students from Medical stream will study Basic Mathematics – I and Students from Non Medical stream will study Mathematics - I

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATH5-301	Mathematics-III	4	1	0	40	60	100	5
BPHYS1-301	Mathematical Physics - I	4	2	0	40	60	100	6
BPHYS1-302	Analog System and Applications	4	0	0	40	60	100	4
BPHYS1-303	Elements of Modern Physics	4	0	0	40	60	100	4
BCHMS1-102	Physical Chemistry- I	4	0	0	40	60	100	4
BPHYS1-305	Analog System and Applications Lab	0	0	4	60	40	100	2
BPHYS1-306	Elements of Modern Physics Lab	0	0	2	60	40	100	1
BCHMS1-104	Physical Chemistry - I Lab	0	0	4	60	40	100	2
Total		**20**	**3**	**10**	**380**	**420**	**800**	**28**

4Th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Internal	External	Total	
BMATH5-401	Mathematics-IV	4	1	0	40	60	100	5
BPHYS1-401	Mathematical Physics - II	4	2	0	40	60	100	6
BPHYS1-402	Digital System and Applications	4	0	0	40	60	100	4
BPHYS1-403	Quantum Mechanics and Applications	4	0	0	40	60	100	4
BCHMS1-202	Physical Chemistry- II	4	0	0	40	60	100	4
BPHYS1-405	Digital System and Applications Lab	0	0	4	60	40	100	2
BPHYS1-406	Quantum Mechanics Lab	0	0	4	60	40	100	2
BCHMS1-204	Physical Chemistry II Lab	0	0	2	60	40	100	1
Total		**20**	**3**	**10**	**320**	**420**	**800**	**28**

5Th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Internal	External	Total	
BPHYS1-501	Mathematical Physics - III	4	2	0	40	60	100	6
BPHYS1-502	Solid State Physics	4	0	0	40	60	100	4
BPHYS1-503	Solid State Physics Lab	0	0	4	60	40	100	2
BPHYS1-504	Basic Instrumentation Skills	0	0	4	60	40	100	2
Departmental Elective – I (Select any One Subject of Six Credit)								
BPHYD1-511	Experimental Techniques	4	0	0	40	60	100	4
BPHYD1-512	Experimental Techniques Lab	0	0	4	60	40	100	2
BPHYD1-513	Nano Materials and Applications	4	0	0	40	60	100	4
BPHYD1-514	Nano Materials and Applications Lab	0	0	4	60	40	100	2
BPHYD1-515	Communication System	4	0	0	40	60	100	4
BPHYD1-516	Communication System Lab	0	0	4	60	40	100	2
Departmental Elective – II (Select any One Select any One)								
BPHYD1-521	Nuclear and Particle Physics	5	1	0	40	60	100	6
BPHYD1-522	Physics of the Earth	5	1	0	40	60	100	6
BPHYD1-523	Biological Physics	5	1	0	40	60	100	6
Total		**17**	**3**	**12**	**340**	**360**	**700**	**26**

6Th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Internal	External	Total	
BPHYS1-601	Electromagnetic Theory	4	0	0	40	60	100	4
BPHYS1-602	Statistical Mechanics	4	0	0	40	60	100	4
BPHYS1-603	Electromagnetic Theory Lab	0	0	4	60	40	100	2
BPHYS1-604	Statistical Mechanics Lab	0	0	4	60	40	100	2
BMNCC0-001	Constitution of India	2	0	0	60	40	100	
Departmental Elective – III (Select any One)								
BPHYD1-611	Classical Dynamics	5	1	0	40	60	100	6
BPHYD1-612	Astronomy and Astrophysics	5	1	0	40	60	100	6
BPHYD1-613	Applied Dynamics	5	1	0	40	60	100	6
Departmental Elective – IV (Select any One)								
BPHYD1-621	Advanced Mathematical Physics	4	0	0	40	60	100	4
BPHYD1-622	Advanced Mathematical Physics Lab	0	0	4	60	40	100	2
BPHYD1-623	Physics of Devices and Communication	4	0	0	40	60	100	4

BPHYD1-624	Physics of Devices and Communication Lab	0	0	4	60	40	100	2
BPHYD1-625	Atmospheric Physics	4	0	0	40	60	100	4
BPHYD1-626	Atmospheric Physics Lab	0	0	4	60	40	100	2
	Total	**19**	**1**	**12**	**400**	**400**	**800**	**24**

Sem.	**Marks**	**Credits**
I	900	26
II	900	24
III	800	28
IV	800	28
V	700	26
VI	800	24
Total	**4900**	**156**

Study Scheme - B.Sc. (Hons.) Chemistry

1st Semester			Contact Hrs.			Marks			Credits
Subject Code	**Subject**		**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHMS1-101	Inorganic Chemistry-I		3	1	-	40	60	100	4
BCHMS1-102	Physical Chemistry-I		3	1	-	40	60	100	4
BCHMS1-103	Inorganic Chemistry-I **Lab**		-	-	4	60	40	100	2
BCHMS1-104	Physical Chemistry-I **Lab**		-	-	4	60	40	100	2
BHUMA0-001	Ability Enhancement Compulsory Course	Communicative English	2	-	-	40	60	100	2
BHUMA0-004		Drug Abuse	2	-	-	40	60	100	0
Generic Elective I (Select any two with lab/tutorial as applicable)[a,b]									
BPHYS1-101	Electricity and Magnetism		4	-	-	40	60	100	4
BMCAS1-102	Introduction to Information Technology		3	1	-	40	60	100	4
BMATH5-101	Mathematics I*		4	1	-	40	60	100	5
BMATH5-102	Basic Mathematics I*								
BPHYS1-104	Electricity and Magnetism Lab		-	-	2	60	40	100	1
BMCAS1-105	Software Lab.-I (Based on BCMC-101)		-	-	2	60	40	100	1
Total#			**17/18**	**3/4**	**10/12**	**420/480**	**480/520**	**900/1000**	**24**

Note: (a): Each student has to opt two papers with lab/tutorial from the category of generic electives in each semester starting from semester I till semester IV from any two disciplines (mathematics, Physics, Computer Science). The disciplines once opted will remain same throughout the course.

*Students from Medical stream will study Basic Mathematics – I and Students from Non-Medical stream will study Mathematics – I

(b) As per letter no. DAA/MRSSTU/283 dated 25/04/16 para no 9f, the elective subject will be offered only if the numbers of students opting that subject will 15 or more.

Depends on combination of electives selected by student.

2nd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHMS1-201	Organic Chemistry-I	3	1	-	40	60	100	4
BCHMS1-202	Physical Chemistry-II	3	1	-	40	60	100	4
BCHMS1-203	Organic Chemistry-I **Lab**	-	-	4	60	40	100	2
BCHMS1-204	Physical Chemistry-II **Lab**	-	-	4	60	40	100	2
BHUMA0-002	Ability Enhancement Compulsory Course Environmental Sciences	2	-	-	40	60	100	2
Generic Elective II (Select any two with lab/tutorial as applicable)[a,b]								
BPHYS1-201	Thermal Physics	4	-	-	40	60	100	4
BMCAS1-403	Linux Operating System	3	1	-	40	60	100	4
BMATH5-201 **BMATH5-202**	Mathematics II* Basic Mathematics II*	4	1	-	40	60	100	5
BPHYS1-204	Thermal Physics Lab	-	-	2	60	40	100	1
BMCAS1-406	Software Lab.-VIII (Based on BCMC-422)	-	-	2	60	40	100	1
Total#		**15/16**	**3/4**	**10/12**	**380/440**	**420/460**	**800/900**	**24**

*Students from Medical stream will study Basic Mathematics – II and Students from Non Medical stream will study Mathematics - II

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHMS1-301	Organic Chemistry-II	3	1	-	40	60	100	4
BCHMS1-302	Physical Chemistry-III	3	1	-	40	60	100	4
BCHMS1-303	Organic Chemistry-II **Lab**	-	-	4	60	40	100	2
BCHMS1-304	Physical Chemistry-III **Lab**	-	-	4	60	40	100	2
Skill enhancement course (Select any one)								
BCHMD1-311 **BCHMD1-312**	Chemistry of cosmetics and perfumes Green Methods in Chemistry	2	-	-	40	60	100	2
Generic Elective III (Select any two with lab/tutorial as applicable)[a,b]								
BPHYS1-303	Elements of Modern Physics	4	-	-	40	60	100	4
BMCAS1-104	Programming in C Language	3	1	-	40	60	100	4
BMATH5-301	Mathematics III	4	1	-	40	60	100	5
BPHYS1-306	Elements of Modern Physics Lab	-	-	2	60	40	100	1
BMCAS1-106	Software Lab.-II (Based on BCMC-103)	-	-	2	60	40	100	1
Total#		**15/16**	**3/4**	**10/12**	**380/440**	**420/460**	**800/900**	**24**

MRSPTU B.Sc. (Hons.) Chemistry STUDY SCHEME 2019 BATCH ONWARDS

4th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Internal	External	Total	
BCHMS1-401	Inorganic Chemistry-II	3	1	-	40	60	100	4
BCHMS1-402	Organic Chemistry-III	3	1	-	40	60	100	4
BCHMS1-403	Inorganic Chemistry-II **Lab**	-	-	4	60	40	100	2
BCHMS1-404	Organic Chemistry-III **Lab**	-	-	4	60	40	100	2
Skill enhancement course (Select any one)								
BCHMD1-411	Fuel Chemistry	2	-	-	40	60	100	2
BCHMD1-412	Pharmaceutical Chemistry							
Generic Elective IV (Select any two with lab/tutorial as applicable)[a,b]								
BPHYS1-202	Waves and Optics	4	-	-	40	60	100	4
BMCAS1-204	Object Oriented Programming Language in C++	3	1	-	40	60	100	4
BMATH5-401	Mathematics IV	4	1	-	40	60	100	5
BPHYS1-205	Waves and Optics Lab	-	-	2	60	40	100	1
BMCAS1-207	Software Lab.-IV (Based on BCMC-209)	-	-	2	60	40	100	1
Total[#]		**15/ 16**	**3/ 4**	**10/ 12**	**380/440**	**420/460**	**800/ 900**	**24**

5th Semester		Contact Hrs.			Marks			Credits
Subject Code	Subject	L	T	P	Internal	External	Total	
BCHMS1-501	Inorganic Chemistry-III	3	1	-	40	60	100	4
BCHMS1-502	Organic Chemistry-IV	3	1	-	40	60	100	4
BCHMS1-503	Physical Chemistry-IV	3	1	-	40	60	100	4
BCHMS1-504	Inorganic Chemistry-III **Lab**	-	-	4	60	40	100	2
BCHMS1-505	Organic Chemistry-IV **Lab**	-	-	4	60	40	100	2
BCHMS1-506	Physical Chemistry-IV **Lab**	-	-	4	60	40	100	2
Discipline Specific Elective – I (Select any two with lab)								
BCHMD1-511	Applications of Computers in Chemistry	3	0	0	40	60	100	3
BCHMD1-512	Instrumental methods of analysis	3	0	0	40	60	100	3
BCHMD1-513	Novel Inorganic Solids	3	0	0	40	60	100	3
BCHMD1-514	Applications of Computers in Chemistry **Lab**	-	-	2	60	40	100	1
BCHMD1-515	Instrumental methods of analysis **Lab**	-	-	2	60	40	100	1
BCHMD1-516	Novel Inorganic Solids **Lab**	-	-	2	60	40	100	1
Total		**15**	**3**	**16**	**500**	**500**	**1000**	**26**

6th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHMS1-601	Physical Chemistry-V	3	1	-	40	60	100	4
BCHMS1-602	Inorganic Chemistry-IV	3	1	-	40	60	100	4
BCHMS1-603	Organic Chemistry-V	3	1	-	40	60	100	4
BCHMS1-604	Physical Chemistry-V **Lab**	-	-	4	60	40	100	2
BCHMS1-605	Inorganic Chemistry-IV **Lab**	-	-	4	60	40	100	2
BCHMS1-606	Organic Chemistry-V **Lab**	-	-	4	60	40	100	2
Discipline Specific Elective – II (Select any two with lab)								
BCHMD1-611	Polymer Chemistry	3	0	0	40	60	100	3
BCHMD1-612	Molecular modeling and drug design	3	0	0	40	60	100	3
BCHMD1-613	Inorganic materials of Industrial Importance	3	0	0	40	60	100	3
BCHMD1-614	Polymer Chemistry **Lab**	-	-	2	60	40	100	1
BCHMD1-615	Molecular modeling and drug design **Lab**	-	-	2	60	40	100	1
BCHMD1-616	Inorganic materials of Industrial Importance **Lab**	-	-	2	60	40	100	1
Total		**15**	**3**	**16**	**500**	**500**	**1000**	**26**

Total credits = 24 + 24 + 24 + 24 + 26 + 26 = 148

B.Tech. Avionics Engineering (3rd SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BMATH4-301	Applied Mathematics – III	3	1	0	40	60	100	4
BAVES0-301	Elements of Aeronautics	3	0	0	40	60	100	3
BAVES0-302	Elements of Space Systems	3	0	0	40	60	100	3
BAVES0-303	Elements of Electronics Engineering	3	0	0	40	60	100	3
BAVES0-304	Object oriented Programming using C++	2	0	2	40	60	100	3
BAVES0-305	Elements of Aeronautics lab	0	0	2	60	40	100	1
BAVES0-306	Elements of Electronics lab	0	0	2	60	40	100	1
BAVES0-307	Training–1 : 4 weeks Summer Training (Manufacturing practices)	-	-	-	60	40	100	2
Total 5 Theory & 2 Lab. Courses		**14**	**2**	**4**	**380**	**420**	**800**	**20**

B.Tech. Avionics Engineering (4th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BAVES0-401	Aircraft Performance	3	1	0	40	60	100	4
BAVES0-402	Control Engineering	3	1	0	40	60	100	4
BAVES0-403	Aircraft Propulsion	3	1	0	40	60	100	4
BAVES0-404	Aircraft Systems	3	0	0	40	60	100	3
BAVES0-405	Aircraft Systems Lab	0	0	2	60	40	100	1
BAVES0-406	Aircraft Propulsion Lab.	0	0	2	60	40	100	1
	Management (Select any One)	3	0	0	40	60	100	3
BHSMC0-013	Introduction to Industrial Management							
BHSMC0-014	Fundamentals of Management for Engineers							
	Mandatory Course							
BMNCC0-002	Environmental Sciences	3	0	0	40	60	100	0
Total 6 Theory & 2 Lab. Courses		**15**	**3**	**04**	**360**	**440**	**800**	**20**

NOTE: Students will go on Industrial training after 4th Semester

B.Tech. Avionics Engineering (5th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAVES0-501	Aircraft Instruments and Measurements	3	1	0	40	60	100	4
BAVES0-502	Signal Processing	3	0	0	40	60	100	3
BAVES0-503	Communication Systems	3	0	0	40	60	100	3
BAVES0-504	Aircraft Instruments and Measurements Lab	0	0	2	60	40	100	1
BAVES0-505	Training-II	-	-	-	60	40	100	3
	Humanities (Select Any One)	3	0	0	40	60	100	3
BHSMC0-005	Effective Technical Communication							
BHSMC0-016	Organizational Behavior							
	Departmental Elective-I (Select One)	3	0	0	60	40	100	3
BAVED0-511	Electromagnetic Interference and Compatibility (EMI & EMC)							
BAVED0-512	Missile Guidance and Control							
	Mandatory Courses* (Any One)	-	-	-				0
BMNCC0-001	Constitution of India							
BMNCC0-006	Essence of Indian Knowledge Tradition							
Total 6 Theory & 1 Lab. Courses		**15**	**3**	**02**	**340**	**360**	**700**	**20**

B.Tech. Avionics Engineering (6th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAVES0-601	Aerospace Data Networks	3	1	0	40	60	100	4
BAVES0-602	Guidance and Navigation	3	1	0	40	60	100	4
BAVES0-603	Aircraft Stability and Automatic Control	3	1	0	40	60	100	4
BAVES0-604	Data Networks Lab	0	0	2	60	40	100	1
	Departmental Elective-II (Select One)	3	0	0	40	60	100	3
BAVED0-611	Radar Technology							
BAVED0-612	Aerospace Embedded Systems							
BAVED0-613								
	Departmental Elective-III (Select One)	3	0	0	60	40	100	3
BAVED0-621	Aerospace Power Electronics							
BAVED0-622	Satellite Systems							
XXXX	Open Elective-I	3	0	0	40	60	100	3
Total 6 Theory & 1 Lab. Courses		**19**	**3**	**02**	**320**	**380**	**700**	**22**

B.Tech. Avionics Engineering (7th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAVES0-701	Advanced Avionics	3	0	0	40	60	100	3
BAVES0-702	Engine Control Systems	3	0	0	40	60	100	3
BAVES0-703	**Project-I	0	0	8	60	40	100	4
BAVES0-704	*Training-III	-	-	-				3
	Departmental Elective-IV (Select One)	3	1	0	40	60	100	4
BAVED0-711	Optimization Techniques							
BAVED0-712	System Modelling and Simulation							
	Departmental Elective-V (Select One)	3	0	0	40	60	100	3
BAVED0-721	Air Transportation and Operation							
BAVED0-722	Aircraft Antenna Systems							
XXXX	**Open Elective-II**	3	0	0	40	60	100	3
Total 5Theory and 01 Lab		**15**	**1**	**08**	**260**	**340**	**600**	**23**

B.Tech. Avionics Engineering (8th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
	Departmental Elective-VI (Select One)							
BAVED0-801	Signal Detection and Estimation	3	1	0	40	60	100	4
BAVED0-802	Unmanned Aerial Systems							
BAVED0-803	Electronic Warfare							
BAVED0-804	Project-II	0	0	08	60	40	100	4
XXXX	Open Elective-III	3	0	0	40	60	100	3
XXXX	Open Elective--IV	3	0	0	40	60	100	3
Total 3 Theory and 01 lab		**9**	**1**	**08**	**180**	**220**	**400**	**14**

NOTE: Choose any one subject from list of Open Elective subjects provided by MRSPTU, Bathinda.