MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
DABWALI ROAD, BATHINDA-151001
(Estb. by Govt. of Punjab Act 5(2015) & Approved u/s 2(f) & 12(b) of UGC Act, 1956)

www.mrsptu.ac.in

Ref. No.: **Date:**

SUBJECT: INVITATION FOR 5TH MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY TO BE HELD ON 20.06.2022

To

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To

Sir/Madam,

It is to inform you that 5th Meeting of Faculty of Engineering & Technology of Maharaja Ranjit Singh Punjab Technical University has been scheduled on 20/06/2022 at 11:00 a.m in on-line mode through Google hangsout meet. Link for the same will be shared on the same day. You are requested to make it convenient to attend this online meeting. Honorarium will be paid as per MRSPTU, Bathinda norms.

Dr. S. K. Bath
Member Secretary,
Faculty of Engg. & Tech.,
MRSPTU, Bathinda

Copy to:

1. PA to Vice Chancellor, MRSPTU, Bathinda for information to Vice Chancellor please.
2. Registrar, MRSPTU, Bathinda
3. Professor I/C, Finance, MRSPTU, Bathinda
4. Dean Academic Affairs, MRSPTU, Bathinda

ITEM NO. 05.01 CONFIRMATION OF THE MINUTES OF 4TH MEETING OF FACULTY OF ENGG. & TECH. OF MRSPTU BATHINDA HELD ON 27/8/2021. (ANNEXURE-I)

Put up before Faculty of Engineering & Technology for confirmation please.

ITEM NO. 05.02 TO APPROVE THE MINUTES OF MEETINGS OF BOARD OF STUDIES OF VARIOUS ENGG. BRANCHES

The meetings of Board of Studies in different engineering branches were held as per following details and are attached herewith as **ANNEXURE-II**.

S. No.	ITEM	Annexure-II	
		Sub Page	Main Page Nos.
05.02.01	Minutes of 8th Meeting of BOS of **Aeronautical and Aerospace** Engineering held on 26/04/2022	01-05	01-05
05.02.02	Minutes of Meeting of BOS in **Computer Science and Engg.** held on 18/05/2022	01-02	06-07
05.02.03	Minutes of 13th Meeting of BOS in **Electrical Engg.** held on 12/05/2022	01-03	08-10
05.02.04	Minutes of Meeting of BOS in **Mechanical Engg.** held on 26/04/2022	01-02	11-12

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 05.03 APPROVAL OF SYLLABI OF UG-ENGG. PROGRAMMES

The Scheme and/or Syllabi of B. Tech Engineering Programmes have been prepared by the concerned Board of Studies as per following details:

S. No.	ITEM	Annexure-III	
		Sub Page	Main Page Nos.
05.03.01.	Scheme and Syllabus of **B. Tech.** (**Civil Engg. with Computer Applications**) 1st - 2nd Sem. for Batches 2022 onwards	01-23	01-23
05.03.02	Scheme and Syllabus of **B. Tech.** (**Artificial Intelligence and Machine Learning Engg.**) 1st - 2nd Sem. for Batches 2022 onwards	01-20	24-43
05.03.03	Scheme and Syllabus of **B. Tech.** (**Computer and Communication Engg.**) 1st - 2nd Sem. for Batches 2022 onwards	01-20	44-63
05.03.04	Course Objectives and Course Outcomes - Scheme and	01-38	64-101

	Syllabus of **B. Tech. (Electronics & Communication Engg.)** Sem 3 – Sem 8 for batches 2018 onwards		

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 05.04 APPROVAL OF SYLLABI OF PG-ENGG. PROGRAMMES

The Scheme and/or Syllabi of M. Tech Engineering Programmes have been prepared by the concerned Board of Studies as per following details:

S. No.	ITEM	Annexure-IV	
		Sub Page	Main Page Nos.
05.04.01	Scheme of **M. Tech. (CTM) (Part-Time)** for Batches 2022 onwards	01-03	01-03
05.04.02	Scheme of **M. Tech. (Structural & Foundation Engg.) (Part-Time)** for Batches 2022 onwards	01-03	04-06
05.04.03	Scheme of **M. Tech. (Environmental Science and Engineering) (Part-Time)** for Batches 2022 onwards	01-04	07-10
05.04.04	Scheme of **M. Tech. (Computer and Communication Engg.) (Full Time**) 1st - 2nd Sem. for Batches 2022 onwards	01-02	11-12
05.04.05	Scheme of **M. Tech. (Computer and Communication Engg.) (Part- Time)** 1st - 2nd Sem. for Batches 2022 onwards	01-01	13-13
05.04.06	Scheme and Syllabus of **M. Tech. (Computer Science and Engg.) (Part-Time)** 1st – 6th semesters for Batches 2022 onwards	01-39	14-52
05.04.07	Scheme and Syllabus (already existing) of **M. Tech. Electrical Engg. (Power System) (Part-Time)** 1st – 6th semesters for Batches 2022 onwards	01-43	53-95
05.04.08	Scheme and Syllabus (already existing) of **M. Tech. Electrical Engg. (Part-Tim**e) for 1st – 6th semesters for Batches 2022 onwards	01-27	96-122
05.04.09	Scheme of **M. Tech. (Mechanical Engg.) (Part-Time)** 1st-6th sem for Batches 2022 onwards	01-03	123-125
05.04.10	Scheme and Syllabus of **M. Tech. Textile Engg. (Part-Time)** for 1st – 6th semesters for Batches 2022 onwards	01-20	126-145

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 05.05 APPROVAL OF SKILL CERTIFICATE COURSES

S. No.	ITEM	Annexure-V	
		Sub Page	Main Page

			Nos.
05.05.01	Scheme and syllabus of One Year (1st & 2nd sem) Skill certificate Course in **'Additive Manufacturing'** proposed by the department of Mechanical Engg. (11-pages)	01-11	01-11
05.05.02	Scheme and syllabus (Already existing on uni. website) of One Year (1st & 2nd sem) certificate Course in **'Electrician'** proposed by the department of Electrical Engg. (35-pages)	01-35	12-46
05.05.03	6 month Skill Certificate Course in **NASTRAN** proposed by PSAEC Patiala	01-12	47-58
05.05.04	6 month Skill Certificate Course in **SOLID WORKS** proposed by PSAEC Patiala	01-14	59-72
05.05.05	6 month Skill Certificate Course in **CATIA** proposed by PSAEC Patiala	01-14	73-86
05.05.06	6 month Skill Certificate Course in **ANSYS** proposed by PSAEC Patiala	01-11	87-97
05.05.07	6 month Skill Certificate Course in **Air Ticketing Management** proposed by PSAEC Patiala	01-11	98-108

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please

ITEM NO. 05.06 Any other agenda Item/Items with the permission of the chair.

Ref. No.: **Date:**

MINUTES OF 4th MEETING OF FACULTY OF ENGG. & TECH. HELD ON 27.08.2021

A pre-scheduled 4th Meeting of Faculty of Engineering & Technology of Maharaja Ranjit Singh Punjab Technical University, Bathinda was held on 27.08.2021 at 10:30 AM onwards in online mode. The following members were present:

1. **Dr. MANINDER SINGH** — **for Dean Faculty of Engg. & Tech. Chairperson**
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At the outset, after verifying quorum of meeting, the Chairperson welcomed the members attending 4th Meeting of Faculty of Engineering & Technology of MRSPTU, Bathinda in online/blended mode. Thereafter, he asked Member Secretary to take up agenda items one by one for discussion. After detailed deliberations, the following decisions were arrived at unanimously:

SBath

ITEM 4.01	**TO APPROVE THE MINUTES OF 6^{TH} MEETING OF BOARD OF STUDIES IN AERONAUTICAL & AEROSPACE ENGG. HELD ON 11.06.2021**
DECISION	Approved
ITEM 4.02	**APPROVAL OF SYLLABI OF UG-ENGG. PROGRAMMES**
ITEM 4.02.01	Scheme and Syllabus of B. Tech. (Aerospace Engg.), 5^{th}–6^{th} Sem. for Batch 2K19 onwards
ITEM 4.02.02	Syllabus of B. Tech. (Civil Engg.), 7^{th} – 8^{th} Sem. for Batch 2K18
ITEM 4.02.03	Syllabus of B. Tech. (Civil Engg.), 5^{th} – 8^{th} Sem. Batch 2K19 onwards
ITEM 4.02.04	Syllabus of B. Tech. (Electronics & Communication Engg.), 7^{th} – 8^{th} Sem. for Batch 2K18 onwards
ITEM 4.02.05	Scheme & Syllabus of B. Tech. (Mechanical Engg.), 7^{th} – 8^{th} Sem. for Batch 2K18 onwards
DECISION	Proposed Schemes and Syllabi were approved. Though, in some cases Course Outcomes/Objectives shall be fine tuned in line with Bloom's Taxonomy's upper pyramid. These shall be finalised by respective BoS Chairpersons, in consultation with Member-secretary Faculty of Engg. (FoE), Dean Academic Affairs and in e-consultation with respective Faculty of Engg. experts and Dean Faculty of Engg. on or before 15.9.2021.
ITEM 4.03	**TO IMPLEMENT THE DECISION OF 4^{TH} MEETING OF ACADMIC COUNCIL REGARDING INCORPORATION OF THE SUBJECT "UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY" AS A MANDATORY CREDIT COURSE FOR ALL UNDERGRADUATE (B.TECH) STUDENTS FROM ACADEMIC YEAR 2020-21.**
DECISION	1. The said subject **"Universal Human Values 2 – Understanding Harmony (BHSMC0-026)"** (with 3-credits) is approved to be taught in $3^{rd}/4^{th}$ semester for batches 2021 onwards replacing the earlier taught (in $1^{st}/2^{nd}$ sem) non-credit course titled "Human Values and Professional Ethics (BHUMA0-103)". 2. Also the subject "Universal Human Values 1" is approved to be taught during the 21-days' Student Induction Program for batches 2021 onwards.

Beth

ITEM 4.04 **(Table Item)**	**IMPLEMENTATION OF NEP-2020 GUIDELINES AT MRSPTU, BATHINDA**
DECISION	To implement NEP-2020 guidelines including multiple entry-exit scheme with awarding of Certificate/Diploma to dropout students; Dean Academic Affairs, MRSPTU sought the views of honorable members including those from other institutions (NIT/NITTTR/PEC/TIET/DCRUST) about the mechanism adopted at their institutions. After deliberations, it was observed that: 1. By starting Major-Minor degree programs, MRSPTU has already incorporated flexibility/multidisciplinary approach in its curriculum, which at some places is being done now under NEP. 2. With ongoing curriculum scheme, it is not possible to introduce Certificate/Diploma level multiple entry-exit, at this point of time. It was decided to watch developments taking place at other Institutions in this regard until next meeting for further necessary action.
General Discussion	1. Chairpersons of Board of Studies of various disciplines should deliberate in their respective meetings, on the issues and procedural details for implementation of NEP – 2020. 2. Faculty should be made to attend the OBE (Outcome Based Education) related workshops for better framing of course outcomes/objectives.

The Meeting concluded with a vote of thanks to the Chair.

SBath
27/8/2021

Member Secretary
(Dr. Sarbjeet Kaur Bath)

For Approval please

CHAIRPERSON

PUNJAB STATE AERONAUTICAL ENGINEERING COLLEGE

(A constituent College of Maharaja Ranjit Singh Punjab Technical University, Bathinda)

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Ref. No: PSAEC/2022/167 **Date: 27/04/2022**

Minutes of Meeting

The 8th BOS of **Aeronautical and Aerospace Engineering** was held on dated 26/04/2022 at 7.00 PM on Goggle Meet platform. Following were present:-

1) Prof Balraj Singh- *Chairman*
   Director PSAEC ,Patiala
2) Prof T. K. Jindal-*Member*
   PEC Chandigarh
3) Dr Subash Chander-*Member*
   Joint Director DRDO, Chandigarh
4) Prof Raj Kumar . S. Pant-*Member*
   IIT Mumbai
5) Prof J.S.Tiwana- *Member*
   Associate Professor, GZSCCET,Bathinda
6) Dr Jimmy Kansal- *Member*
   Joint Director, DGRE,DRDO, Chandigarh
7) Prof Neeraj Grover-*Member*
   TIET, Patiala.
8) Dr Anju Sharma-*Member*
   PSAEC, Patiala
9) Er Abhishek Chand Thakuri - *Special Invitee*
   AP, AerospoaceEngineering , PSAEC Patiala
10) Er Moniya Pal –*Special Invitee*
   AP, AerospoaceEngineering PSAEC
11) Er Vaishali-*Special Invitee*
   AP, Aerospace Engineering, PSAEC,Patiala
12) Dr Priyanka Malhotra-*Special Invitee*
   AP, PSAEC Patiala

Previous to this meeting, the esteemed members have given inputs on dated 18/04/2022 and 25/04/2022. In this meeting held on 26/04/2022, detailed discussions were held regarding finalisation of syllabus for starting Certificate Courses of 6 months duration, from 2022-23 sessions. The Skill Certificate Courses to be started On Line/Off Line are as follows: -

1) 6 month Skill Certificate Course in NASTRAN
2) 6 month Skill Certificate Course in SOLID WORKS
3) 6 month Skill Certificate Course in CATIA
4) 6 month Skill Certificate Course in ANSYS
5) 6 month Skill Certificate Course in Air Ticketing Management

A) The discussions were held on 6 month **" Skill Certificate Course in SOLID WORKS".** The proposed detailed contents for this course have been put as **Annexure-1 (copy attached)** after incorporating the the *observations of BOS committee which are given below:-*

1) Prof Raj Kumar S Pant suggested to add 'E-mail Communication' in learning outcomes along with 'Telephonic Communication' in Unit-I i.e. Communication skills.

2) Prof Raj Kumar S Pant and Prof T.K Jindal recommended to remove the topic "Drawing Instrument" in the Theory part of Unit-II. As per them these things are outdated and is of no use for students.

3) Prof Raj Kumar S Pant suggested to remove the Mathematical Modeling and Design of individual machine elements in Gears, springs, propeller, piston, turbine buckets, runners, pump impellers, pipe elbows, Tees, reducers, flanges, Blocks and Trusses in Theory Part of Unit-III because this is the six month course and contents are very large.

4) Prof Raj Kumar S Pant and Prof T.K Jindal also recommended to remove the topics i.e. Fastening Devices, Bolts and Nuts, Rivets and Riveted joints in Theory part of Unit-III with the consent of all the experts.

5)Prof Neeraj Grover suggested to add Monocoque, spar fuselage structures basic modeling, assembly, application-oriented part to the Theory Part of Unit-IV.

6) These all above mentioned points have been incorporated and attached as Annexure-1 for approval of BoS Members.

B) The discussions were held on 6 month **" Skill Certificate Course in NASTRAN & PANTRAN".** The proposed detailed contents for this course have been put as **Annexure-2** (copy attached) after incorporating the *observations of BOS committee which are given below:-*

1) Prof Raj Kumar S Pant suggested on putting the key words in contents as mentioined in software dictionary.
2) Prof Raj Kumar S Pant & Prof Neeraj suggested for changing the name of the UNITS (Chapter Name) from :-
   a) "Introduction lab" to "Introduction to Patran and MSC Apex"
   b) "MSC Patran and MSC Apex" to "Preprocessing Lab in Patran and MSC Apex"
   c) "Patran and Apex" to "Post Processing Lab in Patran and MSC Apex".
3) Dr Subash Chander suggested for changing the name of the UNIT from "Solution" to "Solution development in MSC Nastran".
4) Prof Raj Kumar S Pant suggested on removing optimization part from theory of Unit III.
5) Prof Raj Kumar S Pant suggested to add more hours to the theory part of UNIT V.
6) These all above mentioned points have been incorporated and attached as Annexure-2 for approval.

C) The discussions were held on 6 month **" Skill Certificate Course in CATIA".** The proposed detailed contents for this course have been put as **Annexure-3** (copy attached) after incorporating the the *observations of BOS committee which are given below:-*

1) Prof Raj Kumar S Pant suggested to add 'Email Communication' in learning outcomes along with 'Telephonic Communication' in Unit-I i.e. Communication skills.

2) Prof Raj Kumar S Pant and Prof T.K Jindal recommended to remove the topic "Drawing Instrument" in the Theory part of Unit-II as these things are outdated.

3) Prof Raj Kumar S Pant and Prof T.K Jindal suggested for removing the 3D drawing of various machine elements such as landing gear, Machinevise, Screw jack,Piston, Bulkhead,

Ribs and Spars etc in Theory Part of Unit-III.

4) Prof Raj Kumar S Pant and Prof T.K Jindal also recommended for removing the topics " Fastening devices, Bolts and Nuts, Rivets and Riveted joints in Theory part of Unit-IV.

5) These all above mentioned points have been incorporated and attached as Annexure-3 for approval.

D) The discussions were held on 6 month **" Skill Certificate Course in Air Line Ticketing ".** The proposed detailed contents for this course have been put as **Annexure-4 (copy attached)** after incorporating the the *observations of BOS committee which are given below:-*

1) Prof R.S pant suggested that in the subject of Business Communication, 'Emails Communication' must be added in learning outcomes along with 'Telephonic Communication'.
2) Prof R. S Pant and Dr Subash Chander suggested that in the subject of "Airline Industry" the topic route planning must be added in Navigation Systems.
3) In the subject of "Air ticketing" the topic " Aircraft Real Time Tracking application" was proposed to be introduced.
4) In the subject of " Passport and VISA" few more topics were suggested to be added such as Cashback offers, Mobile applications, Air Ticket rules, Cancellation, Deportation and Asylum, Liability of Airlines .
5) All the above proposed changes have been made and attached as Annexxure-4 for approval.

A) The discussions were held on 6 month **" Skill Certificate Course in ANSYS ".** The proposed detailed contents for this course have been put as **Annexure-5 (copy attached)** after incorporating the the *observations of BOS committee which are given below:-*

1) Prof Raj Kumar S Pant suggested to add 'Email Communication' in learning outcomes along with 'Telephonic Communication' in Unit-I i.e. Communication skills.

2) Prof. T.K. Jindal suggested to change the name of the chapter from "Static Structural Analysis and CFD" to "Static Structural Analysis" and similarly the name of chapter "Electronic and thermal Analysis and thermal stresses" shall be changed to "Electronic and Thermal analysis".

3) Prof. Raj Kumar Pant and Dr Neeraj Grover suggested to add the topics Meshing of Plate with holes (2D & 3D) in Meshing chapter, Extrusion , Union, Intersection in placed feature and

PUNJAB STATE AERONAUTICAL ENGINEERING COLLEGE

(A constituent College of Maharaja Ranjit Singh Punjab Technical University, Bathinda)
Patiala Civil Aerodrome, Sangrur Road,Patiala – 147001.
Phone: + 91 175 2970746, E-mail: dir.psaec@mrsptu.ac.in

assembly.

The changes as per observations mentioned above have been incorporated by the special invitee members as Annexure 1,2,3,4 and 5. These detailed contents given in Annexure 1,2,3,4 and 5 are approved by BoS members for further necessary action. Next BOS shall be held by this week end to finalise the contents of 7th and 8thsem of Aerospace Engineering.

The meeting ended with thanks to chair.

(Prof. Balraj Singh)	(Prof R.S.Pant)	(Dr. Jimmy Kansal)	(Prof Neeraj Grover) 29/4/22
(Prof J.S.Tiwana)	(Dr. Subash Chander)	(Prof Tushar Siag)	(Dr. Anju Sharma)
(Er. Abhishek Thakuri)	(Er. Moniya Pal)	(Dr. Priyanka Malhotra)	(Er Vaishali)

Giani Zail Singh Campus College of Engineering &Technology
Maharaja Ranjit Singh Punjab Technical University
DABWALI ROAD, BATHINDA-151001
ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਤਕਨੀਕੀ ਯੂਨੀਵਰਸਿਟੀ,
ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿੰਡਾ - 151001
[A State University Estb. by Govt. of Punjab Act No. 5(2015) u/s 2(f) & Approved u/s 12B of UGC Act, 1956]
Department of Computer Science & Engineering

Ref No: HCSD / 2267 Dated: 23-05-2022.

Minutes of meeting

A prescheduled meeting of standing committee of BoS CSE and other faculty members of CSE deptt. was held in the o/o HOD CSE on 18-05-2022 at 2:30pm with HOD CSE in chair, to deliberate about the nomenclature , eligibility , duration, scheme and syllabus of the following courses to be offered by the university in the coming session 22-23.

1. B. Tech. CSE (Artificial Intelligence and Machine Learning)
2. M. Tech. CSE (Part Time)
3. B. Tech. (Computer and Communication Engg.)
4. M. Tech. (Computer and Communication Engg.) Part time
5. M. Tech. (Computer and Communication Engg.) full time

Following members attended the meeting as special invitees in reference to the letter no. 4971 dated 12/5/2022.

1. Dr.Savina Bansal (Prof. ECE Deptt.)
2. Dr. Neeraj Gill (Chairperson BoS ECE Deptt.)
3. Er. Sukhjinder Singh (Nominated by Chairperson BoS, ECE Deptt.)

The nomenclature, eligibility, duration, scheme and syllabus of the new courses to be offered by the university in the coming session 22-23.was deliberated at length and following proposal was unanimously arrived at:

1. The proposed nomenclature, eligibility and duration for the new courses to be offered in session 2022-23 are as follows.

Name of the Course	Eligibility	Duration
B. Tech. CSE (Artificial Intelligence and Machine Learning)	As per B.Tech CSE of MRSPTU	4 yrs.
M. Tech. (CSE) Part Time	B.Tech CSE/IT or any other allied branch	3 yrs.
B. Tech. (Computer and Communication Engg.)	As per B.Tech CSE of MRSPTU	4 yrs.
M. Tech. (Computer and Communication Engg.) Part time	B.Tech CSE/ECE /IT or any other allied branch	3 yrs.
M. Tech. (Computer and Communication Engg.) full time	B.Tech CSE/ECE /IT or any other allied branch	2 yrs.

28/6/22
AR/DAA-I
For ratification in Faculty of Engg. & Tech.
Sd/- 09/06/2022
— CDEO

2. The scheme and syllabus of B.Tech CSE (Artificial Intelligence and Machine Learning) and M. Tech. CSE (Part Time) has been proposed. (already sent vide Ref. No. HCSD/2264 dt: 20/5/22)

3. It was proposed that the scheme and syllabus of first year B.Tech (Computer and Communication Engg.) will be same as that of scheme and syllabus of first year B.Tech of other branches. The syllabus of first year B.Tech (Computer and Communication Engg.) including the subject "Introduction to Computer and Communication Engineering." is attached. (copy attached)

4. The scheme of first year M.Tech (Computer and Communication Engg.) Part time and first year M.Tech (Computer and Communication Engg.) full time has been proposed. The scheme and syllabus for 2nd, 3rd and 4th year of the said courses are being prepared and shall be intimated soon. (syllabus of first sem. is attached)

5. The reframed scheme of 3rd and 4th sem M.Tech CSE (Regular) was proposed which is in line with the CBCS system of MRSPTU. (copy attached)

Encls: As above

23/5/22

HOD CSE
GZSCCET MRSPTU
BATHINDA

Associate Dean Academic Affairs

CC: Chairperson BoS, ECE Deptt, GZSCCET MRSPTU

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
Dabwali Road, BATHINDA – 151001
(A state technical university estb. By Govt. of Punjab Act No. 5(2015) u/s 2(f) & approved u/s 12B of UGC act 1956)

Ref. No. HEED/8595 Date 17/05/2022

Department of Electrical Engg.

(MoM)

13th meeting of BOS in Electrical Engineering of MRSPTU Bathinda, has been held through Google hangouts online meet (https://meet.google.com/iby-spyz-hqc) on May 12, 2022 (Thursday) at 3:00 p.m. onwards. The following members were present in the meeting.

1. Dr. Sarbjeet Kaur Bath (Chairperson), Prof. & Head, Deptt. of Electrical Engg., GZSCCET MRSPTU Bathinda.
2. Dr. Ved Prakash, Assistant Prof. Deptt. of Electrical Engg., GZSCCET MRSPTU Bathinda.
3. Dr. Amit Kumar Manocha, Associate Prof. & Director, Punjab Institute of Tech.GTB Garh Moga.
4. Er. Harsimran Singh, Asstt. Prof. Baba Farid College of Engg. & Tech. Deon, Bathinda.
5. Er. Nitin Bansal, Chief Manager - Sales, Office Manager - Odisha, Siemens Limited Digital Industries, India

The following decisions were taken after the detailed deliberations:

1.1 **Three-Year M. Tech Power System (part-time)** course is proposed to start from the coming session (July 2022), the classes (in offline mode) for which can be held on weekends i.e. on Saturday and Sunday.

1.2 **The already existing Scheme and Syllabus** (based on AICTE model curriculum 2018) for full-time (2-year) course of M. Tech Electrical Engg. (Power System) applicable w.e.f 2018 onwards, is proposed to be adopted as such for M. Tech Power System part-time (3-year) course also.

1.3 Therefore academic **eligibility for M. Tech Power System (part-time) (3-year) course will be same** as for full-time (2-year) course of M. Tech Electrical Engg. (Power System).

1.4 The **Scheme and Subjects of 1st semester** M. Tech Electrical Engg. (Power System) full-time (2-year) will be **bi-furcated to be offered in two semesters** (sem 1st & sem 2nd) for M. Tech Power System part-time (3-year) course.

1.5 Similarly the **Scheme and Subjects of 2nd semester** M. Tech Electrical Engg. (Power System) full-time (2-year) will be **bi-furcated to be offered in two semesters** (sem 3rd & sem 4th) for M. Tech Power System part-time (3-year) course.

1.6 **Subjects of 3rd semester** M. Tech Electrical Engg. (Power System) full-time (2-year) course will be offered in **5th semester** for M. Tech Power System part-time (3-year) course.

1.7 Subject of **Major Project (Phase-II) Dissertation of 4th semester** M. Tech Electrical Engg. (Power System) full-time (2-year) course will be offered in **6th semester** for M. Tech Power System part-time (3-year) course.

SBath 17/5/2022 17/5/2022 (1/2)

1.8 The **restructured scheme** for semesters 1 to 6 of M. Tech Power System part-time (3-year) course has been attached herewith as **Annexure - I.** (3 Pages) SK

1.9 To make the **Implementation** of the part-time course more flexible and economical, the classes of two successive batches may be held together in odd or even semesters by:

1.9.1 Offering Subjects of 1st semester in 3rd semester and vice-versa (odd semesters), if possible.

1.9.2 Similarly some of the subjects of 2nd semester can be interchanged with some subjects of 4th semester, e.g. Departmental Elective-II with Department Elective -IV and Lab-II with Lab-IV and vice-versa, if possible.

2.1 **Three-Year M. Tech Electrical Engg. part-time course** is proposed to start from the coming session, the classes (in offline mode) for which can be held on weekends i.e. on Saturday and Sunday.

2.2 The **already existing Scheme and Syllabus for full-time (2-year) course** of M.Tech Electrical Engg. applicable w.e.f 2016 onwards, is proposed to be **adopted as such for M. Tech Electrical Engg. part-time (3-year)** course also.

2.3 Therefore academic **eligibility for M. Tech Electrical Engg. part-time (3-year) course will be same as for full-time (2-year)** course of M. Tech Electrical Engg.

2.4 The **restructured scheme** for semesters 1 to 6 of **M. Tech Electrical Engg. part-time (3-year)** course has been attached herewith as **Annexure-II.** (3-Pages) SK

2.5 To make the **Implementation** of the part-time course of **M. Tech Electrical Engg.** flexible and cost effective, the classes of two successive batches may be held together, if possible, by interchanging the subjects of odd (1 & 3) semesters or even (2 & 4) semesters.

3. **One Year skill development Certificate Programme in Electrician** is proposed to start from the coming session. For this course, the **scheme and syllabus that is already available** at the MRSPTU website is proposed to be adopted as such (Annexure – III). (One Page) SK

The meeting ended with thanks to the chairperson of BOS of EE, MRSPTU, Bathinda.

SBath 17/5/2022
Dr. Sarbjeet Kaur Bath

17/5/2022
Dr. Ved Prakash,

Er. Harsimran Singh

Dr. Amit Kumar Manocha
(Attended on-Line Meeting)

Er. Nitin Bansal
(Attended on Line Meeting)

Forwarded to Associate Dean Academic Affairs MRSPTU Bathinda
SBath
17/5/2022

(2/2)

HEED-8597
18/05/2022

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
Dabwali Road, BATHINDA – 151001
(A state technical university estb. By Govt. of Punjab Act No. 5(2015) u/s 2(f) & approved u/s 12B of UGC act 1956)

Ref. No. 8597 Date 18/05/2022

Department of Electrical Engg.

To

The Associate Dean,
Academic Affairs,
MRSPTU Bathinda.

Subject: **Regarding academic eligibility** of the Full-Time & Part-Time courses of M. Tech Power System and M. Tech Electrical Engg., and One-Year Certificate course of Electrician

13th meeting of BOS in Electrical Engineering of MRSPTU Bathinda, was held through Google hangouts online meet (https://meet.google.com/iby-spyz-hqc) on May 12, 2022 (Thursday) at 3:00 p.m. onwards. The minutes of the same have already been submitted through our letter no. HEED/8595, dated 17/05/2022. The academic eligibility of the courses is as follows:

S.No.	Programme	Duration of the Programme	Minimum Eligibility Criteria for 2022-23 batch onwards admissions
1.	M.Tech Power System	Part-Time (3Year/6-Sem) Full-Time (2Year/4Sem)	B.E/B.Tech in Electrical Engg./ Electrical & Electronics Engg./ Electrical Engg. & Industrial Control/ Instrumentation & Control Engg.
2.	M.Tech Electrical Engg.	Part-Time (3Year/6-Sem) Full-Time (2Year/4-Sem)	B.E/B.Tech in Electrical Engg./ Electrical & Electronics Engg./ Electrical Engg. & Industrial Control/ Instrumentation & Control Engg.
3.	Certificate Programme in Electrician	Full-Time (One-Year/2-Sem)	Matriculation or equivalent NSQF Level as prescribed by MRSPTU, Bathinda

This is being submitted for your further necessary action please.

Bath
18/5/2022
Dr. Sarbjeet Kaur Bath
(Chairperson of BoS EE)

18/5/2022
Dr. Ved Prakash
(Member of BoS EE)

Subject: BoS (Mechanical Engineering) minutes of meeting.

The online (google meet) BoS meeting was held on April 26, 2022 (started 3:00 PM), which was attended by following BoS members;

1. Prof &HoD JS Tiwana (Chairman)
   Associate Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.
2. Prof. (Dr.) Harpreet Singh (Member)
   Professor, Department of Mechanical Engineering, IIT Ropar.
3. Prof. (Dr.) Ekta Kapoor(Member)
   Head &Professor, Department of Mechanical Engineering, IIT Ropar.
4. Prof. (Dr.) Balwinder Singh(Member)
   Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.
5. Prof Naveen Singla(Member)
   Associate Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.
6. Prof. (Dr.) Rajesh Gupta(Member)
   Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.
7. Prof. (Dr.) Harish Garg(Member)
   Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.
8. Prof Vivek Kaundal(Member)
   Assistant Professor, Department of Mechanical Engineering, GZSCCET, MRSPTU, Bathinda.

As per the agenda, the following points have been discussed;

i. The BoS approved the start of M Tech (Mechanical Engineering) part time course from session August 2022-23 onwards. The study scheme has been finalized and approved.

ii. The BoS approved the start of B Tech (Mechatronics) course from session August 2022-23 onwards. The first year remains common with the other B Tech courses running in MRSPTU, Bathinda. However, study scheme for the subsequent semesters will be prepared in the coming months. The BoS also highlights the specialization of this course with Industry 4.0 concept.

iii. Further, the BoS realized the importance of skill development courses and approved the start of three skill development courses having one year duration. These courses are Refrigeration and Air Conditioning Mechanic, Welder and Additive Manufacturing respectively.Two skill development coursesRefrigeration and Air Conditioning Mechanic and Welder are already running with MRSPTU, Bathinda. The study scheme and syllabus for additive manufacturing has been finalized and approved in the meeting.

iv. Finally, the BoS appreciated the Departmental initiative regarding the start of online courses.

The meeting ended with thanks to chair.

(Prof. JS Tiwana)	(Joined online) (Prof. Harpreet Singh)	(Joined online) (Prof. Ekta Kapoor)
(Prof. Balwinder Singh)	(Prof. Naveen Singla)	(Prof. Rajesh Gupta)
(Prof. Harish Garg)	(Prof Vivek Kaundal)	

GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		15	3	10	540	360	900	19

Note:
1. There will be Induction Programme of 3 weeks before start of normalclasses.
2. Drug Abuse: Problem, Management and Prevention and Introduction toConcerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.

* As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
Total		12	2	12	400	400	800	20

Note:
1. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		14	2	12	500	400	900	20

Note:

1. There will be Induction Programme of 3 weeks before start of normalclasses.
2. Introduction to Concerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.
   * As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
Total		13	3	10	440	360	800	19

Note:

1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester

PHYSICS (SEMICONDUCTORPHYSICS)

Subject Code: BPHYS1-101 **L T PC** **Duration: 38Hrs.**
3 1 0 4

UNIT-I

Quantum Theory: (10 Hrs.)
Need and origin of Quantum Concept, Wave-particle duality, Matter waves, Group and Phase velocities, Concept of Uncertainty Principle and its application: nonexistence of electron in the nucleus, wave function & its significance, normalization of wave function, Schrodinger wave equation: time independent and dependent, Eigen functions & Eigen values, particle in a box in 1-D. Concept of scattering from a potential barrier and tunneling.

UNIT-II

Electronic Materials: (8 Hrs.)
Free electron theory, Density of states and energy band diagrams, Introduction to band gap theory, Direct and in direct and gaps. Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level, Effective mass, phonons.

UNIT-III

Semiconductors and Light- Semiconductor Interactions: (12 Hrs.)
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices. Optical transitions in bulk semiconductors: absorption, spontaneousemission, and stimulated emission; Lasers: principles and working of laser: population inversion, pumping, types of lasers with emphasis on the semi-conductor Lasers.

UNIT-IV

Fibre Optics Communication: (8 Hrs.)
Introduction and importance of use of optical fibres in data transmission, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, applications of optical fibres.

Recommended Books:

1. Satayaparkash, 'QuantumMechanics'.
2. A. Ghatak and Lokanathan, 'QuantumMechanics'.
3. J.Singh,'SemiconductorOptoelectronics:PhysicsandTechnology',McGrawHillInc., **1995.**
4. S.M. Sze, 'Semiconductor Devices: Physics and Technology', Wiley,**2008**.
5. A. Yariv and P. Yeh, 'Photonics: Optical Electronics in Modern Communications', Oxford University Press, New York,**2007**.
6. P. Bhattacharya, 'Semiconductor Optoelectronic Devices', Prentice Hall of India,**1997**.
7. M R Shenoy, 'Online Course: Semiconductor Optoelectronics',NPTEL.
8. MonicaKatiyarandDeepakGupta,'OnlineCourse:OptoelectronicMaterialsandDevices', NPTEL.
9. Ben. G. Streetman, 'Solid State Electronics Devices', Pearson PrenticeHall.

MATHEMATICS-I (CALCULUS, LINEARALGEBRA)

Subject Code: BMATH1-101 **L T PC** **Duration: 46Hrs.**
3 1 0 4

UNIT–I

Calculus: (12 Hrs.)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L' Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT –II

Sequences and Series: (10 Hrs.)

Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT –III

Multivariable Calculus: (12 Hrs.)

Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT –IV

Linear Algebra: (12 Hrs.)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9thEdn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9thEdn, John Wiley & Sons,**2006**.
3. T.Veerarajan,'EngineeringMathematicsforFirstYear',TataMcGrawHill,NewDelhi, **2008.**
4. B.V. Ramana, 'Higher Engineering Mathematics', 11thReprint, Tata McGraw Hill, New Delhi,**2010**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2ndEdn., Brooks/Cole,**2005**.
6. B.S. Grewal, 'Higher Engineering Mathematics', 36thEdn., Khanna Publishers, **2010**.

CourseOutcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students withstandard 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 theirdisciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gammafunctions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineeringproblems.
3. The tool of power series and Fourier series for learning advanced EngineeringMathematics.

4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS &DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

1. Introduction

Engineering Drawing/Engineering Graphics/Technical Drawing - a Visual Science. Types of Engineering Drawing, Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales. Basic Definition of geometrical objects: Points, lines, planes and solids.

2. Theory of Projections - Relevance of projection, Type of projections, Perspective, Orthographic, Axonometric and their basic principles, System of orthographic projection: in reference to quadrants and octants, illustration through simple problems of projection.

3. Projection of Points- Projection of points in quadrants and octants. Projection of point on Auxiliary planes.

4. Projection of Lines -Parallel to both H P and V P, Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle orientation of straight line: rotation method and auxiliary plane method. Distance between two nonintersecting lines, and trace of line.

5. Projection of Planes- Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, and Lamina oblique to three reference planes. Application of auxiliary planes, and trace of planes.

6. Projection of Solids- Definition of solids, types of solids, and elements of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, axis perpendicular to profile plane and parallel to both H P and V P. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

7. Section of Solids Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

8. Development of Surface Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, and development of surface of sphere.

9. Isometric Projection Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.

10. Orthographic Projection Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Recommended Text/Reference Books

1. N.D. Bhatt, V.M. Panchal& P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, 2014.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, 2008.
3. B. Agrawal& C.M. Agrawal, 'Engineering Graphics', TMH Publication, 2012.
4. K.L. Narayana& P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, 2008.

BASIC ELECTRICALENGINEERING

Subject Code: BELEE0-101 **L T PC** **Duration: 42Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dcexcitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasorrepresentation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions,phasordiagrams,equivalentcircuit,calculationoflossesintransformers,regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters**.** Construction and working of single-phase motors(Splitphase,shadedpole,capacitorstart,capacitorrun,capacitorstartandrunmotors).

Electrical Installations: (4Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill,**2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill,**2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press,**2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson,**2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India,**1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:

1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phasetransformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electricalinstallations.

PHYSICS (SEMICONDUCTOR PHYSICS)LAB.

Subject Code: BPHYS1-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

Experiments based on Semiconductor Physics:

1. To study the V-I characteristic of different PN junction diode-Ge andSi.
2. To study the V-I characteristic of Zenerdiode.
3. To study the V-I characteristic ofLED.
4. To analyze the suitability of a given Zener diode as a powerregulator.
5. To find out the intensity response of a solar cell/Photodiode.
6. To find out the intensity response of aLED.
7. To determine the band gap of asemiconductor.
8. To determine the resistivity of a semiconductor by four probemethod.
9. To confirm the de Broglie equation forelectrons.
10. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
11. To study the magnetic field of a circular coil carrying current.
12. To find out polarizability of a dielectric substance.
13. To study B-H curve of a ferromagnetic material using CRO.
14. To find out the frequency of AC mains using electric-vibrator.
15. To find the velocity of ultrasound in liquid.
16. To study the Hall effect for the determination of charge current densities.
17. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
18. Measurement of susceptibility of a liquid or a solution by Quincke's method:
19. AFM experiment to study the sample with the nano-scale objects and measuresurface topography with different scales, width and height of nano objects, and force-distance curves.
20. To study the temperature coefficient of Resistance of copper.

Physics Virtual Lab. Experiments:

21. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
22. To determine the resistivity of semiconductors by Four Probe Method.
23. To study the forward and reverse biased characteristics of PNP and NPN transistors.
24. To study the B-HCurve.
25. To study the Hall effect experiment to determine the charge carrier density.
26. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
27. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
28. Verification and design of combinational logic using AND, OR, NOT, NAND andXOR gates.

Note: Any other experiment based on the above mentioned topics may be included.

ENGINEERING GRAPHICS & DESIGNLAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 45 Hrs.**
0 0 6* 3

1. **Overview of Computer Graphics**
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
2. **Customization & CAD Drawing**
Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
3. **Annotations, Layering & other Functions**
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

.*Lab work will be performed in two parts:

(i) **Computer Lab (2 hours)** Computer Graphics, CAD Drawing etc.

(ii) **Drawing Hall (04 hours)** Manual practice on drawing sheets of theory content the relevant theory part of Engineering Graphics & Design may also be covered in Lab work.

BASIC ELECTRICAL ENGINEERINGLAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstrationofcut-outsectionsofmachines:Inductionmachine(squirrelcagerotorand slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT ANDPREVENTION

Subject Code: BMNCC0-004 **L T PC** **Duration: 30Hrs.**
2 0 0 0

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: Counselling, Behavioural 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. Ishwar Modi and Shalini Modi, '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**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,**2013**.
9. BhimSain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,**1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar,**2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press,**2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime,**2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime,**2017**.

CHEMISTRY-I

Subject Code: BCHEM0-101	**L T PC** **3 1 0 4**	**Duration: 42Hrs.**

Course Objectives:

1. To understand the atomic and & molecular nature of variousmolecules
2. To understand the bandstructures
3. To elaborate the applications of spectroscopictechniques
4. To understand the thermodynamic functions and theirapplications
5. To rationalize periodicproperties
6. To understand the concepts of stereochemistry and preparation of organicmolecules

UNIT-I

1. Atomic and Molecular Structure: (12Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclearandheteronucleardiatomics.Pi-molecularorbitalsofbutadieneandbenzeneand aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8Hrs.)

PrinciplesandselectionrulesofElectronicspectroscopyandFluorescencespectroscopyalong withtheirapplications.PrinciplesandselectionrulesofVibrationalandrotationalspectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4Hrs.)

Ideal gas equation, Ionic, dipolar and vanDer Waals interactions. Realgas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, ‘University Chemistry’.
2. M.J. Sienko and R.A. Plane ‘Chemistry: Principles and Applications’.
3. C.N. Banwell, ‘Fundamentals of Molecular Spectroscopy’.
4. B.L.Tembe,KamaluddinandM.S.Krishnan,‘EngineeringChemistry(NPTELWeb-book).
5. P.W. Atkins, ‘PhysicalChemistry’.
6. K.P.C. Volhardt and N.E. Schore ‘Organic Chemistry: Structure and Function’, 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyzemicroscopicchemistryintermsofatomicandmolecularorbitalsandintermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguishtherangesoftheelectromagneticspectrumusedforexcitingdifferentmolecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II (PROBABILITY AND STATISTICS)

Subject Code: BMATH1-201 **L T PC** **Duration: 40Hrs.**
3 1 0 4

UNIT–I

Basic Probability: (12 Hrs.)

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, Chebyshev's Inequality.

UNIT –II

Continuous Probability Distributions: (6 Hrs.)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions: (6 Hrs.) Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT –III

Basic Statistics: (10 Hrs.)

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 –IV

Applied Statistics: (8 Hrs.)

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 Hrs.)

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.

Recommended Books:

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,'AnIntroductiontoProbabilityTheoryanditsApplications',Vol.-1,Wiley,**1968**.
5. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers,**2000**.
6. T. Veerarajan, 'Engineering Mathematics', Tata McGraw Hill, New Delhi, **2010**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T PC** **Duration: 25Hrs.**
2 0 0 2

UNIT-I

1. Vocabulary Building:

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

Subject-verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions
Redundancies
Clichés

UNIT-IV

4. Nature and Style of sensible Writing:

Describing
Defining

Classifying
Providing examples or evidence
Writing introduction and conclusion

5. Writing Practices:

Comprehension
Précis Writing
Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan,**2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book,**2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press,**2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press,**2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 **L T PC** **Duration: 41Hrs.**
3 0 0 3

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)**.** Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)

Structures, Defining structures and Array of Structures

8. **Pointers: (2Hrs.)**
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
9. **File Handling:** (only if time is available, otherwise should be done as part of thelab)

Recommended Text Books:
1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGrawHill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGrawHill.

Recommended Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:
The student will learn
1. To formulate simple algorithms for arithmetic and logicalproblems.
2. To translate the algorithms to programs (in Clanguage).
3. To test and execute the programs and correct syntax and logicalerrors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquerapproach.
6. To use arrays, pointers and structures to formulate algorithms andprograms.
7. To apply programming to solve matrix addition and multiplication problemsand searching and sortingproblems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simpleintegration.

CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:
1. To learn the preparation and standardization ofsolutions
2. To learn the estimation of various physical properties of given liquidsamples
3. To estimate various crucial parameters for watersample
4. To learn the preparation of various molecules and detection of functionalgroups.

Choice of 10-12 experiments from the following:
1. Preparation of a standard solution
2. Determination of surface tension andviscosity
3. Thin layerchromatography
4. Determination of total Alkalinity/ Acidity of a watersample.
5. Determination of residual chlorine in watersample
6. Estimation of total, temporary and permanent hardness ofwater
7. Determination of the rate constant of areaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials andemfs
10. Synthesis of apolymer
11. Saponification /acid value of anoil
12. Detection and confirmation of organic functionalgroups.
13. Models of spatialorientation
14. TotestthevalidityofLambertBeerlaw/Determinationofλ_{max}/Determinationofunknown concentration of asolution.
15. Determination of the partition coefficient of a substance between twoimmiscible

liquids
16. Adsorption of acetic acid bycharcoal
17. Synthesis of a drug – Acetaminophen,Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products asa function oftime
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a saltsample

ENGLISHLAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. ListeningComprehension
2. Pronunciation, Intonation, Stress andRhythm
3. Common Everyday Situations: Conversations andDialogues
4. Communication atWorkplace
5. Interviews
6. FormalPresentations

PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations
Laboratory Outcomes:
1. To formulate the algorithms for simpleproblems
2. To translate given algorithms to a working and correctprogram
3. To be able to correct syntax errors as reported by thecompilers
4. To be able to identify and correct logical errors encountered at runtime
5. To be able to write iterative as well as recursiveprograms
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in definingself-referential structures.
8. To be able to create, read and write to and from simple textfiles.

MANUFACTURING PRACTICES (THEORY &LAB.)

Subject Code: BMFPR0-101 **L T PC** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additivemanufacturing.
3. Fitting operations & powertools.
4. Sheet MetalOperations.
5. Electrical &Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glasscutting.
8. Metalcasting.
9. Welding (arc welding & gas welding),brazing.

Recommended Text/Reference Books:

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd.,Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4thEdn., Pearson Education India Edn.,**2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson,**2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4thEdn., Prentice HallIndia, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw HillHouse, **2017**.

Course Outcomes:
1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)
1. Machine shop **(10Hrs.)**
2. Fitting shop **(8Hrs.)**

3. Carpentry **(6Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4Hrs.)**
6. Casting **(8Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6Hrs.)**
9. Plastic moulding& Glass Cutting **(6Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

INTRODUCTION TO COMPUTER SCIENCE & ENGINEERING

Subject Code: BMNCC0-014 **L T PC** **Duration: 24Hrs.**
2 0 0 0

UNIT-I

Introduction to Computer Science & Engineering, Difference between science & engineering, Applications of Computer Science & engineering.

UNIT-II

Different branches/fields of Computer Science, Scope of Computer Science in industry, self-employment etc.

UNIT-III

Introduction to Computer, parts of computer system. Difference between Hardware & software, Configuration of computer systems, Types of memory-RAM, ROM, Introduction to UPS-Online and Offline, printers etc.

UNIT-IV

Different types of Software- Application software and System Software, Types of Languages-High level and low level languages, Introduction to Operating System.

GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS4-101	Physics (Mechanics and Mechanics of Solids)	3	1	0	40	60	100	4
BMATH4-101	Mathematics-I (Calculus, Multivariable Calculus & Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS4-102	Physics (Mechanics & Mech. of Solids) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		15	3	10	540	360	900	19

Note:

1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Drug Abuse: Problem, Management and Prevention and Introduction to Concerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.

* As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH4-201	Mathematics-II (Differential Equations)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
Total		12	2	12	400	400	800	20

Note:

1. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH4-101	Mathematics-I (Calculus, Multivariable Calculus & Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		14	2	12	500	400	900	20

Note:
1. **There will be Induction Programme of 3 weeks before start of normal classes.**
2. **Introduction to Concerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.**

*** As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org**

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS4-101	Physics (Mechanics And Mechanics of Solids)	3	1	0	40	60	100	4
BMATH4-201	Mathematics-II (Differential Equations)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS4-102	Physics (Mechanics & Mech. of Solids) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
Total		13	3	10	440	360	800	19

Note:
1. **Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.**
2. **Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester**

PHYSICS (MECHANICS AND MECHANICS OFSOLIDS)

Subject Code: BPHYS4-101 **L T PC 3 1 0 4** **Duration: 38Hrs.**

UNIT-I

Friction and Mechanics of Solids: (10 Hrs.)

Brief introduction to friction, its laws, types, motion on horizontal and inclined plane, methods of changing friction and applications of friction. Concept of stress–strain, elasticity, plasticity, strain hardening, failure (fracture/yielding), Generalized Hooke's law, one dimensional stress- strain curve. Force analysis -- axial force, shear force, bending moment and twisting moment. Bending stress; Shear stress; Concept of strain energy; Yield criteria.

UNIT-II

Simple Harmonic Oscillator: (8 Hrs.)

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator- heavy, critical and light damping, energy decay inadamped harmonicoscillator, quality factor, orced oscillations and resonance (electrical and mechanical).

UNIT-III

Vector Mechanics: (**10 Hrs.**)

Transformationofscalarandvectorunderrotationtransformation,ForcesinNature,Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Concept of Central forces; Conservation of Angular Momentum.

UNIT-IV

Frames of References and Rigid Body Dynamics: (**10 Hrs.**)

Inertial and Non-inertial frames of reference; Galilean and Lorentz transformations, Introduction to Cartesian, spherical and cylindrical coordinate system. Basic idea of Centripetal and Coriolis forces along with their applications. Definition and motion of a rigid body in the plane; Rotation in the plane, Angular momentum about apo into fa rigid body inplanar motion; introduction to three-dimension rigid body motion- only need to highlight the distinction from two-dimensional motion with examples.

Recommended Books:

1. M.K. Harbola, 'Engineering Mechanics', 2nd Edn.
2. M.K. Verma, 'Introduction to Mechanics'.
3. Mathur, 'Mechanics', S. ChandPublishing.
4. Upadhyaya, 'Classical Mechanics', Himalaya PublishingHouse.
5. J.L. Synge & B.A. Griffiths, 'Principles ofMechanics'.
6. J.L. Meriam, 'Engineering Mechanics – Dynamics', 7th Edn.
7. W.T. Thomson, 'Theory of Vibrations withApplications'.
8. N.C. Dahl & T.J. Lardner, 'An Introduction to the Mechanics of Solids', 2nd Edn. with SI Units-SHCrandall.
9. Malik and Singh, 'Engineering Physics', Tata McGrawHill.

MATHEMATICS-I (CALCULUS, MULTIVARIABLE CALCULUS & LINEAR ALGEBRA)

SubjectCode:BMATH4-101 **L T P C** **Duration: 46Hrs.**
3 1 0 4

UNIT–I

Calculus: (14 Hrs.)
Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.

UNIT–II

Multivariable Calculus: (10 Hrs.)
Limit, continuity and partial derivatives, Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT–III

Multiple Integration: (12 Hrs.)
Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes (Statement only), simple applications involving cubes, sphere and rectangular parallel epipeds.

UNIT–IV

Linear Algebra: (10 Hrs.)
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9thEdn., Pearson, Reprint, **2002**.
2. T. Veerarajan, 'Engineering Mathematics for First Year', 11thReprint, Tata McGraw Hill, New Delhi,**2008**.
3. B.V. Ramana, 'Higher Engineering Mathematics', Tata McGraw Hill, New Delhi,**2010**.
4. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, 35thEdn.,**2000**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2ndEdn., Brooks/Cole,**2005**.
6. V. Krishnamurthy, V.P. Mainra and J.L. Arora, 'An Introduction to Linear Algebra', Affiliated East–West Press, Reprint,**2005**.
7. ErwinKreyszig,'AdvancedEngineeringMathematics',9thEdn.,JohnWiley&Sons,**2006**.

Course Outcomes:
The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis 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.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding ofBeta and Gammafunctions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineeringproblems.
3. The tool of power series and Fourier series for learning advancedEngineering Mathematics.
4. To deal with functions of several variables that are essential in most branchesof engineering.
5. The essential tool of matrices and linear algebra in a comprehensivemanner.

ENGINEERING GRAPHICS &DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

1. Introduction

Engineering Drawing/Engineering Graphics/Technical Drawing - a Visual Science. Types of Engineering Drawing, Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales. Basic Definition of geometrical objects: Points, lines, planes and solids.

2. Theory of Projections - Relevance of projection, Type of projections, Perspective, Orthographic, Axonometric and their basic principles, System of orthographic projection: in reference to quadrants and octants, illustration through simple problems of projection.

3. Projection of Points- Projection of points in quadrants and octants. Projection of point on Auxiliary planes.

4. Projection of Lines -Parallel to both H P and V P, Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle orientation of straight line: rotation method and auxiliary plane method. Distance between two nonintersecting lines, and trace of line.

5. Projection of Planes- Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, and Lamina oblique to three reference planes. Application of auxiliary planes, and trace of planes.

6. Projection of Solids- Definition of solids, types of solids, and elements of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, axis perpendicular to profile plane and parallel to both H P and V P. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

7. Section of Solids Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

8. Development of Surface Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, and development of surface of sphere.

9. Isometric Projection Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.

10. Orthographic Projection Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Recommended Text/Reference Books

1. N.D. Bhatt, V.M. Panchal& P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, 2014.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, 2008.
3. B. Agrawal& C.M. Agrawal, 'Engineering Graphics', TMH Publication, 2012.
4. K.L. Narayana& P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, 2008.

BASIC ELECTRICALENGINEERING

SubjectCode:BELEE0-101 **L T PC 3 1 0 4** **Duration: 42Hrs.**

UNIT-1

DC Circuits: (8 Hrs.)

Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dcexcitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)

Representation of sinusoidal waveforms, average, peak and rms values, phasorre presentation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)

Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions,phasordiagrams,equivalentcircuit,calculationoflossesintransformers,regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters**.** Construction and working of single-phase motors(Splitphase,shadedpole,capacitorstart,capacitorrun,capacitorstartandrunmotors).

Electrical Installations: (4Hrs.)

Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of

Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill,**2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill,**2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press,**2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson,**2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India,**1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:

1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electrical installations.

PHYSICS (MECHANICS & MECH. OF SOLIDS)LAB.

Subject Code: BPHYS4-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

Experiments based on Mechanics & Mech. of Solids (Broad Area):

Coupled Oscillators:

1. Experiments on an air-track;
2. Experiment on moment of inertia measurement,
3. Experiments with gyroscope;
4. Resonance phenomena in mechanical oscillators.

Experiments based on the above mentioned Topics:

1. To determine the Height of an object using a Sextant.
2. To determine the angular acceleration α and torque τ offly wheel.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine **g** by Bar Pendulum.
5. To determine **g** by Kater's Pendulum.
6. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i)Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of **g** in the laboratory.
7. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and(c) Modulus of rigidity.
8. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
9. To compare the moment of inertia of a solid sphere and hollow sphere or solid disc of same mass with the torsional pendulum.
10. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i)Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of **g** in the laboratory.
11. To determine the Elastic Constants/Young's Modulus of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
13. To determine the Modulus of Rigidity of brass.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
15. Tocomparethemomentofinertiaofasolidsphereandhollowsphereorsoliddiscofsame mass with the torsional pendulum.

Virtual Lab Experiments:

16. Toverifythatenergyconservationandmomentumconservationcanbeusedwithaballistic pendulum to determine the initial velocity of a projectile, its momentum and kinetic energy.
17. To verify the momentum and kinetic energy conservation using collision balls.
18. To understand the torsional oscillation of pendulum in different liquid. and determine the rigidity modulus of the suspension wire using torsion pendulum.
19. To find the Time of flight, Horizontal range and maximum height of a projectile for different velocity, angle of projection, cannon height and environment.
20. The Elastic and Inelastic collision simulation will help to analyse the collision variations for different situations.
21. Study of variation of Momentum, Kinetic energy, Velocity of collision of the objects and the Center of Mass with different velocity and mass.

22. Demonstration of collision behaviour for elastic and inelastictype.
23. Variation of collision behavior in elastic and inelastictype.
24. Calculation of the Momentum, Kinetic energy, and Velocity after collision.
Note: Any other experiment based on the above mentioned broad topics maybe included.

ENGINEERING GRAPHICS & DESIGNLAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 45 Hrs.**
0 0 6 3

1. **Overview of Computer Graphics**
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
2. **Customization & CAD Drawing**
Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
3. **Annotations, Layering & other Functions**
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

.*Lab work will be performed in two parts:

(i) **Computer Lab (2 hours)** Computer Graphics, CAD Drawing etc.

Drawing Hall (04 hours) Manual practice on drawing sheets of theory content the relevant theory part of Engineering Graphics & Design may also be covered in Lab work.

BASIC ELECTRICAL ENGINEERINGLAB.

SubjectCode:BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors andinductors.
2. To verify Ohm'slaw.
3. To verify Kirchhoff's voltage and currentlaws.
4. To verify SuperpositionTheorem.
5. To verify TheveninTheorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current andvoltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and

verification. Observation of phase differences between current andvoltage.
8. To study resonance phenomenon in R-L-C seriescircuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrelcagerotorand slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase inductionmotor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

Laboratory Outcomes:
1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT ANDPREVENTION

Subject Code: BMNCC0-004 **L T PC** **Duration: 30Hrs.**
2 0 0 0

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: Counselling, Behavioural 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. Ishwar Modi and Shalini Modi, '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**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,**2013**.
9. BhimSain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,**1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar,**2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press,**2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime,**2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime,**2017**.

CHEMISTRY-I

SubjectCode:BCHEM0-101	**L T PC 3 1 0 4**	**Duration: 42Hrs.**

Course Objectives:

1. To understand the atomic and & molecular nature of variousmolecules
2. To understand the bandstructures
3. To elaborate the applications of spectroscopictechniques
4. To understand the thermodynamic functions and theirapplications
5. To rationalize periodicproperties
6. To understand the concepts of stereochemistry and preparation of organicmolecules

UNIT-I

1. Atomic and Molecular Structure: (12Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclearandheteronucleardiatomics.Pi-molecularorbitalsofbutadieneandbenzeneand aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on bandstructures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8Hrs.)

PrinciplesandselectionrulesofElectronicspectroscopyandFluorescencespectroscopyalong withtheirapplications.PrinciplesandselectionrulesofVibrationalandrotationalspectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonanceimaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4Hrs.)

Idealgasequation,Ionic,dipolarandvanDerWaalsinteractions.Realgasequation.Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, andHCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereo chemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, 'UniversityChemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles andApplications'.
3. C.N. Banwell, 'Fundamentals of MolecularSpectroscopy'.
4. B.L.Tembe,KamaluddinandM.S.Krishnan,'EngineeringChemistry(NPTELWeb-book).
5. P.W. Atkins, 'PhysicalChemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp.

Course Outcomes:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.
Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.The course will enable the studentto:

1. Analyzemicroscopicchemistryintermsofatomicandmolecularorbitalsandintermolecular forces.
2. Rationalize bulk properties and processes using thermodynamicconsiderations.
3. Distinguishtherangesoftheelectromagneticspectrumusedforexcitingdifferentmolecular energy levels in various spectroscopictechniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states andelectronegativity.
5. List major chemical reactions that are used in the synthesis ofmolecules.

MATHEMATICS-II (DIFFERENTIALEQUATIONS)

Subject Code: BMATH4-201	L T PC 3 1 0 4	Duration: 44Hrs.

UNIT–I

First Order Ordinary Differential Equations: (6 Hrs.)
Linear and Bernoulli's equations, exact equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
Ordinary Differential Equations of higher Orders: (6 Hrs.):
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Frobenius method.

UNIT–II

Partial Differential Equations: (12 Hrs.)
First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

UNIT–III

Partial Differential Equations: (10Hrs.)
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 variousgeometries.

UNIT –IV

Partial Differential Equations: (10 Hrs.)
Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solutionofthewaveequation;SeparationofvariablesmethodtosimpleproblemsinCartesian coordinates.

Recommended Books:

1. S.J. Farlow, 'Partial Differential Equations for Scientists and Engineers', Dover Publications, **1993**.
2. R. Haberman, 'Elementary Applied Partial Differential Equations with Fourier Series and Boundary Value Problem', 4th Edn., Prentice Hall,**1998**.
3. Ian Sneddon, 'Elements of Partial Differential Equations', McGraw Hill,**1964**.

4. ErwinKreyszig,'AdvancedEngineeringMathematics',9thEdn.,JohnWiley&Sons,**2006**.
5. W.E. Boyce and R.C. DiPrima, 'Elementary Differential Equations and Boundary Value Problems', 9thEdn., Wiley India,**2009**.
6. S.L. Ross, 'Differential Equations', 3rdEdn., Wiley India,**1984**.
7. E.A.Coddington,'AnIntroductiontoOrdinaryDifferentialEquations',PrenticeHallIndia, **1995**.
8. E.L. Ince, 'Ordinary Differential Equations', Dover Publications,**1958**.
9. G.F. Simmons and S.G. Krantz, 'Differential Equations', Tata McGraw Hill, **2007**.

CourseOutcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and theirusage.
2. The effective mathematical tools for the solutions of differential equations that model physicalprocesses.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineeringproblems.

ENGLISH

Subject Code: BHUMA0-101 | **L T PC 2 0 0 2** | **Duration: 25Hrs.**

UNIT-I

1. Vocabulary Building:

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

Subject-verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions
Redundancies
Clichés

UNIT-IV

4. Nature and Style of Sensible Writing:
Describing
Defining
Classifying
Providing examples or evidence
Writing introduction and conclusion

5. Writing Practices:
Comprehension
Précis Writing
Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan,**2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book,**2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press,**2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press,**2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 **L T PC** **3 0 0 3** **Duration: 41Hrs.**

UNIT-I

1. Introduction to Programming: (6 Hrs.)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12Hrs.)
Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)
Arrays (1-D, 2-D), Character arrays and Strings.

4. Basic Algorithms: (5 Hrs.)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT-III

5. Function: (4Hrs.)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

6. Recursion: (4Hrs.)
Recursion, as a different way of solving problems. Example programs, such as Finding

Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. **Structure: (3 Hrs.)**
Structures, Defining structures and Array of Structures
8. **Pointers: (2Hrs.)**
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
9. **File Handling:** (only if time is available, otherwise should be done as part of thelab)

Recommended Text Books:
1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGrawHill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGrawHill.

Recommended Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:
The student will learn
1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in Clanguage).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conque approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namelyrot finding of function, differentiation of function and simple integration.

CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C 0 0 2 1**

Course Objectives:
1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:
1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layerchromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of are action
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials andemfs
10. Synthesis of apolymer
11. Saponification /acid value of anoil
12. Detection and confirmation of organic functional groups.

13. Models of spatialorientation
14. TotestthevalidityofLambertBeerlaw/Determinationofλ_{max}/Determinationofunknown concentration of asolution.
15. Determination of the partition coefficient of a substance between twoimmiscible liquids
16. Adsorption of acetic acid bycharcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products asa function oftime
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

PROGRAMMING FOR PROBLEM SOLVINGLAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations
Laboratory Outcomes:
1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at runtime
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101 **L T PC** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical &Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glasscutting.
8. Metal casting.
9. Welding (arc welding & gas welding),brazing.

Recommended Text/Reference Books:
1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd.,Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4thEdn., Pearson Education India Edn.,**2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson,**2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4thEdn., Prentice HallIndia, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw HillHouse, **2017**.

Course Outcomes:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)

1. Machine shop **(10Hrs.)**
2. Fitting shop **(8Hrs.)**
3. Carpentry **(6Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4Hrs.)**
6. Casting **(8Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6Hrs.)**
9. Plastic moulding & Glass Cutting **(6Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

INTRODUCTION TO CIVIL ENGINEERING

Subject Code: BMNCC0-011 **L T P C** **Duration: 30 Hrs.**

2 0 0 0

NOTE: Only Basic Concepts are to be covered for all the topics.

Unit-I

1. **INTRODUCTION:** Civil Engineering, Scope of Civil Engineering, Branches of Civil Engineering, Applications of Civil Engineering to Allied Fields, Role of Civil Engineer in various Construction Activities, Applications in Industrial, Public and Residential Buildings.
2. **BUILDING TECHNOLOGY:** General Idea, Components of Sub-Structure and their Functions, Components of Super-Structure and their Functions, Foundation, Concept of Bearing Capacity, Super Structure, Building Plans and Sectional Details.

Unit-II

3. **BUILDING MATERIALS:** Basic Introduction to Stones, Bricks, Cement, Lime, Sand, Timber, Steel, Plastic, Aluminium, Glass, Roof Covering Materials, Asphalt and Bitumen, Smart and Intelligent Materials.
4. **BUILDING CONSTRUCTION:** Basic Introduction to Masonry, Stone Masonry, Brick Masonry, Mortar, Concrete, Types of Concretes, Reinforced Cement Concrete, Concrete Block Masonry, Reinforced Brick Masonry, Composite Masonry, Pre-stressed Concrete (Pre-Cast Concrete and Pre-Fabricated Construction), Steel Structures.

Unit-III

5. **TRANSPORTATION ENGINEERING:** Different Modes of Transportation, Comparison, Categories of Roads in India, Characteristics of Hill Roads, Rail Gauges used in India,

Elements of Railway Track, Airports, Runway, Terminal Building, Ports and Harbours, Tunnels, Integration of Transport Modes in Urban Areas.

Unit-IV

6. **ENVIRONMENTAL & WATER RESOURCES:** Basic Introduction, Water and Sewerage Management, Water Supply Engineering and Sanitary Engineering.
Basic Introduction to Hydraulic Structures, Hydrology and Water Resources, Construction Management.

Books:

1. An Introduction to Civil Engineering by R. Agor.
2. Basic Civil Engineering by G.K. Hiraskar, Dhanpat Rai Publications.

INTRODUCTION TO CONCERENED BRANCH (AERONAUTICAL ENGINEERING)

Subject Code – BMNCC0-012	L T P Cr	Duration:30 Hours
	2 0 0 0	

UNIT –I (09 Hrs.)

Introduction :Mankind's desire to fly, various efforts in Pre-Wright Brothers era – brief historical sketch, Wright flyer, Earlier types of flying machines, Development of aeronautical science in America and Europe. Progress in Aircraft design, aerospaceapplications

Current Status : Different types of heavier than air vehicles, along with prominent features. Airplane, Helicopter, Hovercraft, V/STOL machines, modern developments

Airplane Aerodynamics :Nomenclature used in Aerodynamics, different parts of airplane. Wing as lifting surface, Types of wing plan forms, Aerodynamic features like Aerofoil pressure distribution, Aerodynamic forces and moments, Lift and Drag. Drag polar, L/D ratio, high lift devices, Airplane performance like Thrust / Power available, climb and glide, maximum range and endurance, take off and landings. Illustrations throughsketches/plots

UNIT –II (09 Hrs.)

Airplane Stability and Control: Airplane axis system, forces and moments about longitudinal, latheraland vertical axes, equilibrium of forces developed on wing and horizontal tail, centreof gravity, its importance in stability and control. Control surfaces elevators ailerons andrudder.

Airplane Propulsion :Requirement of power : various means of producingpower. Briefdescription of thermodynamics of engines. Piston engines, Jet engines. Engine airframe combinations of varioustypes, their performance. Detailed functioning of components of a Piston-Prop engine. Use of propellers as means of producing forward thrust. Functioning of Jet engine, turbo-prop, turbo-fan, turbo-shaft, Prop-fan, Possible locations of power plant on airplane, Rocket Propulsion, Classification of rockets like liquid and solid propellantrockets.

UNIT –III (06 Hrs.)

Airplane Structure, Materials and Production : Structural arrangement of earlier airplane, developments leading to all metal aircraft. Strength to weight ratio - choice of aircraft materials for different parts. Detailed description of wing, tail and fuselage joints. Stress-Strain diagrams, Plane and Space, Trusses, loads on airplane components, V – ndiagram.

Mechanical properties of mate rials. Materials for different components, use of composites. Aircraft production methods and equipment.

Aircraft Instruments : Flight instruments : Air speed indicators, Altimeters, Rate of climb/descent meter, Gyro based instruments. Engine Performance measuring instruments.

Basic instruments in Avionics.

Aircraft Systems : Elementary ideas about Hydraulic and pneumatic systems, pressurization, temperature control and oxygen system. System Integration, accessories.

UNIT –IV (06 Hrs.)

Aircraft Electrical System: Generation and distribution of Electricity on board the airplane. Flight Control System temperature / Environment, Aircraft Fuel System, Fire Protection, Ice and Rain Protection System.

Airplane Design, type Centrification and Airworthiness : Basic steps in airplane design, airplane specification part/component wise specification, design and testing for certification, Airworthiness requirements, Air safety requirements and standards.

RECOMMENDED BOOKS

Text Books :

1. R S Shevell, Fundamentals of Flight, PrenticeHall
2. E H J Pallet, Aircraft Instruments, HimalayanBooks
3. John Anderson Jr., Introduction to Flight, McGrawHill

Reference Books :

1. E H J Pallet, Aircraft Electrical Systems, HimalayanBooks
2. E W Somerset Maugham, Jet Engine Manual, BIPPublications
3. Fundamentals of Flight; By Dr. O. P. Sharma and Lalit Gupta (underprint

INTRODUCTION TO CONCERENED BRANCH (AEROSPACE ENGINEERING)

Subject Code – BMNCC0-013	L T P Cr	Duration:30 Hours
	2 0 0 0	

UNIT –I (09 Hrs.)

INTRODUCTION AND HISTORY: what is space, Uses of space, History of Spaceflight, Manned space flight, Unmanned space flights, Commercial satellites, military satellites, The future

AIRCRAFT CONFIGURATIONS :Early flying vehicles – hot air balloons – heavier than air flying machines - Classification of flight vehicles, airplanes and Helicopters – Components of an airplane and their functions.

UNIT –II (09 Hrs.)

BASICS OF AERONAUTICS: International StandardAtmosphere, Temperature, pressure and altitude relationships, lift, drag and moment, Basic characteristics of airfoils, NACA nomenclature, propagation of sound, Mach number, subsonic, transonic, supersonic, hypersonic flows.

AIRCRAFT STRUCTURES

General types of construction, Monocoque and Semimonocoque - construction,Typical wing and fuselage Structures - Materials used inAircraft.

UNIT –III (06 Hrs.)

SYSTEMS AND INSTRUMENTS

Conventional control, Powered controls, Basic instruments for flying, typical systems for controlactuation.

UNIT –IV (06 Hrs.)

POWER PLANTS USED IN AIRCRAFTS

Basic ideas about piston, turboprop and jet engines – comparativemerits,Principle of operation of rocket, types of rocket and typical applications, Exploration intospace.

TEXT BOOKS

1. Kermode,A.C., 'Flight without Formulae', McGrawHill,1987.

2. Shevell,R.S., Fundamentals of flights, Pearson education2004.

REFERENCES

1. Anderson.J.D., Introduction to Flight, McGraw Hill,1995. 2. McKinley.J.L. and R.D. Bent, Aircraft Power Plants, McGraw Hill1993.

3. Pallet.E.H.J. Aircraft Instruments & Principles, Pitman & Co 1933.

GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		15	3	10	540	360	900	19

Note:
1. There will be Induction Programme of 3 weeks before start of normalclasses.
2. Drug Abuse: Problem, Management and Prevention and Introduction toConcerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.

* As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
Total		12	2	12	400	400	800	20

Note:
1. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BMNCC0-010	Universal Human values - I	22 hrs (to be completed during 21 days SIP)*			Satisfactory/ Unsatisfactory			0
ZZZZZ	Introduction to Concerned Branch of Engineering	2	0	0	100	0	100	0
Total		14	2	12	500	400	900	20

Note:

1. There will be Induction Programme of 3 weeks before start of normalclasses.
2. Introduction to Concerned Branch of Engineering are non-credit Courses; however, it is necessary to secure at least E grade in each of them.
   * As per AICTE SIP Manual Hour Plan available at http://fdp-si.aicte-india.org

2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BMNCC0-004	Drug Abuse: Problem, Management and Prevention	2	0	0	100	0	100	0
Total		13	3	10	440	360	800	19

Note:

1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rdSemester

PHYSICS (SEMICONDUCTORPHYSICS)

Subject Code: BPHYS1-101 **L T PC** **Duration: 38Hrs.**
3 1 0 4

UNIT-I

Quantum Theory: (10 Hrs.)

Need and origin of Quantum Concept, Wave-particle duality, Matter waves, Group and Phase velocities, Concept of Uncertainty Principle and its application: nonexistence of electron in the nucleus, wave function & its significance, normalization of wave function, Schrodinger wave equation: time independent and dependent, Eigen functions & Eigen values, particle in a box in 1-D. Concept of scattering from a potential barrier and tunneling.

UNIT-II

Electronic Materials: (8 Hrs.)

Free electron theory, Density of states and energy band diagrams, Introduction to band gap theory, Direct and in direct and gaps. Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level, Effective mass, phonons.

UNIT-III

Semiconductors and Light- Semiconductor Interactions: (12 Hrs.)

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices. Optical transitions in bulk semiconductors: absorption, spontaneousemission, and stimulated emission; Lasers: principles and working of laser: population inversion, pumping, types of lasers with emphasis on the semi-conductor Lasers.

UNIT-IV

Fibre Optics Communication: (8 Hrs.)

Introduction and importance of use of optical fibres in data transmission, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, applications of optical fibres.

Recommended Books:

1. Satayaparkash, 'QuantumMechanics'.
2. A. Ghatak and Lokanathan, 'QuantumMechanics'.
3. J.Singh,'SemiconductorOptoelectronics:PhysicsandTechnology',McGrawHillInc., **1995.**
4. S.M. Sze, 'Semiconductor Devices: Physics and Technology', Wiley,**2008**.
5. A. Yariv and P. Yeh, 'Photonics: Optical Electronics in Modern Communications', Oxford University Press, New York,**2007**.
6. P. Bhattacharya, 'Semiconductor Optoelectronic Devices', Prentice Hall of India,**1997**.
7. M R Shenoy, 'Online Course: Semiconductor Optoelectronics',NPTEL.
8. MonicaKatiyarandDeepakGupta,'OnlineCourse:OptoelectronicMaterialsandDevices', NPTEL.
9. Ben. G. Streetman, 'Solid State Electronics Devices', Pearson PrenticeHall.

MATHEMATICS-I (CALCULUS, LINEARALGEBRA)

Subject Code: BMATH1-101 **L T PC 3 1 0 4** **Duration: 46Hrs.**

UNIT–I

Calculus: (12 Hrs.)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L' Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT –II

Sequences and Series: (10 Hrs.)
Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT –III

Multivariable Calculus: (12 Hrs.)
Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT –IV

Linear Algebra: (12 Hrs.)
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons, **2006**.
3. T.Veerarajan,'EngineeringMathematicsforFirstYear',TataMcGrawHill,NewDelhi, **2008.**
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, **2010**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2nd Edn., Brooks/Cole, **2005**.
6. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, **2010**.

CourseOutcomes:
The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students withstandard 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 theirdisciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gammafunctions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineeringproblems.
3. The tool of power series and Fourier series for learning advanced EngineeringMathematics.

4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS &DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

1. Introduction

Engineering Drawing/Engineering Graphics/Technical Drawing - a Visual Science. Types of Engineering Drawing, Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales. Basic Definition of geometrical objects: Points, lines, planes and solids.

2. Theory of Projections - Relevance of projection, Type of projections, Perspective, Orthographic, Axonometric and their basic principles, System of orthographic projection: in reference to quadrants and octants, illustration through simple problems of projection.

3. Projection of Points- Projection of points in quadrants and octants. Projection of point on Auxiliary planes.

4. Projection of Lines -Parallel to both H P and V P, Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle orientation of straight line: rotation method and auxiliary plane method. Distance between two nonintersecting lines, and trace of line.

5. Projection of Planes- Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, and Lamina oblique to three reference planes. Application of auxiliary planes, and trace of planes.

6. Projection of Solids- Definition of solids, types of solids, and elements of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, axis perpendicular to profile plane and parallel to both H P and V P. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

7. Section of Solids Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

8. Development of Surface Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, and development of surface of sphere.

9. Isometric Projection Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.

10. Orthographic Projection Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Recommended Text/Reference Books

1. N.D. Bhatt, V.M. Panchal& P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, 2014.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, 2008.
3. B. Agrawal& C.M. Agrawal, 'Engineering Graphics', TMH Publication, 2012.
4. K.L. Narayana& P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, 2008.

BASIC ELECTRICALENGINEERING

Subject Code: BELEE0-101 **L T PC** **3 1 0 4** **Duration: 42Hrs.**

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dcexcitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasorrepresentation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions,phasordiagrams,equivalentcircuit,calculationoflossesintransformers,regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters**.** Construction and working of single-phase motors(Splitphase,shadedpole,capacitorstart,capacitorrun,capacitorstartandrunmotors).

Electrical Installations: (4Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill,**2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill,**2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press,**2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson,**2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India,**1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:

1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phasetransformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electricalinstallations.

PHYSICS (SEMICONDUCTOR PHYSICS)LAB.

Subject Code: BPHYS1-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

Experiments based on Semiconductor Physics:

1. To study the V-I characteristic of different PN junction diode-Ge andSi.
2. To study the V-I characteristic of Zenerdiode.
3. To study the V-I characteristic ofLED.
4. To analyze the suitability of a given Zener diode as a powerregulator.
5. To find out the intensity response of a solar cell/Photodiode.
6. To find out the intensity response of aLED.
7. To determine the band gap of asemiconductor.
8. To determine the resistivity of a semiconductor by four probemethod.
9. To confirm the de Broglie equation forelectrons.
10. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
11. To study the magnetic field of a circular coil carrying current.
12. To find out polarizability of a dielectric substance.
13. To study B-H curve of a ferromagnetic material using CRO.
14. To find out the frequency of AC mains using electric-vibrator.
15. To find the velocity of ultrasound in liquid.
16. To study the Hall effect for the determination of charge current densities.
17. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
18. Measurement of susceptibility of a liquid or a solution by Quincke's method:
19. AFM experiment to study the sample with the nano-scale objects and measuresurface topography with different scales, width and height of nano objects, and force-distance curves.
20. To study the temperature coefficient of Resistance of copper.

Physics Virtual Lab. Experiments:

21. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
22. To determine the resistivity of semiconductors by Four Probe Method.
23. To study the forward and reverse biased characteristics of PNP and NPN transistors.
24. To study the B-HCurve.
25. To study the Hall effect experiment to determine the charge carrier density.
26. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
27. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
28. Verification and design of combinational logic using AND, OR, NOT, NAND andXOR gates.

Note: Any other experiment based on the above mentioned topics may be included.

ENGINEERING GRAPHICS & DESIGNLAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 45 Hrs.**
0 0 6* 3

1. **Overview of Computer Graphics**
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
2. **Customization & CAD Drawing**
Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
3. **Annotations, Layering & other Functions**
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

.*Lab work will be performed in two parts:
- **(i)** **Computer Lab (2 hours)** Computer Graphics, CAD Drawing etc.
- **(ii)** **Drawing Hall (04 hours)** Manual practice on drawing sheets of theory content the relevant theory part of Engineering Graphics & Design may also be covered in Lab work.

BASIC ELECTRICAL ENGINEERINGLAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstrationofcut-outsectionsofmachines:Inductionmachine(squirrelcagerotorand slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT ANDPREVENTION

Subject Code: BMNCC0-004 **L T PC** **Duration: 30Hrs.**
2 0 0 0

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: Counselling, Behavioural 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. Ishwar Modi and Shalini Modi, '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**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,**2013**.
9. BhimSain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,**1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar,**2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press,**2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime,**2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime,**2017**.

CHEMISTRY-I

Subject Code: BCHEM0-101 **L T PC** **3 1 0 4** **Duration: 42Hrs.**

Course Objectives:

1. To understand the atomic and & molecular nature of variousmolecules
2. To understand the bandstructures
3. To elaborate the applications of spectroscopictechniques
4. To understand the thermodynamic functions and theirapplications
5. To rationalize periodicproperties
6. To understand the concepts of stereochemistry and preparation of organicmolecules

UNIT-I

1. Atomic and Molecular Structure: (12Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclearandheteronucleardiatomics.Pi-molecularorbitalsofbutadieneandbenzeneand aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8Hrs.)

PrinciplesandselectionrulesofElectronicspectroscopyandFluorescencespectroscopyalong withtheirapplications.PrinciplesandselectionrulesofVibrationalandrotationalspectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4Hrs.)

Ideal gas equation, Ionic, dipolar and vanDer Waals interactions. Realgas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, ‘University Chemistry’.
2. M.J. Sienko and R.A. Plane ‘Chemistry: Principles and Applications’.
3. C.N. Banwell, ‘Fundamentals of Molecular Spectroscopy’.
4. B.L.Tembe,KamaluddinandM.S.Krishnan,‘EngineeringChemistry(NPTELWeb-book).
5. P.W. Atkins, ‘PhysicalChemistry’.
6. K.P.C. Volhardt and N.E. Schore ‘Organic Chemistry: Structure and Function’, 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyzemicroscopicchemistryintermsofatomicandmolecularorbitalsandintermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguishtherangesoftheelectromagneticspectrumusedforexcitingdifferentmolecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II (PROBABILITY AND STATISTICS)

Subject Code: BMATH1-201	L T PC 3 1 0 4	Duration: 40Hrs.

UNIT–I

Basic Probability: (12 Hrs.)

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, Chebyshev's Inequality.

UNIT –II

Continuous Probability Distributions: (6 Hrs.)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions: (6 Hrs.) Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT –III

Basic Statistics: (10 Hrs.)

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 –IV

Applied Statistics: (8 Hrs.)

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 Hrs.)

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.

Recommended Books:

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,'AnIntroductiontoProbabilityTheoryanditsApplications',Vol.-1,Wiley,**1968**.
5. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers,**2000**.
6. T. Veerarajan, 'Engineering Mathematics', Tata McGraw Hill, New Delhi, **2010**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T PC** **Duration: 25Hrs.**
2 0 0 2

UNIT-I

1. Vocabulary Building:

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

Subject-verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions
Redundancies
Clichés

UNIT-IV

4. Nature and Style of sensible Writing:

Describing
Defining

Classifying
Providing examples or evidence
Writing introduction and conclusion

5. Writing Practices:

Comprehension
Précis Writing
Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan,**2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book,**2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press,**2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press,**2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 **L T PC** **Duration: 41Hrs.**
3 0 0 3

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)

Structures, Defining structures and Array of Structures

8. **Pointers: (2Hrs.)**
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
9. **File Handling:** (only if time is available, otherwise should be done as part of thelab)

Recommended Text Books:
1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGrawHill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGrawHill.

Recommended Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:
The student will learn
1. To formulate simple algorithms for arithmetic and logicalproblems.
2. To translate the algorithms to programs (in Clanguage).
3. To test and execute the programs and correct syntax and logicalerrors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquerapproach.
6. To use arrays, pointers and structures to formulate algorithms andprograms.
7. To apply programming to solve matrix addition and multiplication problemsand searching and sortingproblems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simpleintegration.

CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:
1. To learn the preparation and standardization ofsolutions
2. To learn the estimation of various physical properties of given liquidsamples
3. To estimate various crucial parameters for watersample
4. To learn the preparation of various molecules and detection of functionalgroups.

Choice of 10-12 experiments from the following:
1. Preparation of a standard solution
2. Determination of surface tension andviscosity
3. Thin layerchromatography
4. Determination of total Alkalinity/ Acidity of a watersample.
5. Determination of residual chlorine in watersample
6. Estimation of total, temporary and permanent hardness ofwater
7. Determination of the rate constant of areaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials andemfs
10. Synthesis of apolymer
11. Saponification /acid value of anoil
12. Detection and confirmation of organic functionalgroups.
13. Models of spatialorientation
14. TotestthevalidityofLambertBeerlaw/Determinationofλ_{max}/Determinationofunknown concentration of asolution.
15. Determination of the partition coefficient of a substance between twoimmiscible

liquids
16. Adsorption of acetic acid bycharcoal
17. Synthesis of a drug – Acetaminophen,Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products asa function oftime
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a saltsample

ENGLISHLAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. ListeningComprehension
2. Pronunciation, Intonation, Stress andRhythm
3. Common Everyday Situations: Conversations andDialogues
4. Communication atWorkplace
5. Interviews
6. FormalPresentations

PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes:

1. To formulate the algorithms for simpleproblems
2. To translate given algorithms to a working and correctprogram
3. To be able to correct syntax errors as reported by thecompilers
4. To be able to identify and correct logical errors encountered at runtime
5. To be able to write iterative as well as recursiveprograms
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in definingself-referential structures.
8. To be able to create, read and write to and from simple textfiles.

MANUFACTURING PRACTICES (THEORY &LAB.)

Subject Code: BMFPR0-101 **L T PC** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additivemanufacturing.
3. Fitting operations & powertools.
4. Sheet MetalOperations.
5. Electrical &Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glasscutting.
8. Metalcasting.
9. Welding (arc welding & gas welding),brazing.

Recommended Text/Reference Books:

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, 'Elements of Workshop Technology', Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd.,Mumbai.
2. S. Kalpakjian, Steven S. Schmid, 'Manufacturing Engineering and Technology', 4thEdn., Pearson Education India Edn.,**2002**.
3. Gowri P. Hariharan and A. Suresh Babu, 'Manufacturing Technology – I', Pearson,**2008**.
4. Roy A. Lindberg, 'Processes and Materials of Manufacture', 4thEdn., Prentice HallIndia, **1998**.
5. P.N. Rao, 'Manufacturing Technology', Vol.-I and Vol.-II, Tata McGraw HillHouse, **2017**.

Course Outcomes:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)

1. Machine shop **(10Hrs.)**
2. Fitting shop **(8Hrs.)**

3. Carpentry **(6Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4Hrs.)**
6. Casting **(8Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6Hrs.)**
9. Plastic moulding& Glass Cutting **(6Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

INTRODUCTION TO COMPUTER & COMMUNICATION ENGINEERING

Subject Code: **L T P C** **Duration: 30Hrs.**
2 0 0 0

Course Objectives:

1. To make student aware of Basic computer devices.
2. To make the students aware about the major study areas of Computer & Communication Engineering.
3. To make the students aware about the major advantages of Computer & Communication Engineering.
4. To provide some insight to the various professional opportunities/ Recruiters and higher education opportunities.

Course Outcomes:

1. Students shall be able to know about various diversified fields which they can take up as their career.
2. Students shall be able to appreciate the role of Computer & Communication Engineering in Day to Day life.
3. Students shall be able to appreciate the role of a Computer & Communication Engineer towards Nation Building.
4. Students shall be able to know the hardware and software of computer.

UNIT-I (7 Hrs)

Elementary ideas of Analog & Digital Electronics
Semiconductors and their classifications, Junction diodes and their applications, Bipolar Junction Transistor - operation and application as switch and amplifier, Analog Vs digital signals and systems, Logic gates and operations , concepts of combinational and sequential circuits, overview of microprocessors and microcontrollers.

UNIT-II (8 Hrs)

Electronics Communication fundamentals : Wired and wire-less communication, Electromagnetic model for communication, EM Spectrum, overview of optical fibre/mobile/satellite/microwave and radar communication, evolution of communication from 1G, 2G, 3G, 4G and 5G.

UNIT-III(8 hrs)

Introduction to Computer Science: Introduction to Computer Science & Engineering, Difference between science & engineering, Applications of Computer Science & engineering. Different branches/fields of Computer Science, Scope of Computer Science in industry, self-employment etc.

UNIT-IV(7 hrs)

Introduction to parts of Computer: Introduction to Computer, parts of computer system. Difference between Hardware & software, Configuration of computer systems, Types of memory-RAM, ROM, Introduction to UPS-Online and Offline, printers etc. Different types of Software- Application software and System Software, Types of Languages-High level and low level languages, Introduction to Operating System.

3rd Semester

Total Contact Hours= 24 **Total Marks= 800** **Total Credits= 25**

Semester 3rd		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BECES1-301	Electronic Devices & Circuits	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-302	Digital Electronic Circuits & Design	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-303	Signals and Systems	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-304	Network Theory: Analysis & Synthesis	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-305	Electronic Devices & Circuits Lab	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BECES1-306	Digital Electronic Circuits & Design Lab	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BMATH3-301	Mathematics-III	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-307	Training-I	**-**	**-**	**-**	**60**	**40**	**100**	**3**
Total		**15**	**5**	**4**	**380**	**420**	**800**	**25**

ELECTRONIC DEVICES & CIRCUITS

Subject Code: BECES1-301	**L T P C**	**Duration: 60 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 aware the students about various electronic devices and 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, junction diodes, transistors and their applications.
2. Analyze BJT characteristics and design of various biasing circuits.
3. Analyze characteristics of FETs/MOSFETs/CMOSFETs.
4. Low and high frequency modelling of transistors.
5. Understanding of IC fabrication techniques.

DIGITAL ELECTRONIC CIRCUITS & DESIGN

Subject Code: BECES1-302	**L T P C**	**Duration: 60 Hrs**
	3 1 0 4	

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 circui

SIGNALS AND SYSTEMS

Subject Code: BECES1-303 **L T P C** **Duration: 60 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.

NETWORK THEORY: ANALYSIS & SYNTHESIS

Subject Code: BECES1-304 **L T P C** **Duration: 60 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. Apply Laplace Transform for steady state and transient analysis.
3. Synthesis of various electrical networks using different techniques
4. Design of analog filters

ELECTRONIC DEVICES & CIRCUITS LAB

Subject Code: BECES1-305 **L T P C** **Duration: 30 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 perform experiment and analyse various semiconductor devices.
2. Design of electronic circuits based on junction diodes and transistors.
3. Design of analog filters.
4. Verifications of network theorems.

DIGITAL ELECTRONIC CIRCUITS & DESIGN LAB

Subject Code: BECES-306 **L T P C** **Duration: 30 Hrs**

0 0 2 1

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. Verifications of truth tables of various combinational and sequential circuits.
2. Design of different logic functions using universal gates.
3. Design and verification of various combinational and sequential digital systems.

MATHEMATICS-III

Subject Code: BMATH3-301 **L T P C** **Duration: 60 Hrs**

3 1 0 4

Course Objectives:

1. To enable students to use Fourier series and Fourier transform.
2. To understand the basics of Partial Differential Equations
3. To solve elementary problems in linear second order Partial Differential Equations (heat and wave equations).
4. To understand concepts of partial order relations, Boolean algebra and Lattices

Course Outcomes:

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

1. Apply the concept of Fourier series and transformation to solve practical problems in physics and various areas of mathematics
2. Apply a range of techniques to solve first & second order partial differential equations.
3. Model physical phenomena using partial differential equations such as the heat and wave equations.
4. To understand concepts of partial order relations, Boolean algebra, Lattices and to show logical equivalences by using truth tables and rules in logics To understand concepts of partial order relations, Boolean algebra and Lattices

4th Semester

Total Contact Hours= 22 **Total Marks= 800** **Total Credits= 25**

Semester 4th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BECES1-401	Analog and Digital Communication	3	1	0	40	60	100	4
BECES1-402	Analog Electronic Circuits	3	1	0	40	60	100	4
BECES1-403	Electromagnetic Theory & Applications	3	1	0	40	60	100	4
BECES1-404	Analog and Digital Communication Lab	0	0	2	60	40	100	1
BECES1-405	Analog Electronic Circuits Lab	0	0	2	60	40	100	1
BMECE0-001	Engineering Mechanics	3	1	0	40	60	100	4
BMNCC0-001	Constitution of India	2	0	0	-	-	-	-
Total		14	4	4	280	320	600	18

There will be 4-week Internship after 4th semester as per AICTE Internship Policy.

ANALOG AND DIGITAL COMMUNICATION

Subject Code: BECES1-401	**L T P C**	**Duration: 60 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.
4. Analyze different digital modulation schemes and can compute the bit error performance.

ANALOG ELECTRONIC CIRCUITS

Subject Code: BECES1-402	**L T P C**	**Duration: 60 Hrs**
	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. Design and analysis of different BJT amplifiers.
2. Analysis and design of feedback amplifiers and oscillators and power amplifiers
3. Understand the functioning of OP-AMP and design OP-AMP based circuits.
4. Analysis of different multivibrators and converter circuits.

ELECTROMAGNETIC THEORY & APPLICATIONS

Subject Code: BECES1-403	**L T P C**	**Duration: 60 Hrs**
	3 1 0 4	

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. Understand the basic concepts of electromagnetics.
2. Apply the postulates of electrostatics and magnetostatics to respective fields, potentials, boundary related problems and their applications.
3. Apply Maxwell‘s equations to solutions of problems relating to time varying electromagnetic fields.
4. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.

ENGINEERING MECHANICS

Subject Code: BMECE0-001	**L T P C**	**Duration: 60 Hrs**
	3 1 0 4	

Course Objective:

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

Course Outcomes:
After the completion of this course the students shall be able to:

1. Students shall be able to understand problems related to Mechanics.
2. Shall be able to apply this knowledge to find solution of engineering problems
3. This will make student learning life long
4. Students can use knowledge in new areas

ANALOG AND DIGITAL COMMUNICATION LAB

Subject Code: BECES1-404 **L T P C** **Duration: 30 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. Examine and classify various modulation and demodulation techniques.
2. Examine and classify various data coding and encoding techniques.
3. Analysis of different parameters of radio receivers.
4. Software design of basic building blocks of communication systems.

ANALOG ELECTRONIC CIRCUITS LAB

Subject Code: BECES1-405 **L T P C** **Duration: 30 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. Examine and analysis frequency response analysis of different power amplifiers.
2. Examine and analysis of different oscillator circuits.
3. Examine and analysis of various multivibrator circuits.
4. Design and analysis of various applications of Op-Amps.

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001 **L T P C** **Duration: 30 Hrs**

2 0 0 0

The course objectives and course outcomes to be formulated by Management Department.

5^{th} Semester

Total Contact Hours= 22 **Total Marks= 800** **Total Credits= 24**

Semester 5th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BECES1-501	Microprocessors & Microcontrollers	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-502	Information Theory & Coding	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-503	Control System & Applications	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-504	Control Systems Lab	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BECES1-505	Microprocessors & Microcontrollers Lab	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BECES1-506	Training- II*	**-**	**-**	**-**	**60**	**40**	**100**	**4**
BECED1-5XX	Departmental Elective-I	**3**	**0**	**0**	**40**	**60**	**100**	**3**
XXXXX	Open Elective**	**3**	**0**	**0**	**40**	**60**	**100**	**3**
Departmental Elective - I (Select any one)								
BECED1-511	Antenna and Wave Propagation							
BECED1-512	VHDL Design							
BECED1-513	Computer Architecture							
BECED1-514	Industrial Automation							
Total		**15**	**3**	**4**	**380**	**420**	**800**	**24**

***Note:** During the summer vacation after 4th semester.

****Note: Open Electives (OE) can also be taken from existing lists of Open Elective-I, Open Elective-II, Open Elective-III and MRSPTU UG Open Electives.**

MICROPROCESSORS & MICROCONTROLLERS

Subject Code: BECES1-501	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the architecture, programming of microprocessor and microcontroller along with interfacing with peripherals:

To provide knowledge

1. About the architectures of various microprocessors.
2. About interfacing of microprocessor with memory and peripheral devices.
3. About architecture and operation of microcontrollers

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. To learn architecture of microprocessors 8085 & 8086 and microcontroller 8051.
2. Assembly language programming for 8-bit microprocessors and microcontrollers.
3. To apply and implement the interfacing and programming techniques of microprocessors and microcontrollers in various practical problems/projects.

INFORMATION THEORY AND CODING

Subject Code: BECES1-502	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

Course Objectives:

1. To give insight of the information in a source.
2. To give a thorough understanding of various coding schemes.
3. To provide the detailed knowledge of modelling of channels.
4. To create awareness about the error detection and correction

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Explain measure of information and entropy.
2. Model the continuous and discrete communication channels.
3. Differentiate various encoding and decoding techniques for various codes.

CONTROL SYSTEMS & APPLICATIONS

Subject Code: BECES1-503	**L T P C**	**Duration: 60 Hrs.**
	3 1 0 4	

Course Objectives:

1. Thorough knowledge of linear control systems & their classifications, control components.
2. Knowledge of mathematical modelling of different control systems using different techniques.
3. Detailed knowledge about time and frequency domain analysis of linear control systems and their stability analysis in both time and frequency domains.
4. Insight to modelling and analysis of control systems using state-space variables

Course Outcomes: Upon completion of the course, students will be able to:
1. Understand control systems, control components and their mathematical modelling.
2. Analysis and design of control systems in time and frequency domains.
3. Perform stability analysis of linear control systems in time and frequency domains.
4. Modelling, analysis and design of control systems using state-space variable techniques.

CONTROL SYSTEMS LAB

Subject Code: BECES1-504	**L T P C**	**Duration: 30 Hrs.**
	0 0 2 1	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various control systems along with their behavior in time and frequency domain.

1. To introduce methods for analyzing time and frequency response of control systems.
2. To design the compensation technique that can be used to stabilize control systems.
3. Apply root locus technique to analyze and design control systems.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Perform time domain and frequency domain analysis of control systems.
2. Perform Stability analysis of control systems using various techniques.
3. To analyze and design control systems.
4. Analysis of various control components.

MICROPROCESSORS & MICROCONTROLLERS LAB

Subject Code: BECES1-505	L T P C	Duration: 30 Hrs.
	0 0 2 1	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the assembling language programming using 8085/8086/8051:

1. To introduce assembling language programming concepts.
2. To differentiate serial and parallel interface.
3. To interface different I/Os with microprocessor(s) and microcontroller.
4. Introduce the practical concepts to control speed of DC and stepper motor.

Course Outcomes:

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

1. Assembly language programming of 8085/8051.
2. Interface different I/O peripherals with microprocessor through assembly language programming.
3. Assembly language programming for interfacing different I/O peripherals with microcontrollers.

PROGRAM ELECTIVE-I

ANTENNA AND WAVE PROPAGATION

Subject Code: BECED1-511	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives:

1. To give insight of the fundamental concepts of antennas.
2. To give a thorough understanding of the radiation characteristics of different types of antennas.
3. To provide the detailed knowledge of antenna arrays and smart antennas.
4. To create awareness about the different types of propagation of radio waves at different frequencies

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the concepts of wave propagation and antennas.

2. Analyse the properties of different types of antennas and antenna arrays.
3. Classify different modes of wave propagation.

VHDL DESIGN

Subject Code: BECED1-512 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in VHDL Design:

1. To teach the students about CAD tools for digital system design.
2. To learn hardware description language VHDL for design of digital systems.
3. To model combinational and sequential digital systems using VHDL.
4. To learn and design dedicated and general-purpose microprocessor using VHDL.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understand the hardware description language.
2. Model and design digital logic systems using VHDL.
3. Design of digital systems using ROMs, PALs, PLDs, etc.
4. Design and model dedicated and general-purpose microprocessor using VHDL

COMPUTER ARCHITECTURE

Subject Code: BECED1-513 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding the basic principles of computers structure, its functioning, design, performance, and related issues

1. To make the students aware about the basic structure of computer.
2. To impart knowledge about the functioning of various computer blocks
3. To impart basic knowledge for design of hypothetical Computer

Course Outcomes: At the end of this course student will acquire the ability to:

1. Analysis of computer architecture and functional modules.
2. Categorization of data flow for arithmetic operations.
3. Illustration of ALU design concepts.
4. Memory classification and management.

INDUSTRIAL AUTOMATION

Subject Code: BECED1-514	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives:

1. To make the students familiar about the industrial automation.
2. To provide understanding of computer aided measurement and control.
3. To provide the knowledge of detailed concepts of PLC and its applications.
4. To give awareness about the industrial automation using robots.

Course Outcomes: At the end of the course the students will be able to:

1. Understand various industrial automation components.
2. Summarize evolution from PLC to SCADA to Computers in control.
3. Illustrate the use of Internet of Things based sensors and actuators for industrial automation.
4. Discuss Man-machine application-based interface.

6th Semester

Total Contact Hours= 28 **Total Marks= 900** **Total Credits= 22**

Semester 6th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BECES1-601	Digital Signal Processing	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-602	Computer Communication Networks	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BECES1-603	Digital Signal Processing Lab	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BECES1-604	Computer Communication Networks Lab	**0**	**0**	**2**	**40**	**60**	**100**	**1**
BECES1-605	Electronic Measurement	**0**	**0**	**2**	**40**	**60**	**100**	**1**
BECES1-606	Mini Project/ Electronic Design Workshop	**0**	**0**	**4**	**60**	**40**	**100**	**2**
BECED1-6XX	Departmental Elective-II	**3**	**0**	**0**	**60**	**40**	**100**	**3**
XXXXX	Open Elective*	**3**	**0**	**0**	**60**	**40**	**100**	**3**
BHSMC0-014	Fundamentals of Management for Engineers	**3**	**0**	**0**	**40**	**60**	**100**	**3**
Departmental Elective - II (Select any one)								
BECED1-611	Microwave Theory & Techniques							
BECED1-612	Power Electronics							
BECED1-613	Embedded Systems							
Total		**15**	**2**	**10**	**440**	**460**	**900**	**22**

***Note: Open Electives (OE) can also be taken from existing lists of Open Elective-I, Open Elective-II, Open Elective-III and MRSPTU UG Open Electives.**

There will be a 4-weeks Internship as per AICTE Internship Policy

DIGITAL SIGNAL PROCESSING

Subject Code: BECES1-601 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in digital signal processing:

1. To learn modelling and analysis of discrete time signals and systems.
2. To learn different transforms for the analysis of discrete time signals and systems.
3. To understand implementation of LSI systems.
4. To learn the design of IIR and FIR filters for various applications.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Mathematical analysis of signals in continuous and discrete time and frequency domains.
2. Analysis and implementation of LSI systems.
3. DFT analysis of digital signals & systems.
4. Design IIR and FIR filters for various signal processing applications.

COMPUTER COMMUNICATION NETWORKS

Subject Code: BECES1-602 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. This course is meant to provide fundamental knowledge to-
2. Understand layering architecture of OSI / TCP/IP protocol suite for computer networks
3. Understand the protocols associated with each layer.
4. Understand concepts of wireless, adhoc and various emerging network technologies.
5. Familiarize students with basic design concepts and issues of cellular wireless networks.

Course Outcomes: At the end of this course student will be able to:

1. Explain and classify computer communication networks and their architecture.
2. Describe the architecture for infrastructure based and infrastructure-less wireless LANs.
3. Appraise the need of IPv6 over IPv4 protocols.
4. Access the performance of cellular networks in terms of its coverage and capacity.

DIGITAL SIGNAL PROCESSING LAB

Subject Code: BECES1-603 **L T P C** **Duration: 30 Hrs.**

0 0 2 1

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various signals mathematically in continuous and discrete time and frequency domain.

1. To implement linear and circular convolution.
2. To develop and implement programs for computing Z-transform, DFT and IDFT
3. To design of different types of digital- FIR and IIR filters for various applications

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Programming and analysis of continuous time and discrete time signals.
2. Analysis of discrete time systems through MATLAB programming, in time domain and frequency domain.
3. Design IIR and FIR filters for low pass and high pass applications.

COMPUTER COMMUNICATION NETWORKS LAB

Subject Code: BECES1-604 **L T P C** **Duration: 30 Hrs.**

0 0 2 1

Course Objectives:

1. To develop an understanding of networking hardware components
2. Familiarization with a networking simulator and its working.
3. Simulation based performance analysis of LAN and its different topologies
4. Simulating network and transport layer protocols
5. Learning to configure LAN &WLAN and security firewall

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Identify the different types of network devices and their functions within a network.
2. Compare different network topologies.
3. Familiarize and analyze basic protocols of computer networks and their performances.
4. Acquire the ability to setup and configure LAN/WLAN.

ELECTRONIC MEASUREMENT

Subject Code: BECES1-605 **L T P C** **Duration: 30 Hrs.**

0 0 2 1

Course Objectives: This course is meant to provide fundamental knowledge of measurements and measuring instruments related to electronics engineering.

1. To make aware the students about basic concepts and definitions in measurement.
2. To provide knowledge about different types of measuring, waveform generation and analysis of electronic instruments.
3. To provide detailed knowledge about different bridges.
4. To understand CRO and its operation.

Course Outcomes: At the end of this course student will be able to:

1. Learn about various measurement devices, their characteristics, operation and limitations.
2. Design and validate DC and AC bridges.
3. Design of signal conditioning systems for various applications.
4. Analyze the dynamic response and the calibration of few instruments.

FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS

Subject Code: BHSMC0-014 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The main aim of this course is:

1. To help the students gain understanding of the functions and responsibilities of managers.
2. To provide them tools and techniques to be used in the performance of the managerial job.
3. To enable them to analyze and understand the environment of the organization.
4. To help the students to develop cognizance of the importance of management principles

Course Outcomes

After completing this course, the students will be able to:

1. Recognize the role of a manager and how it relates to the organization's mission.
2. Define management, its four basic functions and skills.
3. Know critical management theories and philosophies and how to apply them.
4. Recognize the concept of social responsiveness and its benefits.
5. Explain the relationship between strategic, tactical, and operational plans.

PROGRAM ELECTIVE-II

MICROWAVE THEORY AND TECHNIQUES

Subject Code: BECED1-611	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives:

1. To understand Waveguides and different modes.
2. To Understand various microwave components and their properties.
3. To provide knowledge on the different antenna parameters and antenna types.
4. To gain knowledge about various Microwave Systems

Course Outcomes:

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

1. Understand various microwave system components and their properties.
2. Analyze microwave circuits using scattering parameters.
3. Analyze different kinds of antennas and associated antenna parameters.
4. Classification of different microwave systems.

POWER ELECTRONICS

Subject Code: BECED1-612	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in power electronics:

1. Ability to analyze various power converter circuits.
2. To develop skills to build, and troubleshoot power electronics circuits.
3. Acquire knowledge about current applications of power electronics in industry.
4. To analyze and design of different types of chopper circuits

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understanding of power electronic devices, their characteristics and applications.
2. Analysis of phase-controlled rectifiers under different loading conditions.
3. Design and analysis of power electronic circuits like choppers and single-phase inverters.
4. Analysis and design of different SMPSs.

EMBEDDED SYSTEMS

Subject Code: BECED1-613	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding embedded systems.

1. To make aware the students about the concept of embedded systems.
2. To impart knowledge of different types of embedded processors.
3. To provide the students concepts of interfacing of embedded processors.
4. To implement basic programming using embedded processors.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understanding of embedded systems.
2. Architecture and programming of ARM processors.
3. Design interfacing of the systems with other data handling / processing systems.
4. Analysis of different performance parameters of embedded systems for real time applications.

7th Semester

Total Contact Hours= 18 **Total Marks= 600** **Total Credits= 18**

Semester 7th		**Contact Hours**			**Max Marks**		**Total Marks**	**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BECED1-7XX	Departmental Elective-III	3	0	0	40	60	100	3
BECED1-7XX	Departmental Elective-IV	3	0	0	40	60	100	3
BECED1-7XX	Departmental Elective-V	3	0	0	40	60	100	3
XXXXX	Open Elective-III	3	0	0	40	60	100	3
BECES1 -701	Project Stage-I	0	0	4	60	40	100	2
BMNCC0-102	Environment Science (MC)	2	0	0	--	--	--	--
BECES1 -702	Training-III	--	--	--	60	40	100	4
Departmental Elective – III (Select any one)								
BECED1-711	Fiber Optic Communications							
BECED1-712	Mobile Communication and Networks							
Departmental Elective – IV (Select any one)								
BECED1-721	Parallel Processing							
BECED1-722	Scientific Computing							
BECED1-723	Neural Network & Fuzzy Logic							
Departmental Elective – V (Select any one)								
BECED1-731	VLSI Technology							
BECED1-732	CMOS Design							
BECED1-733	High Speed Electronics							
Total		**14**	**0**	**4**	**280**	**320**	**600**	**18**

FIBRE OPTIC COMMUNICATIONS

Subject Code: BECED1-711 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. To provide knowledge about various types of optical sources and detectors.
2. To impart knowledge about optical fiber link design and multiplexing techniques.
3. To provide basic understanding of optical switches and amplifiers.
4. To make aware the students about non-linear effects of fiber optic communication.

Course Outcomes:

At the end of the course the students will demonstrate the ability to:

1. Analyse different modes of fibers and their applications.
2. Design of fiber optical link and its analysis based on performance parameters.
3. Analysis of optical switches and amplifiers.
4. Understand and development of Optical communication systems.

MOBILE COMMUNICATION AND NETWORKS

Subject Code- BECED1-712 **L T P C** **Duration:-45 hrs**

3 0 0 3

Course Objectives: - This course is meant to provide fundamental knowledge to students for understanding the basics of mobile communication and networks.

1. To make aware the students about the concept of mobile communication.
2. To provide the knowledge about the concepts of Signal Propagation.
3. To provide the knowledge about frequency selective channels and Access schemes.
4. To provide the knowledge of different receiver structures.

Course Outcomes: - At the end of course, students will demonstrate the ability to: -

1. Understand the concepts of cellular communication and its structure.
2. Differentiate between various signal propagation mechanisms.
3. Examine and discuss different types of antennas, multiple access schemes and modulation schemes for mobile communication.
4. Analyze mobile communication systems for improved performance.

PARALLEL PROCESSING

Subject Code: BECED1-721 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in parallel processing:

1. To familiarize students with the fundamental concepts of parallel processing.
2. Acquire knowledge about techniques and tools of parallel computing.
3. To understand the need of parallel processing.
4. To prepare students for advanced courses in more specific areas of parallel computing.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understand the need and applications of parallel processing.
2. Explain terminologies used for parallel computation.
3. Describe software and hardware related issues and challenges of parallel processing.
4. Differentiate among the popular parallel computing architectures.

SCIENTIFIC COMPUTING

Subject Code: BECED1-722 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. To study the concepts of scientific computing.
2. To make students familiar with the concepts of programming and get them accustomed with high-level languages like MATLAB.
3. To provide an overview of some of the issues and problems that arises in scientific computation, such as non-linear systems, numerical and symbolic integration, differential equations and simulation.

Course Outcomes:

At the end of the course the students will demonstrate the ability to:

1. Understand the concepts of scientific computing languages and apply them to write a meaningful program.
2. Understand and apply different scientific computing methods to solve complex engineering problems.
3. Design and analysis of realizable physical systems using programming tools like MATLAB/SIMULINK etc.
4. Implement Numerical differentiation and integration methods for scientific computing.

NEURAL NETWORK & FUZZY LOGIC

Subject Code: BECED1-723	L T P C	Duration: 45 Hrs
	3 0 0 3	

Course Objectives:

1. To introduce the fundamentals of Artificial Neural Networks.
2. To Learn and apply ANN architectures, learning laws to different applications
3. To understand Fuzzy logic and design fuzzy inference systems.
4. To apply fuzzy logic and neural nets to real world problems.

Course Outcomes:

At the end of the course the students will demonstrate the ability to:

1. To design different types of ANNs for variety of applications.
2. To solve various real-world applications using ANNs.
3. Design different fuzzy inference systems.
4. To design hybrid systems using Neural networks, fuzzy logic and genetic algorithms.

VLSI TECHNOLOGY

Subject Code: BECED1-731	L T P C	Duration: 45 Hrs
	3 0 0 3	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various processes and techniques for semiconductor:

To provide knowledge of

1. The fundamentals of IC technology, components, scaling trends and limitations.
2. Various techniques and systems for IC fabrication.
3. NMOS and CMOS IC technology, bipolar IC fabrication.
4. Assembling and packaging of ICs.
5. Yield and reliability of VLSI technology

Course Outcomes:

At the end of this course students will demonstrate an ability to:

1. To understand different processes involved in IC fabrication technology
2. To understand single crystal growth, Epitaxy, Oxidation, lithography, etching Diffusion. Metallization techniques
3. Justify the procedural sequence of design of NMOS, CMOS and bipolar IC fabrication technologies.
4. Organize the assembling & packaging of ICs and their respective significances.

CMOS DESIGN

Subject Code: BECED1-732 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in CMOS design:

1. Understand the fundamentals of IC technology components, scaling trends and limitations.
2. Design VLSI circuits and systems utilizing modern IC design methodologies and design automation tools.
3. Utilize modern CAD tools for IC design, simulation, verification and automated logic synthesis and layout.
4. Explore circuit and higher-level solutions for low-power and variation-aware designs.
5. Anticipate future challenges in IC technologies and think critically about solutions.

Course Outcomes:

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

1. Understand the operation and characteristics of MOS devices.
2. Design different CMOS circuits using various logic families along with their circuit layouts.
3. Design different CMOS combinational and sequential circuits.
4. Analyze trade-offs to optimize power, delay and area in CMOS IC fabrication.

HIGH SPEED ELECTRONICS

Subject Code: BECED1-733 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in High-Speed Electronics:

1. To review basic EM concepts required for high-speed electronic design.
2. To impart knowledge about the signal transmission and related issues for high-speed electronic circuits.
3. To impart basic knowledge of properties of various components used in high-speed electronics
4. To create solution for real time design problems.

Course Outcomes:

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

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high-speed electronics
3. Design and analysis of RF amplifiers, oscillators mixers etc. for high-speed applications.
4. Design High-speed electronic systems.

8th Semester

Total Contact Hours= 24 **Total Marks= 600** **Total Credits= 17**

Semester 8th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BECED1-8XX	Departmental Elective-VI	3	0	0	40	60	100	3
BECED1-8XX	Departmental Elective-VII	3	0	0	40	60	100	3
XXXXX	Open Elective*	3	0	0	40	60	100	3
BECES1 -801	Project Stage-II	0	0	10	120	80	200	5
BMNCC0-006	Indian Traditional Knowledge (MC)	2	0	0	--	--	--	--
BHSMC0-024	Project Management and Entrepreneurship	3	0	0	40	60	100	3
Departmental Elective – VI (Select any One)								
BECED1-811	Wireless Sensor Networks							
BECED1-812	Satellite Communication							
BECED1-813	Error Correcting Codes							
Departmental Elective –VII (Select any One)								
BECED1-821	Machine Learning							
BECED1-822	Data Mining & Big Data							
BECED1-823	Artificial Intelligence							
BECED1-824	Internet of Things							
	Total	**14**	**0**	**10**	**280**	**320**	**600**	**17**

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.

***Note: Open Electives (OE) can also be taken from existing lists of Open Elective-I, Open Elective-II, Open Elective-III and MRSPTU UG Open Electives.**

WIRELESS SENSOR NETWORKS

Subject Code: BECED1-811	**L T P C**	**Duration: 45 Hrs**
	3 0 0 3	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding wireless sensor networks and related MAC, routing, traffic support and security protocols. In addition, it shall expose the students to hardware components and operating systems used for WSNs.

Course Outcomes:

At the end of the course the students will be able to:

1. Explain the need and working of WSN and identify related issues and challenges.
2. Describe and classify MAC and routing protocols used for WSNs.
3. Illustrate the basic design principles and access the need for gateways for the WSNs.
4. Identify and explain hardware components and operating systems used for WSNs.

SATELLITE COMMUNICATION

Subject Code: BECED1-812	**L T P C**	**Duration: 45 Hrs**
	3 0 0 3	

Course Objectives:

1. To introduce various aspects in the design of systems for satellite communication.
2. To illustrate various aspects related to satellite systems such as orbital equations, sub-systems, link budget.
3. To impart knowledge about various phenomena in Satellite Communication.
4. To provide the knowledge of various multiple access techniques.

Course Outcomes:

At the end of the course the students will demonstrate the ability to:

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. Understand link design for satellite communication.
3. Understand and utilize the basic approaches for multiple access techniques.
4. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

ERROR CORRECTION CODING

Subject Code: BECED1-813	**L T P C**	**Duration: 45 Hrs.**
	3 0 0 3	

Course Objectives:

Students shall be exposed to the need and basic requirements for error correction coding in electronic communication systems. In addition, students shall be imparted with the knowledge of various types of error correction codes, their design and applications.

Course Outcomes:

At the end of this course students will be able to:

1. Explain and classify different types of error correction coding schemes and their applications.s
2. Apply the knowledge to design block, linear. cyclic, BCH and convolutional codes.
3. Differentiate between memory based and memory-less error correction coding schemes.
4. Appraise the need and purpose for concatenated codes (Turbo and LDPC).

MACHINE LEARNING

Subject Code: BECED1-821	**L T P C**	**Duration: 45 Hrs**
	3 0 0 3	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding machine learning and its applications.

1. To make aware the students about the concept machine learning.
2. To impart knowledge of different types of learning.
3. To provide the students concepts of clustering and classification in machine learning.
4. To implement basic classification algorithms in different domains.

Course Outcomes:

At the end of the course the students will be able to

1. Understand the concept of data processing.
2. Understand the concepts of supervised and unsupervised learning.
3. Understand the concept of classification

DATA MINING & BIG DATA

Subject Code: BECED1-822	L T P C	Duration: 45 Hrs
	3 0 0 3	

Course Objectives:

The course shall provide fundamental knowledge to students for understanding of the various concepts, techniques and applications of data mining & upcoming big data scenario:

1. To study fundamentals of data mining.
2. To know about basic algorithms including data preprocessing and classification.
3. To provide understanding of terminologies and the core concepts behind big data problems.
4. To develop skills to build various applications of Big Data for real life applications.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Develop algorithms for finding patterns in large data sets.
2. Apply novel cutting-edge techniques to applications of Big Data Computing in industry.
3. Analyse various frameworks and large-scale data storage technologies.
4. Apply Data Mining concepts to real life problems.

ARTIFICIAL INTELLIGENCE

Subject Code: BECED1-823	L T P C	Duration: 45 Hrs
	3 0 0 3	

Course Objectives:

1. To study the concepts of Artificial Intelligence.
2. To learn the methods of solving problems using Artificial Intelligence.
3. To introduce Image processing and NLP as application areas of AI.

Course Outcomes:

At the end of the course the students will demonstrate the ability to:

1. Apply the concepts of knowledge representation, planning and reasoning for real world applications.
2. Apply AI techniques to solve complex problems of Industry using machine learning.
3. Apply AI techniques to solve problems in Image Processing and NLP.
4. Learn to use AI with complete Ethics and Follow legal considerations.

INTERNET OF THINGS

Subject Code: BECED1-824 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in internet of things:

1. To learn the definition and significance of the Internet of Things.
2. To understand about SDN and data handling methods.
3. To explore the relationship between IoT and cloud computing.
4. To acquire knowledge about the different application-domain.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Explore the interconnection and integration of the physical world and the cyber space.
2. Develop skills to build machine to machine communication.
3. Design and develop of IoT Devices.
4. Identify how IoT differs from traditional data collection systems.

Total Contact Hours= 12 **Total Marks= 300** **Total Credits= 12**

Semester-I (M.Tech CTM Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE6-101	Project Planning & Control	3	1	0	40	60	100	4
MCIE6-102	Construction Engineering & Management	3	1	0	40	60	100	4
MCIE6-103	Concrete Construction Technology	3	1	0	40	60	100	4
Total		**09**	**03**	**00**	**120**	**180**	**300**	**12**

Total Contact Hours= 08 **Total Marks= 200** **Total Credits= 08**

Semester-II (M.Tech CTM Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE6-205	Construction Laws & Contract Management	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	1	0	40	60	100	4
MCIE6-156	Computational Techniques							
MCIE6-157	Environment Engineering & Management							
Total		**06**	**02**	**00**	**80**	**120**	**200**	**08**

Total Contact Hours= 12 **Total Marks= 300** **Total Credits= 12**

Semester-III (M.Tech CTM Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE6-206	Building Cost & Quality Management	3	1	0	40	60	100	4
MCIE6-159	Composite Materials	3	1	0	40	60	100	4
Departmental Elective-II (Select any one)		3	1	0	40	60	100	4
MCIE6-262	Foundation Design & Construction							
MCIE6-263	Rural Construction Technology							
Total		**09**	**03**	**00**	**120**	**180**	**300**	**12**

Total Contact Hours= 08 Total Marks= 200 Total Credits= 08

Semester-IV (M.Tech CTM Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
Departmental Elective-III (Select any one)		3	1	0	40	60	100	4
MCIE6-260	Construction Costing & Finance Management							
MCIE6-261	Project Safety Management							
Departmental Elective-IV (Select any one)		3	1	0	40	60	100	4
MCIE6-364	Advanced Structural Design & Detailing							
MCIE6-365	Pavement Design, Construction & Maintenance							
Total		**06**	**02**	**00**	**80**	**120**	**200**	**08**

Total Contact Hours= 16 Total Marks= 300 Total Credits= 10

Semester-V (M.Tech CTM Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MCIE6-310	Project	0	0	8	100	00	100	4
MCIE6-207	QA & QC Lab	0	0	4	60	40	100	2
Total		**04**	**00**	**12**	**200**	**100**	**300**	**10**

Total Contact Hours= ---- Total Marks= ---- Total Credits= 20

Semester-VI (M.Tech CTM Part Time)		Contact Hours			Evaluation Criteria	Credits
Subject Code	Subject Name	L	T	P		
MCIE6-411	Thesis	0	0	0	Satisfactory/ Unsatisfactory	20

Overall Marks / Credits

Semester	**Marks**	**Credits**
1st	300	12
2nd	200	08
3rd	300	12
4th	200	08
5th	300	10
6th	-----	20
Total	**1300**	**70**

Chairperson
Board of Studies
Deptt. of Civil Engineering
MRSPTU, Bathinda

Total Contact Hours= 12 **Total Marks= 300** **Total Credits= 12**

Semester-I (M.Tech Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE5-101	Matrix Structural Analysis	3	1	0	40	60	100	4
MCIE5-102	Advanced Foundation Engineering	3	1	0	40	60	100	4
MCIE5-103	Bridge Engineering	3	1	0	40	60	100	4
Total		**09**	**03**	**00**	**120**	**180**	**300**	**12**

Total Contact Hours= 08 **Total Marks= 200** **Total Credits= 08**

Semester-II (M.Tech Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE5-205	Direct Stiffness Method	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	1	0	40	60	100	4
MCIE5-158	Prestressed Concrete Structures							
MCIE5-159	Behaviour & Design of Steel Structures							
Total		**06**	**02**	**00**	**80**	**120**	**200**	**08**

Total Contact Hours= 12 **Total Marks= 300** **Total Credits= 12**

Semester-III (M.Tech Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE5-206	Structural Dynamics	3	1	0	40	60	100	4
MCIE5-263	Composite Materials	3	1	0	40	60	100	4
Departmental Elective-II (Select any one)		3	1	0	40	60	100	4
MCIE5-260	Analysis and Design of Bridges							
MCIE5-261	Concrete Technology							
Total		**09**	**03**	**00**	**120**	**180**	**300**	**12**

Total Contact Hours= 08 Total Marks= 200 Total Credits= 08

Semester-IV (M.Tech Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MCIE5-262	Advanced Concrete Design	3	1	0	40	60	100	4
Departmental Elective-III (Select any one)		3	1	0	40	60	100	4
MCIE5-364	Analysis of Plates							
MCIE5-365	Finite Element Analysis							
Total		**06**	**02**	**00**	**120**	**180**	**300**	**12**

Total Contact Hours= 16 Total Marks= 300 Total Credits= 10

Semester-V (M.Tech Part Time)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MCIE5-310	Project	0	0	8	100	00	100	4
MCIE5-104	Non Destructive Testing Lab	0	0	4	60	40	100	2
Total		**04**	**00**	**12**	**200**	**100**	**300**	**10**

Total Contact Hours= ---- Total Marks= ---- Total Credits= 20

Semester-VI (M.Tech Part Time)		Contact Hours			Evaluation Criteria	Credits
Subject Code	Subject Name	L	T	P		
MCIE5-411	Thesis	0	0	0	Satisfactory/ Unsatisfactory	20

Overall Marks / Credits

Semester	Marks	Credits
1st	300	12
2nd	200	08
3rd	300	12
4th	200	08
5th	300	10
6th	-----	20
Total	**1300**	**70**

Chairperson
Board of Studies
Deptt. of Civil Engineering
MRSPTU, Bathinda

To
The Dean Academics
MRSPTU, Bathinda.

Subject: BoS Meeting Agenda.

Dear Sir

In reference to your email, dated ___________, regarding the conduct of BoS meeting for the approval of the following Courses offer by Civil Engineering Department from the session 2022-23 onwards.

S No	Course	Duration	Eligibility
1	M Tech (Environmental Science and Engineering) Part time	3 yrs	B Tech (any branch)/ M. Sc (Environmental Sciences/ Environmental management/Chemistry/ Physics/ Biotechnology)

.

Regards

HoD (CE)

Attached documents

i. M Tech (Environmental Science and Engineering) Part time

Study Scheme

M Tech (Environmental Science and Engineering) Part time

1st Semester		Contact Hours			Assessment			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MESEP1-101	Remedial Course in Environmental Science and Engineering	4	0	0	40	60	100	4
MESEP1-102	Environmental Chemistry	4	0	0	40	60	100	4
MESEP1-103	Water Pollution and Wastewater Treatment	4	0	0	40	60	100	4
Total	**Theory Subjects 03**	**12**	**0**	**0**	**120**	**180**	**300**	**12**

2nd Semester		Contact Hours			Assessment			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MESEP1-201	Air Pollution and Control	4	0	0	40	60	100	4
MESEP1-202	Solid & Hazardous Waste Management	4	0	0	40	60	100	4
MESEP1-203	Lab I	0	0	4	100	---	100	2
Departmental Elective – I (Select any one)								
MESED1-211	Energy Technology & Alternative Energy Sources	4	0	0	40	60	100	4
MESED1-212	Hydrology & Water Harvesting							

Total	**Theory Subjects 03; Lab 01**	**12**	**0**	**4**	**220**	**180**	**400**	**14**

3rd Semester		**Contact Hours**			**Assessment**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MESEP1-301	Industrial Pollution Management	4	0	0	40	60	100	4
MESEP1-302	Industrial Health and Safety	4	0	0	40	60	100	4
MESEP1-303	Environmental Laws	4	0	0	40	60	100	4
Total	**Theory Subjects 03**	**12**	**0**	**0**	**120**	**180**	**300**	**12**

4th Semester		**Contact Hours**			**Assessment**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MESEP1-401	Disaster Management	4	0	0	40	60	100	4
MESEP1-402	Lab II	0	0	4	100	---	100	2
MESEP1-403	Environmental Auditing & Impact Assessment	4	0	0	40	60	100	4
Departmental Elective – II (Select any one)								
MESED1-411	Soil Pollution & Control	4	0	0	40	60	100	4
MESED1-412	Energy through Waste Utilization							
Total	**Theory Subjects 03; Lab 01**	08	**0**	4	**220**	**180**	**400**	**14**

5th Semester		Contact Hours			Assessment			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MESEP1-501	Total Quality Management	4	0	0	40	60	100	4
MESEP1-502	Research Methodology	4	0	0	40	60	100	4
MESEP1-503	Project	0	0	0	100	-	100	10
Total	**Theory Subjects 02; Project =01**	**8**	**0**	**0**	**180**	**120**	**300**	**18**

6th Semester		Contact Hours			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**		
MESEP1-601	Final Thesis	0	0	0	Satisfactory/ Not satisfactory	20

Semester	Credits	Total marks
1	12	300
2	14	400
3	12	300
4	14	400
5	18	300
6	20	----
Total	**90**	**1700**

1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCCES1-101	Soft Computing	3	0	0	40	60	100	3
MCCES1-102	Digital System Design	3	0	0	40	60	100	3
MCCES1-103	Research Lab	0	0	4	60	40	100	2
MCCES1-104	Advance Communication Systems	3	0	0	40	60	100	3
Departmental Elective-I		3	0	0	40	60	100	3
MCCED1-111	Digital Forensics							
MCCED1-113	Advanced Wireless and Mobile Networks							
MCCED1-115	Introduction to Intelligent Systems							
Lab.-II (Based on any one Departmental Elective chosen in 1st semester)		0	0	4	60	40	100	2
MCCED1-116	Introduction to Intelligent Systems Lab							
MCCED1-112	Digital Forensics Lab							
MCCED1-114	Advanced Wireless and Mobile Networks Lab							
Audit Course (Choose any one)		2	0	0	100	0	100	0
BMNCC0-045	English For Research Paper Writing							
BMNCC0-046	Disaster Management							
BMNCC0-047	Sanskrit for Technical Knowledge							
BMNCC0-048	Value Education							
	Constitution of India							
BMNCC0-049	Pedagogy Studies							
BMNCC0-050	Stress Management by Yoga							
BMNCC0-051	Personality Development through Life Enlightenment Skills							
Total		**14**	**0**	**8**	**380**	**320**	**700**	**16**

2nd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCCES1-201	Machine Learning	3	0	0	40	60	100	3
MCCES1-202	Digital Signal Procssing	3	0	0	40	60	100	3
	Lab.-III (Based on Cores of 2nd Semester)	0	0	4	60	40	100	2
MCCES1-203	Machine Learning Lab.							
	Departmental Elective-III	3	0	0	40	60	100	3
MCCED1-211	Data Preparation and Analysis							
MCCED1-213	Secure Software Design & Enterprise Computing							
MCCED1-215	Computer Vision							
	Departmental Elective-IV	3	0	0	40	60	100	3
MCCED1-311	Parallel Processing							
MCCED1-312	Information Theory and Coding							
MCCED1-313	Cellular and Mobile Communication							
	Lab.-IV 2 (Based on Electives of 2nd Semester)	0	0	4	60	40	100	2
MCCED1-212	Data Preparation and Analysis Lab							
MCCED1-214	Secure Software Design & Enterprise Computing Lab							
MCCED1-216	Computer Vision Lab							
MCCES1-204	Mini Project With Seminar	0	0	4	60	40	100	2
	Audit Course (Choose any one)	2	0	0	100	-	100	0
BMNCC0-045	English For Research Paper Writing							
BMNCC0-046	Disaster Management							
BMNCC0-047	Sanskrit for Technical Knowledge							
BMNCC0-048	Value Education							
	Constitution of India							
BMNCC0-049	Pedagogy Studies							
BMNCC0-050	Stress Management by Yoga							
BMNCC0-051	Personality Development through Life Enlightenment Skills							
	Total	**14**	**0**	**12**	**440**	**360**	**800**	**18**

Note: Choose any one Audit Course in the table for 2nd semester except the one chosen in 1st semester.

1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCCES1-101	Soft Computing	3	0	0	40	60	100	3
MCCES1-102	Digital System Design	3	0	0	40	60	100	3
MCCES1-104	Advance Communication Systems	3	0	0	40	60	100	3
MCCES1-103	Research Lab	0	0	4	60	40	100	2
		9	**0**	**4**	**180**	**220**	**400**	**11**
2nd semester								
	Departmental Elective-I	3	0	0	40	60	100	3
MCCED1-111	Digital Forensics							
MCCED1-113	Advanced Wireless and Mobile Networks							
MCCED1-115	Introduction to Intelligent Systems							
MCCES1-202	Digital Signal Procssing	3	0	0	40	60	100	3
	Lab.-II	0	0	4	60	40	100	2
MCCED1-116	Introduction to Intelligent Systems Lab							
MCCED1-112	Digital Forensics Lab							
MCCED1-114	Advanced Wireless and Mobile Networks Lab							
Audit Course (Choose any one)		2	0	0	100	0	100	0
BMNCC0-045	English For Research Paper Writing							
BMNCC0-046	Disaster Management							
BMNCC0-047	Sanskrit for Technical Knowledge							
BMNCC0-048	Value Education							
	Constitution of India							
BMNCC0-049	Pedagogy Studies							
BMNCC0-050	Stress Management by Yoga							
BMNCC0-051	Personality Development through Life Enlightenment Skills							
Total		**8**	**0**	**4**	**240**	**160**	**400**	**8**

M.TECH. COMPUTER SCIENCE & ENGINEERING (PART TIME) SYLLABUS 2022 BATCH ONWARDS

1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSCE1-101	Mathematical Foundations of Computer Science	3	0	0	40	60	100	3
MCSCE1-102	Advanced Data Structures	3	0	0	40	60	100	3
MCSCE1-103	Lab.-I (Advanced Data Structures Lab)	0	0	4	60	40	100	2
Total		**06**	**0**	**4**	**140**	**160**	**300**	**08**
2nd Semester		**Contact Hrs.**			**Marks**			**Credits**
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSCE1-204	Advanced Algorithms	3	0	0	40	60	100	3
MCSCE1-205	Soft Computing	3	0	0	40	60	100	3
	Lab II							
MCSCE1-269	Soft Computing Lab.	0	0	4	60	40	100	2
MCSCE1-268	Advanced Algorithm Lab							
Audit Course (Choose any one)		2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**08**	**0**	**4**	**240**	**160**	**400**	**08**

M.TECH. COMPUTER SCIENCE & ENGINEERING (PART TIME) SYLLABUS 2022 BATCH ONWARDS

3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
	Departmental Elective-I	3	0	0	40	60	100	3
MCSCE1-159	Data Science							
MCSCE1-160	Distributed Systems							
MCSCE1-157	Wireless Sensor Networks							
Departmental Elective-II		3	0	0	40	60	100	3
MCSCE1-156	Machine Learning							
MCSCE1-158	Introduction to Intelligent Systems							
MCSCE1-161	Advanced Wireless and Mobile Networks							
Lab III		0	0	4	60	40	100	2
MCSCE1-162	Machine Learning Lab							
MCSCE1-163	Advanced Wireless Sensor Networks Lab							
MCSCE1-164	Introduction to Intelligent Systems Lab							
MCSCE1-165	Data Science Lab							
MCSCE1-166	Distributed Systems Lab							
MCSCE1-167	Wireless Sensor Networks Lab							
	Audit Course (Choose any one)	2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**08**	**0**	**4**	**240**	**160**	**400**	**8**

4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
Departmental Elective-III		3	0	0	40	60	100	3
MCSCE1-273	Human and Computer Interaction							
MCSCE1-274	GPU Computing							
MCSCE1-275	Digital Forensics							
Open Elective		3	0	0	40	60	100	3
MCSCE1-F92	Industrial Safety							
MCSCE1-F93	Operations Research							
MCSCE1-F94	Cost Management of Engineering Projects							
MCSCE1-F95	Composite Materials							
MCSCE1-F96	Waste to Energy							
MCSCE1-206	Mini Project With Seminar	0	0	4	60	40	100	2
Total		**6**	**0**	**04**	**140**	**160**	**300**	**08**

M.TECH. COMPUTER SCIENCE & ENGINEERING (PART TIME) SYLLABUS 2022 BATCH ONWARDS

5th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MRMIP0-101	Research Methodology and IPR	2	0	0	40	60	100	2
Departmental Elective-IV		3	0	0	40	60	100	3
MCSCE1-270	Data Preparation and Analysis							
MCSCE1-271	Secure Software Design & Enterprise Computing							
MCSCE1-272	Computer Vision							
Lab IV		0	0	4	60	40	100	2
MCSCE1-276	Data Preparation and Analysis Lab							
MCSCE1-277	Secure Software Design & Enterprise Computing Lab							
MCSCE1-278	Computer Vision Lab							
Departmental Elective-V		3	0	0	40	60	100	3
MCSCE1-382	Mobile Applications and Services							
MCSCE1-383	Compiler for HPC							
MCSCE1-384	Optimization Techniques							
MCSCE1-308	Major Project	0	0	16	60	40	100	10
Total		**08**	**0**	**04**	**180**	**220**	**400**	**20**

6^{th} Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSCE1-409	Dissertation	0	0	32	Satisfactory			16
Total		**0**	**0**	**32**		**0**		**16**

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Subject Code: MCSCE1-101 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
To understand the mathematical fundamentals that is prerequisites for a variety of courses like:
1. Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

Course Outcomes:
After completion of course, students would be able to:
CO1: To understand the basic notions of discrete and continuous probability.
CO2: To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
CO3: To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

UNIT-I

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

UNIT-II

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

UNIT-III

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

UNIT-IV

Applications of Mathematics in various fields of Computer science and engineering.
Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Recommended Books:
1. John Vince, 'Foundation Mathematics for Computer Science', Springer.
2. K. Trivedi, 'Probability and Statistics with Reliability, Queuing, and Computer Science Applications', Wiley.
3. M. Mitzenmacher and E. Upfal, 'Probability and Computing: Randomized Algorithms and Probabilistic Analysis'.
4. Alan Tucker, 'Applied Combinatorics', Wiley.

ADVANCED DATA STRUCTURES

Subject Code: MCSCE1-102 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. The student should be able to choose appropriate data structures, understand the ADT/libraries and use it to design algorithms for a specific problem.

2. Students should be able to understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes:

After completion of course, students would be able to:

CO1: Understand the implementation of symbol table using hashing techniques

CO2: Develop and analyze algorithms for red-black trees, B-trees and Splay trees.

CO3: Develop algorithms for text processing applications.

CO4: Identify suitable data structures and develop algorithms for computational geometry problems

UNIT–I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic, Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT–II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT–III

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT – IV

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

Recommended Books:

1. Mark Allen Weiss, ‘Data Structures and Algorithm Analysis in C++’, 2ndEdn., Pearson, **2004**.
2. M.T. Goodrich, Roberto Tamassia, ‘Algorithm Design’, John Wiley, **2002**.

LAB.-I (ADVANCED DATA STRUCTURES)

Subject Code: MCSCE1-103	**L T P C** **0 0 4 2**	**Duration: 60 Hrs.**

Programs may be implemented using C/C++/java

EXP 1: Program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions, use the following collision resolution techniques,

a) Linear probing,
b) Quadratic probing,
c) Double hashing/rehashing,
d) Chaining

EXP 2: Program for Binary Search Tree to implement following operations:

a) Insertion,
b) Deletion,
   i) Delete a node with only child,
   ii) Delete a node with both children
c) Finding an element,
d) Finding Min element,

e) Finding Max element,
f) Left child of the given node,
g) Right child of the given node,
h) Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

EXP 3: Program for AVL Tree to implement following operations: (For nodes as integers)
a) Insertion: Test program for all cases (LL, RR, RL, LR rotation),
b) Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1),
c) Display: using set notation.

EXP 4: Program to implement Red-Black trees with insertion and deletion operation for the given input data as Integers/Strings

EXP 5: Program to implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have at most m children) for the given data as integers.

EXP 6: Program to perform string matching using Knuth-Morris-Pratt algorithm.

EXP 7: Program to perform string matching using Boyer-Moore algorithm.

EXP 8: Program to implement 2-D range search over computational geometry problem

EXP 9: Program on latest efficient algorithms on trees for solving contemporary problems.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

ADVANCED ALGORITHMS

Subject Code- MCSCE1-204 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:
1. Introduce students to the advanced methods of designing and analysing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes:
After completion of course, students would be able to:
CO1: Analyze the complexity/performance of different algorithms.
CO2: Determine the appropriate data structure for solving a particular set of problems.
CO3: Categorize the different problems in various classes according to their complexity.
CO4: Students should have an insight of recent activities in the field of the advanced data structure.

UNIT-I (12 Hrs.)

Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-II (11 Hrs.)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-III (11 Hrs.)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials.

UNIT-IV (11 Hrs.)

Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Advanced Number Theoretic Algorithm.

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Recommended Books:

1. Cormen, Leiserson, Rivest, Stein, ‘Introduction to Algorithms’.
2. Aho, Hopcroft, Ullman, ‘The Design and Analysis of Computer Algorithms’.
3. Kleinberg and Tardos, ‘Algorithm Design’.

SOFT COMPUTING

Subject Code: MCSCE1-205 L T P C **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide student hand-on experience on MATLAB to implement various strategies.

Course Outcomes:

After completion of course, students would be able to:

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO3: Apply genetic algorithms to combinatorial optimization problems.

CO4: Evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT-I (11 Hrs.)

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-II (11 Hrs.)

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-III (13 Hrs.)

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT-IV (10 Hrs.)

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

Recommended Books:

1. Jyh: Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, 'Neuro: Fuzzy and Soft Computing17', Prentice-Hall of India, **2003**.
2. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic: Theory and Applications17', Prentice Hall, **1995**.
3. MATLAB Toolkit Manual.

ADVANCED ALGORITHMS LAB.

Subject Code: MCSCE1-268 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using C/C++/java
Expt. 1: Program to implement Dijkstra's algorithm for single-source shortest path in a weighted directed graph.
Expt. 2: Program to find all-pairs shortest path using Floyd-Warshall algorithm.
Expt. 3: Program to find inverse of a triangular matrix using divide and conquer strategy.
Expt. 4: Program to convert base (decimal/hexa) representation to modulo representation.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

SOFT COMPUTING LAB.

Subject Code: MCSCE1-269 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using Matlab/Python
Expt. 1: Program to implement array operations in Python
Expt. 2: Program to append strings using functions in Python
Expt. 3: Study of Neural Network Tool Box/ use of Library functions
Expt. 4: Study of Fuzzy Logic Tool Box/ use of Library functions
Expt. 5: Program to perform operations on fuzzy sets.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

ENGLISH FOR RESEARCH PAPER WRITING

Subject Code: MHUMA-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:
Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

UNIT-I

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-II

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT-III

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Recommended Books:

1. R. Goldbort, 'Writing for Science', Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses, Vol.-I, **2006**.
2. R. Day, 'How to Write and Publish a Scientific Paper', Cambridge University Press, **2006**.
3. N.Highman, 'Handbook of Writing for the Mathematical Sciences', SIAM. Highman's Book, **1998**.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, **2011**.

DISASTER MANAGEMENT

Subject Code: MCIVE0-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I

Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-II

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-III

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Recommended Books:

1. R. Nishith, A.K. Singh, 'Disaster Management in India: Perspectives, Issues and Strategies', New Royal Book Company, Model Curriculum of Engineering & Technology PG Courses, Vol.-I.
2. Sahni, Pardeep et. al.(Eds.), 'Disaster Mitigation Experiences and Reflections', Prentice Hall of India, New Delhi.
3. S.L. Goel, 'Disaster Administration and Management, Text and Case Studies', Deep & Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE

Subject Code: MHUMA0-102 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature

Alphabets in Sanskrit, Past/Present/Future Tense
Simple Sentences
Order
Introduction of roots
Technical information about Sanskrit Literature
Technical concepts of Engineering-Electrical, Mechanical
Architecture, Mathematics

Recommended Books:

1. Vishwas, 'Abhyaspustakam', Samskrita-Bharti Publication, New Delhi.
2. 'Teach Yourself Sanskrit', Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi, Publication.
3. Suresh Soni, 'India's Glorious Scientific Tradition', Ocean Books Pvt. Ltd., New Delhi.

Course Outcomes:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students.

VALUE EDUCATION

Subject Code: MHUMA0-103 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

UNIT-I

Content Hours Values and self-development –Social values and individual attitudes.
Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

UNIT-II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism, Love for nature, Discipline.

UNIT-III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV

Character and Competence –Holy books vs Blind faith, Self-management and Good health.
Science of reincarnation, Equality, Nonviolence, Humility, Role of Women.
All religions and same message, mind your Mind, Self-control, Honesty, Studying effectively.

Recommended Books:

1. S.K. Chakroborty, 'Values and Ethics for Organizations Theory and Practice', Oxford University Press, New Delhi.

Course Outcomes:

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

CONSTITUTION OF INDIA

Subject Code: MHUMA0-104 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-1

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working). Philosophy of the Indian Constitution: Preamble Salient Features

UNIT-II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNITIII

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. **Pachayati Raj:** Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), **Village Level:** Role of Elected and Appointed officials, importance of grass root democracy

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Recommended Books:

1. 'The Constitution of India', (Bare Act), Government Publication, **1950**.
2. S.N. Busi, B.R. Ambedkar, 'Framing of Indian Constitution', 1st Edn., **2015**.
3. M.P. Jain, 'Indian Constitution Law', 7th Edn., Lexis Nexis, **2014**.
4. D.D. Basu, 'Introduction to the Constitution of India', Lexis Nexis, **2015**.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. 4. Discuss the passage of the Hindu Code Bill of 1956.

PEDAGOGY STUDIES

Subject Code: MHUMA0-105 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal, classrooms in developing countries. Curriculum, Teacher education.

UNIT-II

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-III

Professional Development: alignment with classroom practices and follow- up, support Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT IV

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Recommended Books:

1. J. Ackers, F. Hardman, 'Classroom Interaction in Kenyan Primary Schools, Compare', 31 (2): 245-261, **2001**.
2. M. Agrawal, 'Curricular Reform in Schools: The Importance of Evaluation, Journal of Curriculum Studies', 36 (3): 361-379, **2004**.
3. K. Akyeampong, 'Teacher Training in Ghana - Does it Count?', Multi-site Teacher Education Research Project (MUSTER) Country Report 1. London: DFID, **2003**.

4. K. Akyeampong, K. Lussier, J. Pryor, J. Westbrook, 'Improving Teaching and Learning of basic Maths and Reading in Africa: Does Teacher Preparation Count?', International Journal Educational Development, 33 (3): 272–282, **2013**.
5. R.J. Alexander, 'Culture and Pedagogy: International Comparisons in Primary Education, Oxford and Boston', Blackwell, **2001**.
6. M. Chavan, 'Read India: A Mass Scale, Rapid, 'Learning to Read' Campaign, **2003**.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

STRESS MANAGEMENT BY YOGA

Subject Code: MHUMA0-106 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

UNIT-I

Definitions of Eight parts of Yog. (Ashtanga)

UNIT-II

Yam and Niyam. Do`s and Don'ts in life:

a) Ahinsa, satya, astheya, bramhacharya and aparigraha
b) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-III

Asan and Pranayam:

a) Various yog poses and their benefits for mind & body
b) Regularization of breathing techniques and its Effects-Types of pranayam

Recommended Books:

1. 'Yogic Asanas for Group Tarining', Part-I, Janardan Swami Yogabhyasi Mandal, Nagpur.
2. 'Rajayoga or Conquering the Internal Nature', Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Subject Code: MHUMA0-107 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course Outcomes:

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

UNIT-I

Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's)

UNIT-II

Approach to day to day work and duties.2 Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48

UNIT-III

Statements of basic knowledge.3 Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68, Chapter 12 - Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63

Recommended Books:

1. 'Srimad Bhagavad Gita', Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. 'Bhartrihari's Three Satakam (Niti-sringar-vairagya)', P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

DATA SCIENCE

Subject Code: MCSCE1-159 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
3. Produce Python code to statistically analyses a dataset
4. Critically evaluate data visualizations based on their design and use for communicating stories from data

Course Outcomes:

On completion of the course the student should be able to

CO1: Explain how data is collected, managed and stored for data science;

CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists

CO3: Implement data collection and management scripts using MongoDB

UNIT-I

Introduction to Core Concepts and Technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

UNIT-II

Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-III

Data Visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-IV

Applications of Data Science, Technologies for visualization, Bokeh (Python)

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Recommended Books:

1. Cathy O'Neil and Rachel Schutt, 'Doing Data Science, Straight Talk from the Frontline', O'Reilly.
2. Jure Leskovek, Annand Rajaraman and Jeffrey Ullman, 'Mining of Massive Datasets', Vol.- 2.1, Cambridge University Press.

DISTRIBUTED SYSTEMS

Subject Code: MCSCE1-160 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

Course Outcomes: After completion of course, students would be:

CO1: Design trends in distributed systems.

UNIT-I

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

Distributed Database Management System Architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II

Distributed Database: Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. BASICS OF SEMANTIC DATA CONTROL, QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries;

Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.

Concurrency Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing.

Advanced Topics: Mobile Databases, Multi-databases.

Recommended Books:

1. M.T. Ozsu and P. Valduriez, 'Principles of Distributed Database Systems', Prentice Hall, **1991**.
2. D. Bell and J. Grimson, 'Distributed Database Systems', Addison Wesley, **1992**.

WIRELESS SENSOR NETWORKS

Subject Code: MCSCE1-157 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost
3. Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.

4. Evaluate the performance of sensor networks and identify bottlenecks.

Course Outcomes:

After completion of course, students would be able to:

CO1: Describe and explain radio standards and communication protocols for wireless sensor networks.

CO2: Explain the function of the node architecture and use of sensors for various applications.

CO3: Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

UNIT-I

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors,

Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters.

UNIT-II

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

Medium Access Control Protocol Design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled.

Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis.

MAC Protocol: Introduction to analysis of MAC Protocols.

UNIT-III

Routing Protocols: Introduction, MANET protocols

Routing Protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast.

Opportunistic Routing Analysis: Introduction to opportunistic routing.

UNIT-IV

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.

ADVANCED TOPICS Recent development in WSN standards, software applications.

Recommended Books:

1. W. Dargie and C. Poellabauer, ‘Fundamentals of Wireless Sensor Networks –Theory and Practice’, Wiley, **2010.**
2. Kazem Sohraby, Daniel Minoli and TaiebZnati, ‘Wireless Sensor Networks -Technology, Protocols, and Applications’, Wiley Interscience, **2007**.
3. Takahiro Hara, Vladimir I. Zadorozhny and Erik Buchmann, ‘Wireless Sensor Network Technologies for the Information Explosion Era’, Springer, **2010**.

MACHINE LEARNING

Subject Code: MCSCE1-156	**L T P C**	**Duration: 38 Hrs.**
	3 0 0 3	

Course Objectives:

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

Course Outcomes:

After completion of course, students would be able to:

CO1: Extract features that can be used for a particular machine learning approach in various IOT applications.

CO2: To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
CO3: To mathematically analyze various machine learning approaches and paradigms.

UNIT-I

Supervised Learning (Regression/Classification) Basic Methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification.

UNIT-II

Unsupervised Learning Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

UNIT-III

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.
Scalable Machine Learning (Online and Distributed Learning). A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

UNIT-IV

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Introduction to Various models for IOT applications.

Recommended Books:

1. Kevin Murphy, 'Machine Learning: A Probabilistic Perspective', MIT Press, **2012**.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, 'The Elements of Statistical Learning', Springer, **2009** (freely available online).
3. Christopher Bishop, 'Pattern Recognition and Machine Learning', Springer, **2007**.

INTRODUCTION TO INTELLIGENT SYSTEMS

Subject Code: MCSCE1-158 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
The aim of the course is to introduce to the field of Artificial Intelligence(AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.

Course Outcomes:
After completion of course, students would be:
CO1 Able to demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyses and compare the relative merits of a variety of AI problem solving techniques.

UNIT-I

Biological Foundations to Intelligent Systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.
Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

UNIT-II

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

UNIT-III

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

UNIT-IV

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.
Recent trends in Fuzzy logic, Knowledge Representation.

Recommended Books:

1. G.F. Luger and W.A. Stubblefield, ‘Artificial Intelligence: Structures and Strategies for Complex Problem Solving’, 6th Edn., Addison Wesley, **2008**.
2. S. Russell and P. Norvig, ‘Artificial Intelligence: A Modern Approach’, 3rd Edn., Prentice-Hall, **2009**.

ADVANCED WIRELESS AND MOBILE NETWORKS

Subject Code: MCSCE1-161 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. The students should get familiar with the wireless/mobile market and the future needs and challenges.
2. To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
3. To learn how to design and analyse various medium access
4. To learn how to evaluate MAC and network protocols using network simulation software tools.
5. The students should get familiar with the wireless/mobile market and the future needs and challenges.

Course Outcomes:

After completion of course, students would be:

CO1: Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
CO2: Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
CO3: Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
CO4: Design wireless networks exploring trade-offs between wire line and wireless links.
CO5: Develop mobile applications to solve some of the real world problems.

UNIT-I

Introduction: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF& PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

UNIT-II

Wireless Cellular Networks: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT-III

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview **Wireless Sensor Networks:** Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

UNIT-IV

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.
Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.
Advanced Topics: IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.

Recommended Books:

1. J. Schiller, 'Mobile Communications', Addison Wesley,**2000.**
2. W. Stallings, 'Wireless Communications and Networks', Pearson Education, **2005.**
3. Stojmenic Ivan, 'Handbook of Wireless Networks and Mobile Computing', John Wiley and Sons Inc., **2002**.
4. Yi Bing Lin and ImrichChlamtac, 'Wireless and Mobile Network Architectures', John Wiley and Sons Inc.,**2000**.
5. Pandya Raj, 'Mobile and Personal Communications Systems and Services', PHI.

MACHINE LEARNING LAB.

Subject Code: MCSCE1-162 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using WEKA/R/PYTHON etc. similar software
Expt. 1: Study of platform for Implementation of Assignments Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA, R or any other software.
Expt. 2: Supervised Learning – Regression Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set.

a) Perform linear regression analysis with Least Squares Method.
b) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.
c) Verify the Effect of Data Set Size and Bias-Variance Trade off.
d) Apply Cross Validation and plot the graphs for errors. v) Apply Subset Selection Method and plot the graphs for errors. Describe your findings in each case.

Expt. 3: Supervised Learning – Classification Implement Naïve Bayes Classifier and K-Nearest Neighbour Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.
Expt. 4: Unsupervised Learning Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.
Expt. 5: Dimensionality Reduction Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.
Expt. 6: Supervised Learning and Kernel Methods Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non-separable Dataset.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

ADVANCED WIRELESS AND MOBILE NETWORKS LAB.

Subject Code: MCSCE1-167 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using NS2/NS3/Omnet++

Expt. 1: Setup & Configuration of Wireless Access Point (AP)
Expt. 2: Study of WLAN: Ad Hoc & Infrastructure Mode
Expt. 3: Study of Bluetooth Protocol and Applications
Expt. 4: GSM modem study and SMS client-server application
Expt. 5: Mobile Internet and WML
Expt. 6: J2ME Program for Mobile Node Discovery
Expt. 7: Mobile protocol study using omnet++
Expt. 8: Wireless Network Security: kismet and Netstumbler
Expt. 9: Design and Program Income Tax and Loan EMI Calculator for Mobile Phones
Mini Project: Implementation of Mobile Network using Network Simulator (NS2/NS3).

INTRODUCTION TO INTELLIGENT SYSTEMS LAB.

Subject Code: MCSCE1-164	L T P C 0 0 4 2	Duration: 60 Hrs.

Programs may be implemented using Matlab/Python
Expt. 1: Implementation of simple artificial neural network.
Expt. 2: Implementation of neural network with backpropagation.
Expt. 3: Implementation of radial basis function network
Expt. 4: Implementation of recurrent neural network.
Expt. 5: Implementation of fuzzy neural network.
Expt. 6: Implementation of iterative deepening search.
Expt. 7: Implementation of Hill climbing Search algorithm.
Expt. 8: Implementation of optimization genetic algorithm.
Expt. 9: Implementation of induction based learning method such as decision tree.
Expt. 10: Implementation of statistical learning methods such as naive Bayes.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as have to give a presentation of the same.

DATA SCIENCE LAB.

Subject Code: MCSCE1-165	L T P C 0 0 4 2	Duration: 60 Hrs.

Programs may be implemented using Matlab/Python/R
Expt. 1: **Introduction to R:** This Cycle introduces you to the use of the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in this cycle you should able to: a. Read data sets into R, save them, and examine the contents.
Tasks you will complete in this Cycle include:
a) Invoke the R environment and examine the R workspace.
b) Created table and datasets in R.
c) Examine, manipulate and save datasets. d. Exit the R environment.
Expt. 2: **Basic Statistics and Visualization:** This Cycle introduces you to the analysis of data using the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in Tins Cycle you should able to:
a) Perform summary (descriptive) statistics on the datasets.
b) Create basic visualizations using R both to support investigation of the data as well as exploration of the data.
c) Create plot visualizations of the data using a graphics package.
Tasks you will complete in this Cycle include:
a) Reload data sets into the R statistical package.
b) Perform summary statistics on the data.

c) Remove outliers from the data.
d) Plot the data using R.
e) Plot the data using lattice and ggplot.

Expt. 3: **K-means Clustering:** This Cycle is designed to investigate and practice K-means Clustering. After completing the tasks in This Cycle you should able to:

a) Use R functions to create K-means Clustering models.
b) Use ODBC connection to the database and execute SQL statements and load datasets from the database in an R environment.
c) Visualize the effectiveness of the K-means Clustering algorithm using graphic capabilities in R.
d) Use the ODBC connection in the R environment to create the average household income from the census database as test data for K-means Clustering.
e) Use R graphics functions to visualize the effectiveness of the K-means Clustering algorithm.

Expt. 4: **Association Rules:** This Cycle is designed to investigate and practice Association Rules. After completing the tasks in This Cycle you should able to: a. Use R functions for Association Rule based models. Tasks you will complete in this Cycle include:

a) Use the R-Studio environment to code Association Rule models.
b) Apply constraints in the Market Basket Analysis methods such as minimum thresholds on support and confidence measures that can be used to select interesting rules from the set of all possible rules.
c) Use R graphics "rules" to execute and inspect the models and the effect of the various thresholds.

Expt. 5:Linear Regression: This Cycle is designed to investigate and practice linear regression. After completing the tasks in This Cycle you should able to:

a) Use R functions for Linear Regression (Ordinary Least Squares - OLS).
b) Predict the dependent variables based on the model.
c) Investigate different statistical parameter tests that measure the effectiveness of the model. Tasks you will complete in This Cycle include:
a) Use the R-Studio environment to code OLS models
b) Review the methodology to validate the model and predict the dependent variable for a set of given independent variables
c) Use R graphics functions to visualize the results generated with the mode

Expt. 6: **Naïve Bayesian Classifier:** This Cycle is designed to investigate and practice Navive Bayesian classifier. After completing the tasks in this Cycle you should able to:

a) Use R functions for Naïve Bayesian Classification
b) Apply the requirements for generating appropriate training data
c) Validate the effectiveness of the Naïve Bayesian Classifier with the big data.

Tasks you will complete in Tins Cycle include:

a) Use R-Studio environment to code the Naïve Bayesian Classifier
b) Use the ODBC connection to the "census" database to create a training data set for Naïve Bayesian Classifier from the big data.
c) Use the Naive Bayesian Classifier program and evaluate how well it predicts the results using the training data and then compare the results with original data.

Expt. 7: **Decision Trees:** This Cycle is designed to investigate and practice Decision Tree (DT) models covered in the course work. After completing the tasks in This Cycle you should able to:

a) Use R functions for Decision Tree models.
b) Predict the outcome of an attribute based on' the model.

Tasks you will complete in This Cycle include:

a) Use the R-Studio environment to code Decision Tree Models.
b) Build a Decision Tree Model based on data whose schema is composed of attributes.
c) Predict the outcome of one attribute based on the model.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

DISTRIBUTEDSYSTEMS LAB.

Subject Code: MCSCE1-166 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using any open source tool
Expt. 1: Installation and configuration of database packages.
Expt. 2: Creating and managing database objects (Tables, views, indexes etc.)
Expt. 3: Creating and managing database security through user management.
Expt. 4: Creating and maintaining database links.
Expt. 5: Implement Partitioning on the database tables.
Expt. 6: Implement various Transaction concurrency control methods [i.e. lock's] by executing multiple update and queries.
Expt. 7: Performance tuning of SQL queries.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

WIRELESS SENSOR NETWORKS LAB.

Subject Code: MCSCE1-163 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using NS2/NS3
Expt. 1: Introduction to Network Simulators used for Wireless Sensor Networks.
Expt. 2: Introduction to TCL scripting: Demonstration of one small network simulator setup.
Expt. 3: To study various trace files formats of Network Simulators.
Expt. 4: To create a sensor network setup using the nodes configured with fixed initial energy, transmission power, reception power, routing agent, transport agent and application in rectangular area.
Expt. 5: Create different simulation scenarios by varying MAC protocols.
Expt. 6: Compute the performance of above created simulation scenarios of network in terms of total energy consumption, transmission latency, number of packets generated, received and dropped.
Expt. 7: To implement and compare various routing protocols using above mentioned performance metrics.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

HUMAN AND COMPUTER INTERACTION

Subject Code: MCSCE1-273 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:
1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile Human Computer interaction.
4. Learn the guidelines for user interface.
5. Understand the structure of models and theories of human computer interaction and vision.
6. Design an interactive web interface on the basis of models studied.

Course Outcomes:
After completion of course, students would be
CO1: Understand the structure of models and theories of human computer interaction and vision.
CO2: Design an interactive web interface on the basis of models studied.

UNIT-I (11 Hrs.)

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models– frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT-II (12 Hrs.)

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration Models-Hypertext, Multimedia and WWW.

UNIT-III (11 Hrs.)

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT-IV (11 Hrs.)

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Recent Trends: Speech Recognition and Translation, Multimodal System.

Recommended Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, 'Human Computer Interaction', 3rd Edn., Pearson Education, **2004.**
2. Brian Fling, 'Mobile Design and Development', 1st Edn., O17Reilly Media Inc., **2009**.
3. Bill Scott and Theresa Neil, 'Designing Web Interfaces', 1st Edn., O17Reilly, **2009**.

GPU COMPUTING

Subject Code: MCSCE1-274 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

To learn parallel programming with Graphics Processing Units (GPUs).

Course Outcomes:

After completion of course, students would be:

CO1 Students would learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

UNIT-I (11 Hrs.)

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL/Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps/ Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs.

UNIT-II (12 Hrs.)

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multidimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

UNIT-III (11 Hrs.)

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, using libraries (such as Thrust), and developing libraries.

UNIT-IV (11 Hrs.)

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning.

Advanced Topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.

Recommended Books:

1. David Kirk, Wen-meiHwu, Morgan Kaufman, 'Programming Massively Parallel Processors: A Hands-on Approach', (ISBN: 978-0123814722), **2010**.
2. Shane Cook; Morgan Kaufman, 'CUDA Programming: A Developer's Guide to Parallel Computing with GPUs', (ISBN: 978-0124159334), **2012**.

DIGITAL FORENSICS

Subject Code: MCSCE1-275 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes:

After completion of course, students would be able to:
CO1: Understand relevant legislation and codes of ethics
CO2: Computer forensics and digital detective and various processes, policies and procedures
CO3: E-discovery, guidelines and standards, E-evidence, tools and environment.
CO4: Email and web forensics and network forensics.

UNIT-I (11 Hrs.)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT-II (12 Hrs.)

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT-III (11 Hrs.)

Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT-IV (11 Hrs.)

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

Recommended Books:

1. John Sammons, 'The Basics of Digital Forensics', Elsevier.
2. John Vacca, 'Computer Forensics: Computer Crime Scene Investigation', Laxmi Publications.

INDUSTRIAL SAFETY

Subject Code: MMECE0-F91 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

COURSE OBJECTIVES:

The objective of course is to provide insight to distributed database, normalization techniques and integrity rules. It also includes parallel database systems along with object oriented models.

COURSE OUTCOMES:

At the end of this course, students will be able to

CO1: Understand relational database management systems, normalization to make efficient retrieval from database and query.

UNIT-I (12 Hrs.)

Introduction: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department,

Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-II (11Hrs.)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-III (11 Hrs.)

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-IV (11 Hrs.)

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

RECOMMENDED BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPERATIONS RESEARCH

Subject Code: MMECE0-F92 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

COURSE OUTCOMES:

At the end of this course, students will be able to
CO1: Students should able to apply the dynamic programming to solve problems of discreetand continuous variables.
CO2: Students should able to apply the concept of non-linear programming
CO3: Students should able to carry out sensitivity analysis
CO4: Student should able to model the real world problem and simulate it.

UNIT-I (11 Hrs.)

Optimization Techniques, Model Formulation, models, General L.R Formulation, SimplexTechniques, Sensitivity Analysis, Inventory Control Models.

UNIT-II (12 Hrs.)

Formulation of a LPP, Graphical solution revised simplex method - duality theory - dualsimplex method - sensitivity analysis - parametric programming
Nonlinear programming problem, Kuhn-Tucker conditions min cost flow problem - max flowproblem - CPM/PERT

UNIT-III (11 Hrs.)

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT-IV (11 Hrs.)

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

RECOMMENDED BOOKS:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

COST MANAGEMENT OF ENGINEERING PROJECTS

Subject Code: MMECE0-F93 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

UNIT-I (11 Hrs.)

Introduction and Overview of the Strategic Cost Management Process
Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-II (12 Hrs.)

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution

Project cost control. Bar charts and Network diagram. Project commissioning: mechanicaland process

UNIT-III (11 Hrs.)

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-IV (11 Hrs.)

Quantitative techniques for cost management, Linear Programming, PERT/CPM,Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Recommended Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

COMPOSITE MATERIALS

Subject Code: MMECE0-F94 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

COURSE OBJECTIVES:
COURSE OUTCOMES:

UNIT-I (12 Hrs.)

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-II (11 Hrs.)

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-III (11 Hrs.)

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT-IV (11 Hrs.)

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength designusing caplet plots; stress concentrations.

RECOMMENDED BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen **W. Tasi.**

WASTE TO ENERGY

Subject Code: MMECE0-F95 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

COURSE OBJECTIVES:
COURSE OUTCOMES:

UNIT-I (12 Hrs.)

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-II (11 Hrs.)

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangementfor thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III (11 Hrs.)

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-IV (11 Hrs.)

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology andstatus - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

RECOMMENDED BOOKS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I& II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, JohnWiley & Sons, 1996.

MINI PROJECT WITH SEMINAR

Subject Code: MCSCE1-206L T P C
0 0 4 2

Mini project based on any one of departmental cores and departmental electives of current semester.

RESEARCH METHODOLOGY AND IPR

Subject Code: MRMIP0-101 **L T P C** **Duration: 28 Hrs.**

2 0 0 2

Course Objectives:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

Course Outcomes:

At the end of this course, students will be able to

CO1: Understand research problem formulation, analyze research related information, Follow research ethics

CO2: Understand that today's world is controlled by Computer, Information Technology, buttomorrow world will be ruled by ideas, concept, and creativity.

CO3: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO4: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and inturn brings about, economic growth and social benefits.

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Introduction to international Scenario on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

New Developments in IPR: Administration of Patent System. New developments in IPR: introduction to IPR of Biological Systems, Computer Software etc. Traditional Knowledge Case Studies, IPR or IITs

Recommended Books:

1. Stuart Melville and Wayne Goddard, 'Research methodology: An Introduction for Science & Engineering Students'.
2. Wayne Goddard and Stuart Melville, 'Research Methodology: An Introduction'.
3. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., **2007**.
5. Mayall , 'Industrial Design', McGraw Hill, **1992**.
6. Niebel , 'Product Design', McGraw Hill, **1974**.
7. Asimov, 'Introduction to Design', Prentice Hall, **1962**.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', **2016**.
9. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, **2008.**

DATA PREPARATION AND ANALYSIS

10. Subject Code: MCSCE1-270 **L T P C** **Duration: 45 Hrs.**
11. 3 0 0 3

Course Objectives:
To prepare the data for analysis and develop meaningful Data Visualizations
Course Outcomes:
After completion of course, students would be:
CO1 Able to extract the data for performing the Analysis.

UNIT-I (11 Hrs.)

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT-II (12 Hrs.)

Data Cleaning: Consistency checking, Heterogeneous and missing data, DataTransformation and segmentation.

UNIT-III (11 Hrs.)

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association,Hypothesis generation.

UNIT-IV (11 Hrs.)

Visualization: Designing visualizations, Time series, Geolocated data, Correlations andconnections, Hierarchies and networks, interactivity.

Recommended Books:

1. **Glenn J. Myatt, 'Making Sense of Data: A Practical Guide to Exploratory Data Analysisand Data Mining'.**

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Subject Code: MCSCE1-271 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
3. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes:

After completion of course, students would be able to:

CO1: Differentiate between various software vulnerabilities.

CO2: Software process vulnerabilities for an organization.

CO3: Monitor resources consumption in a software.

CO4: Interrelate security and software development process

UNIT-I (11 Hrs.)

Secure Software Design Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, perform security testing and quality assurance.

UNIT-II (11 Hrs.)

Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed Ntier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Enterprise Systems Administration Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT-III (11 Hrs.)

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT-IV (12 Hrs.)

Handle insecure exceptions and command/SQL injection, defend web and mobileapplications against attackers, software containing minimum vulnerabilities and flaws.

Case study of DNS server, DHCP configuration and SQL injection attack.

Recommended Books:

1. Theodor Richardson, Charles N Thies, 'Secure Software Design', Jones & Bartlett.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, 'Enterprise Software Security', Addison Wesley.

COMPUTER VISION

Subject Code: MCSCE1-272 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Understand the geometric relationships between 2D images and the 3D world.
4. Grasp the principles of state-of-the-art deep neural networks.

Course Outcomes:

After completion of course, students would be able to:

CO1 Developed the practical skills necessary to build computer vision applications.
CO2 To have gained exposure to object and scene recognition and categorization from images.

UNIT-I (11 Hrs.)

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.

Edge detection, Edge detection performance, Hough transform, corner detection.

UNIT-II (11 Hrs.)

Segmentation, Morphological filtering, Fourier transform.

UNIT-III (11 Hrs.)

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing.

UNIT-IV (12 Hrs.)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi supervised. Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Nonparametric methods.

Recent trends in Activity Recognition, computational photography, Biometrics.

Recommended Books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Good fellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisheretal.

DATA PREPARATION AND ANALYSIS LAB.

Subject Code: MCSCE1-276 **L T P C** **Duration: 60 Hrs.**

0 0 4 2

Programs to be implemented using WEKA.
Expt. 1: Using weka tool to explore the data.
Expt. 2: Using weka tool to do Parametric–Means.
Expt. 3: Using weka tool to do Parametric -T-Test.
Expt. 4: Using weka tool to do Correlation analysis
Expt. 5: Preprocess the given data using weka tool.
Expt. 6: Apply different classification techniques to classify the given data set.
Expt. 7: Apply various clustering techniques to cluster the data.
Expt. 8: Apply various association rule mining algorithms.
Expt. 9: Implement classification using Decision tree.
Expt. 10: Apply Visualization methods using weka tool.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of thesame.

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING LAB.

Subject Code: MCSCE1-277 L T P C Duration: 60 Hrs.

0 0 4 2

Expt.1: Program to implement authentication to prevent various attacks.
Expt.2: Program to Limit or increasingly delay failed login attempts.
Expt.3: Create a scenario to test authentication of various security attacks.Expt.4: Program to debug backdrop entry of given source code.
Expt.5: Program to debug HTTP headers, input fields, hidden fields, drop down lists, andother web components.
Expt.6: Program to test Input filtering via white list validation
Expt.7: Create a scenario to Set Up Your Own Private Cloud Storage.
Expt.8: Setup and configuration Various network services (DNS/ DHCP/ Terminal Services/ Clustering/ Web/ Email).
Expt.9: Design and build a database using an enterprise database system.

Expt.10: Design and implement a directory-based server infrastructure in a heterogeneous systems environment.
Expt.11: An attacker wishing to execute SQL injection manipulates a standard SQL query to exploit non-validated input vulnerabilities in a database. Show different ways that this attack vector can be executed.
Expt.12: Install IBM Rhapsody Tool using NetBeans for Java and Junit (a unit testing tool).
Expt.13: Create a Unified Modelling Language (UML) Class diagram and a UML Sequence diagram using IBM's Rhapsody modelling tool.
Expt.14: Configure NetBeans to use JUnit and test code written for the classes and methodsdescribed in the UML.

COMPUTER VISION LAB.

Subject Code: MCSCE1-278	L T P C	Duration: 60 Hrs.
	0 0 4 2	

Programs may be implemented using MATLAB/C/C++/Java/Python on binary/grayscale/color images.
Expt. 1: Implementation of basic image transformations: a. Log b. Power law c. Negation
Expt. 2: Implementation the following:

a) Histogram processing
b) Histogram equalization/matching

Expt. 3: Implementation of piecewise linear transformations
a) Contrast stretching
b) Grey level slicing
c) Bit plane slicing

Expt. 4: Implementation of image enhancement/smoothing using
a) Linear (weighted and non-weighted filters)
b) Order statistics filters (Nonlinear filters) i. Mean ii. Median iii. Min iv. Max v. Average

Expt. 5: Implementation of image enhancement/sharpening using
a) Laplacian operators
b) Sobel's operators
c) Robert's cross operators

Expt. 6: Implement the 2D-DFT to obtain Fourier coefficients and reconstruct the image, i.e.,IDFT.
Expt. 7: Implement image enhancement using Fourier low pass filters,
a) Ideal,
b) Butterworth,
c) Gaussian

Expt. 8: Implement image enhancement using Fourier high pass filters,
a) Ideal,
b) Butterworth,
c) Gaussian

Expt. 9: Implement algorithms to detect the following in an image,
a) Point,
b) Line,
c) Boundary

Expt. 10: Implement Hough transform to detect a line.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of thesame.

MOBILE APPLICATIONS AND SERVICES

Subject Code: MCSCE1-382 **L T P C 3 0 0 3** **Duration: 45 Hrs.**

COURSE OBJECTIVES:

- This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
- It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets
- It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

COURSE OUTCOMES: On completion of the course the student should be able to

CO1 Identify the target platform and users and be able to define and sketch a mobile application
CO2 Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap
CO3 Design and develop a mobile application prototype in one of the platform (challengeproject)

COURSE CONTENT:

UNIT-I (13 HRS.)

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User
More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

UNIT-II (11 HRS)

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony
Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

UNIT-III (11 HRS)

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android
Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

UNIT-IV (10 HRS)

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android
Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT

RECOMMENDED BOOKS:

1. **Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley& Sons**

COMPILER FOR HPC

Subject Code: MCSCE1-383 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The objective of this course is to introduce structure of compilers and high performance compiler design for students. Concepts of cache coherence and parallel loops in compilers areincluded.

COURSE OUTCOMES:

After completion of course, students would be able to:

CO1: Familiar with the structure of compiler.

CO2: Parallel loops, data dependency and exception handling and debugging in compiler.

UNIT–I (11 Hrs)

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph.

Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.

UNIT–II (12 Hrs.)

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations.

Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality**.**

UNIT–III (11 Hrs.)

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers.

Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

UNIT – IV (11 Hrs.)

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Codefor Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics.

Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

RECOMMENDED BOOKS:

1. **Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson**

OPTIMIZATION TECHNIQUES

Subject Code: MCSCE1-384 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

COURSE OBJECTIVES:

The objective of this course is to provide insight to the mathematical formulation of realworld problems.
To optimize these mathematical problems using nature based algorithms. And the solution isuseful especially for NP-Hard problems

COURSE OUTCOMES:

At the end of this course, students will be able to
CO1: Formulate optimization problems.
CO2: Understand and apply the concept of optimality criteria for various types ofoptimization problems.
CO3: Solve various constrained and unconstrained problems in Single variable as well asmultivariable.
CO4: Apply the methods of optimization in real life situation.

UNIT-I (11 Hrs.)

Engineering application of Optimization, Formulation of design problems as mathematicalprogramming problems.
General Structure of Optimization Algorithms, Constraints, The Feasible Region.

UNIT-II (11 Hrs.)

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

UNIT-III (13 Hrs.)

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, AntColony Optimization etc.
Real life Problems and their mathematical formulation as standard programming problems.

UNIT-IV (10 Hrs.)

Recent trends: Applications of ant colony optimization, genetics and linear and quadraticprogramming in real world applications.

RECOMMENDED BOOKS:

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. DynamicIdeas. ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978- 0-8493- 1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387- 92279-9.
7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3- 540-68274-5.
8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer

Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

1ST SEMESTER

Total Contact Hours = 12 Total Marks = 400 Total Credits = 08

1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-101	Power System Analysis	3	0	0	40	60	100	3
MELEE1-103	Power System (Power System Steady State Analysis) Lab-I.	0	0	4	60	40	100	2
	Departmental Elective-I (Select any one)	3	0	0	40	60	100	3
MELEE1-160	Electrical Power Distribution System							
MELEE1-161	Optimization Techniques for Power Engineering							
MELEE1-162	Pulse Width Modulation for PE Converters							
MELEE1-163	Electric and Hybrid Vehicles							
Audit Course (Choose any one)		2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**8**	**0**	**4**	**240**	**160**	**400**	**8**

2nd SEMESTER

Total Contact Hours = 12 Total Marks = 400 Total Credits = 10

2nd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-102	Power System Dynamics-I	3	0	0	40	60	100	3
MRMIP-101	Research Methodology and IPR	2	0	0	40	60	100	2
MELEE1-104	Power System (Renewable Energy) Lab-II.	0	0	4	60	40	100	2
	Departmental Elective-II (Select any one)	3	0	0	40	60	100	3
MELEE1-156	Renewable Energy System and Distributed Generation							
MELEE1-157	Smart Grids							
MELEE1-158	High Power Converters							
MELEE1-159	Wind and Solar Systems							
Total		**8**	**0**	**4**	**180**	**220**	**400**	**10**

3rd SEMESTER

Total Contact Hours = 12 Total Marks = 400 Total Credits = 08

3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-205	Digital Protection of Power System	3	0	0	40	60	100	3
MELEE1-207	Power System Lab.-III (Power System Protection Lab.)	0	0	4	60	40	100	2
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
MELEE1-264	Restructured Power Systems							
MELEE1-265	Advanced Digital Signal Processing							
MELEE1-266	Dynamics of Electrical Machines							
MELEE1-267	Electrical Machine Design							
Audit Course (Choose any one)		2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**8**	**0**	**4**	**240**	**160**	**400**	**8**

Note: Choose any one Audit Course in the table for 3rd semester except the one chosen in 1st semester.

4th SEMESTER

Total Contact Hours = 14 Total Marks = 400 Total Credits = 10

4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-206	Power System Dynamics-II	3	0	0	40	60	100	3
Lab.-IV (Choose any one)								
MELEE1-208	Artificial Intelligence Lab.	0	0	4	60	40	100	2
MELEE1-209	Smart Grid Lab.							
MELEE1-210	Mini Project	0	0	4	60	40	100	2
Departmental Elective-IV (Select any one)								
MELEE1-268	Advanced Micro-Controller Based Systems	3	0	0	40	60	100	3
MELEE1-269	SCADA System and Applications							
MELEE1-270	Power Quality							
MELEE1-271	Artificial Intelligence Techniques							
Total		**6**	**0**	**8**	**200**	**200**	**400**	**10**

NOTE: To make the implementation of the course flexible and economical, Subjects of 1st semester and 3rd semester can be interchanged with each other. Similarly some of the subjects of 2nd semester can be interchanged with some subjects of 4th semester (e.g. Departmental Elective - I with Departmental Elective - IV and Lab - II with Lab - IV), if possible.

5th SEMESTER

Total Contact Hours = 26 Total Marks = 300 Total Credits = 16

5th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-311	Major Project (Phase-I) Dissertation	0	0	20	60	40	100	10
Departmental Elective-V (Select any one)		3	0	0	40	60	100	3
MELEE1-372	Power System Transients							
MELEE1-373	FACTS and Custom Power Devices							
MELEE1-374	Industrial Load Modeling and Control							
MELEE1-375	Dynamics Of Linear Systems							
Open Elective (Select any one from the following list) OR *		3	0	0	40	60	100	3
MELEE1-391	Business Analytics							
MELEE1-392	Industrial Safety							
MELEE1-393	Operations Research							
MELEE1-394	Cost Management of Engineering Projects							
MELEE1-395	Composite Materials							
MELEE1-396	Waste to Energy							
Total		**6**	**0**	**20**	**140**	**160**	**300**	**16**

***(Select any other open elective from the list of PG Open Electives available on the university web site)**

6th SEMESTER

Total Contact Hours = 32 Total Marks = NIL Total Credits = 16

6th Sem		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-412	Major Project (Phase-II) Dissertation	0	0	32	Satisfactory/ unsatisfactory			16

Overall Credits

Semester	Marks	Credits
1st	400	08
2nd	400	10
3rd	400	08
4th	400	10
5th	300	16
6th	--	16
Total	**1900**	**68**

Programme Outcomes of Power Systems Stream:

PO1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in power sector with a global perspective.
PO2: Ability to critically analyze and carry out detailed investigation on multifaceted complex Problems in area of Power Systems and envisage advanced research in thrust areas.
PO3: Ability to identify, analyze and solve real-life engineering problems in the area of Power Systems and provide strategic solutions satisfying the safety, cultural, societal and environmental aspects/ needs.
PO4: Ability for continued pursuance of research and to design, develop and propose theoretical and practical methodologies towards research and development support for the Power System infrastructure.
PO5: Ability to develop and utilize modern tools for modeling, analyzing and solving various Engineering problems related to Power Systems.
PO6: Willingness and ability to work in a team of engineers/ researchers with mutual understandings to take unsophisticated challenges, in the field of Power Systems, lead and motivate the group to inculcate multi-disciplinary and collaborative approach.
PO7: Willingness and ability to take up administrative challenges including the management of various projects of interdisciplinary nature and carry out the same in an efficient manner giving due consideration to societal, environmental, economic and financial factors.
PO8: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

POWER SYSTEM ANALYSIS

Subject Code: MELEE1-101 **L T P C 3 0 0 3** **Duration: 40 Hrs.**

Course Objectives: Students will be able to:
1. Study various methods of load flow and their advantages and disadvantages.
2. Understand how to analyze various types of faults in power system.
3. Understand power system security concepts and study the methods to rank the contingencies.
4. Understand need of state estimation and study simple algorithms for state estimation.
5. Study voltage instability phenomenon.

UNIT-I (8 Hrs.)

Load Flow: Overview of Newton-Raphson, Gauss-Siedel, Fast decoupled methods, convergence properties, sparsity techniques, handling Q- max violations in constant matrix, inclusion of frequency effects. AVR in load flow, handling of discrete variables in load flow.

UNIT-II (8 Hrs.)

Fault Analysis: Simultaneous faults, open conductor faults. Generalized method of fault analysis.

UNIT-III (8 Hrs.)

Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, Overload index ranking.

UNIT-IV (8 Hrs.)

State Estimation: Sources of errors in measurement, Virtual and pseudo measurement, Observability, Tracking state estimation. WSL method, bad data correction.

UNIT-V (8 Hrs.)

Voltage Stability: Voltage collapse, P-V curve, optimal power flow solution, continuation power flow, voltage collapse proximity indices.

Recommended Books:

1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', McGraw Hill, **2003**.
2. R. Bergen and Vijay Vittal, 'Power System Analysis', Pearson, **2000**.
3. L.P. Singh, 'Advanced Power System Analysis and Dynamics', New Age International, **2006**.
4. G.L. Kusic, 'Computer aided Power System Analysis', Prentice Hall India, **1986**.
5. A.J. Wood, 'Power Generation, Operation and Control', John Wiley, **1994.**
6. P.M. Anderson, 'Faulted Power System Analysis', IEEE Press, **1995**.

Course Outcomes: Students will be able to:
1. Able to calculate voltage phasor at all buses, given the data using various methods of load flow.
2. Able to calculate fault currents in each phase.
3. Rank various contingencies according to their severity.
4. Estimate the bus voltage phasor given various quantities viz. power flow, voltages, taps, CB status etc.
5. Estimate closeness to voltage collapse and calculate PV curves using continuation power flow.

POWER SYSTEM DYNAMICS-I

Subject Code: MELEE1-102 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:
1. Study of system dynamics and its physical interpretation.
2. Development of mathematical models for synchronous machine.
3. Modelling of induction motor.

UNIT-I (10 Hrs.)

Synchronous Machines: Per unit systems, Park's Transformation (modified), Flux-linkage equations, power angle characteristics during steady state and transient state, Significance of SCR.

UNIT-II (8 Hrs.)

Voltage and current equations, torque equation, Formulation of State-space equations, Equivalent circuit.

UNIT-III (8 Hrs.)

Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines, synchronous machine dynamics (Electromechanical transients).

UNIT-IV (8 Hrs.)

Small Signal Model: Introduction to frequency model, Excitation systems and Philips-Heffron model, Power System Stabilizer, Load modeling.

UNIT-V (6 Hrs.)

Modeling of Induction Motors: Prime mover controllers, Induction motor dynamics during starting and breaking.

Recommended Books:

1. P.M. Anderson & A.A. Fouad, 'Power System Control and Stability', Galgotia, New Delhi, **1981.**
2. J. Machowski, J. Bialek and J.R.W. Bumby, 'Power System Dynamics and Stability', John Wiley & Sons, **1997.**
3. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc.,**1994**.
4. E.W. Kimbark, 'Power System Stability', Vol.-I & III, John Wiley & Sons, New York, **2002**.

Course Outcomes: Students will be able to:
1. Understand the modeling of synchronous machine in details.
2. Carry out simulation studies of power system dynamics using MATLAB-SIMULINK, MI POWER.
3. Carry out stability analysis with and without power system stabilizer (PSS).
4. Understand the load modelling in power system.

RESEARCH METHODOLOGY AND IPR

Subject Code: MRMIP0-101 **L T P C** **Duration: 28 Hrs.**
2 0 0 2

Course Objectives:
To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

Course Outcomes: At the end of this course, students will be able to:

CO1: Understand research problem formulation, analyze research related information, Follow research ethics.

CO2: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO3: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO4: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I (7 Hrs.)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II (7 Hrs.)

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III (7 Hrs.)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Introduction to international Scenario on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

UNIT-IV (7 Hrs.)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

New Developments in IPR: Administration of Patent System. New developments in IPR: introduction to IPR of Biological Systems, Computer Software etc. Traditional Knowledge Case Studies, IPR or IITs.

Recommended Books:

1. Stuart Melville and Wayne Goddard, 'Research methodology: An Introduction for Science & Engineering Students'.
2. Wayne Goddard and Stuart Melville, 'Research Methodology: An Introduction'.
3. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., **2007**.
5. Mayall , 'Industrial Design', McGraw Hill, **1992**.
6. Niebel , 'Product Design', McGraw Hill, **1974**.
7. Asimov, 'Introduction to Design', Prentice Hall, **1962**.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', **2016**.
9. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, **2008.**

POWER SYSTEM (POWER SYSTEM STEADY STATE ANALYSIS) LAB-I.

Subject Code: MELEE1-103 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS

1. Simulation of IGBT Inverters.
2. Simulation of Thyristor Converters.
3. Transient Stability Studies.
4. Short Circuit Studies.
5. Load Flow and optimal load flow Studies.
6. Load Flow and optimal load flow Studies.
7. Simulation of automatic generation control.

POWER SYSTEM (RENEWABLE ENERGY) LAB-II.

Subject Code: MELEE1-104 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS

1. Power Curves.
2. Build a Wind Farm.
3. Test the Capabilities of the Hydrogen Fuel Cells and Capacitors.
4. Effect of Temperature on Solar Panel Output.
5. Variables Affecting Solar Panel Output.
6. Effect of Load on Solar Panel Output.
7. Wind Turbine Output: The Effect of Load.
8. Test the Capabilities of Solar Panels and Wind Turbines.

RENEWABLE ENERGY SYSTEM & DISTRIBUTED GENERATION

Subject Code: MELEE1-156 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:
1. To learn various renewable energy sources.
2. To gain understanding of integrated operation of renewable energy sources.
3. To understand Power Electronics Interface with the Grid.
4. To understand about Distributed Generation.

UNIT-I (8 Hrs.)

Introduction to Renewable Energy Resources: Types, Advantages, Limitations & scope of renewable energy resources.
Solar Energy: Basic principles and energy conversion schemes.
Wind Energy: Introduction, Basic principles & energy conversion schemes, Major components, Electrical wind generators and their analysis.

UNIT-II (4 Hrs.)

Hydro Energy: Site selection, Types of power stations, Major components & their working.
Biomass Energy: Biogas generation, Types of biogas plants.

UNIT-III (8 Hrs.)

Tidal Energy: Basic principles of tidal energy, Tidal power generation systems.
Wave Energy: Wave energy conversion devices, Advantages and Disadvantages of wave energy.
Geothermal Energy: Origin and nature of geothermal energy; Classification of geothermal resources; Schematic of geothermal power plants.
Fuel Cells: Schematic of fuel cell, Characteristics, Working of different types of fuel cells.

UNIT-IV (10 Hrs.)

Distributed Generation: Introduction, Distributed v/s central station generation, Technologies of distributed generation as sources of energy such as Micro-turbines, Micro combined heat power, Rooftop solar PV, Solar and wind hybrid system, Impact of distributed generation on power grid reliability.

UNIT-V (10 Hrs.)

Distributed Generators: Introduction, Various types of distributed generators, such as, Permanent magnet generator, Self-excited Induction generators, Power Electronic Interface of distributed Generators with the Grid, Analysis of Effect of Distributed Generation on Transmission System Operation, Protection of Distributed Generators, Economics Issues of Distributed Generation, Case Studies on distributed generations for electric vehicle and energy storage integration.

Recommended Books:

1. D.P. Kothari, K.C. Singal and Ranjan Rakesh, 'Renewable Energy Sources and Emerging Technologies', 2nd Edn., Prentice Hall of India, **2011**.
2. Math H. Bollen, Fainan Hassan, 'Integration of Distributed Generation in the Power System', Wiley-IEEE Press, **2011**.
3. Loi Lei Lai, Tze Fun Chan, 'Distributed Generation: Induction and Permanent Magnet Generators', Wiley-IEEE Press, **2007**.
4. A. Roger, Messenger and Jerry Ventre, 'Photovoltaic System Engineering', 3rd Edn., **2010.**
5. James F. Manwell, Jon G. McGowan and Anthony L. Rogers, 'Wind Energy Explained: Theory Design and Application', 2nd Edn., John Wiley and Sons **2010**.

Course Outcomes: Students will be able to:

1. Know about various renewable energy sources.
2. Understand the working of distributed generation system in autonomous/grid connected modes.
3. Know the Impact of Distributed Generation on Power System.

SMART GRIDS

Subject Code: MELEE1-157 **L T P C** **3 0 0 3** **Duration: 40 Hrs.**

Course Objectives: Students will be able to:

1. Understand concept of Smart Grid and its Advantages over Conventional Grid.
2. Know Smart Metering Techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

UNIT-I (7 Hrs.)

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions and Necessity of Smart Grid, Concept of Robust & Self-Healing Grid, Present Development & International Policies in Smart Grid.

UNIT-II (7 Hrs.)

Introduction to Smart Meters: Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation.

UNIT-III (7 Hrs.)

Smart Grid Technologies: Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, Superconducting Magnetic Energy Storage (SMES), Pumped Hydro, Compressed Air Energy Storage (CAES), Wide Area Measurement System(WAMS), Phase Measurement

Unit (PMU).

UNIT-IV (7 Hrs.)

Micro-Grid: Concept, Necessity & Applications of Micro-Grid, Formation of Micro-Grid, Issues of Interconnection, Operation, Control & Protection of Micro-Grid. Plastic & Organic solar cells, Thin film solar cells, Variable Speed Wind Generators, Fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

UNIT-V (6 Hrs.)

Power Quality: Electromagnetic Compatibility (EMC) of Smart Grid, Power Quality Issues of Grid Connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT-VI (6 Hrs.)

Communications in Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network, Communication through GPRS and Power Line Carrier Communication, Internet of Things (IoT) based Protocols.

Recommended Books:

1. Ali Keyhani, 'Design of Smart Power Grid Renewable Energy Systems', 2nd Edn., Wiley IEEE Press.
2. Clark W. Gellings, 'The Smart Grid: Enabling Energy Efficiency and Demand Response', CRC Press, **2009**.
3. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu and Nick Jenkins, 'Smart Grid: Technology and Applications', Wiley Online Library, **2012**.
4. Stuart Borlase, 'Smart Grid: Infrastructure, Technology and solutions', CRC Press.

Course Outcomes:

Students will be able to:

1. Appreciate the difference between Smart grid & Conventional grid.
2.
3. Apply smart metering concepts to industrial and Commercial Installations.
4. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
5. Come up with smart grid solutions using modern communication technologies.

HIGH POWER CONVERTERS

Subject Code: MELEE1-158 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

Course Objectives: Students will be able to:

1. Understand the requirements of high power rated converters.
2. Understand the different topologies involved for these converters.
3. Able to understand the design of protection circuits for these converters.

UNIT-I (8 Hrs.)

Power Electronic Systems: Power semiconductors devices and circuits, Characteristics and specification of switches, Phase shifting transformer.

Multi-Pulse Diode Rectifier: Multiphase star rectifier, three phase bridge rectifier, three phase bridge rectifier with RL load, three phase rectifier with a highly inductive load, Rectifier circuit design, output voltage with LC filter.

UNIT-II (6 Hrs.)

Multi-Pulse SCR Rectifier: Three-phase full converters with *RL* load, Twelve –pulse converters, Effect of load and source inductance.

UNIT-III (8 Hrs.)

Multilevel Inverters: Introduction, Multilevel concept, Types of multilevel inverters such as: diode clamped multilevel inverter, Flying-Capacitor multilevel inverter, Cascaded multilevel inverter, Applications, PWM current source inverters.

UNIT-IV (4 Hrs.)

DC-DC Converter: Introduction, performance parameter of DC-DC converters, Switching mode regulators such as: Buck, Boost and Buck-Boost regulators.

UNIT-V (8 Hrs.)

AC Voltage Controllers: Introduction, performance parameters of AC voltage controllers, single phase full wave controller with resistive loads and inductive loads, three phase full wave controllers, three phase full wave delta connected controllers, Single phase and three phase Cyclo-converters, Matrix converter.

Un-interruptible Power Supply (UPS): Switched mode DC and AC power supplies.

UNIT-VI (6 Hrs.)

Protection of Devices and Circuits: Introduction, Cooling and heat sinks, Thermal modeling of power switching devices, Snubber circuit, Reverse recovery transients, supply and load side transients, Voltage protection by selenium diodes and metal oxide varistors, Current protections, fusing, fault current with AC & DC source.

Recommended Books:

1. N. Mohan, T.M. Undeland and W.P. Robbins, 'Power Electronics: Converter, Applications and Design', John Wiley and Sons, **1989.**
2. P.S. Bhimbra, 'Power Electronics', Khanna Publishers, **2012.**
3. M.H. Rashid, 'Power Electronics', Pearson/Prentice Hall, **2004.**
4. B.K. Bose, 'Power Electronics and A.C. Drives', Prentice Hall, **1986.**
5. Bin Wu, 'High Power Converters and Drives', IEEE Press, Wiley Interscience.

Course Outcomes: Students will be able to:

1. Learn the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems.
2. Knowledge of working of multi-level VSIs, DC-DC switched mode converters, Cyclo-converters and PWM techniques and the ability to use them properly.
3. Acquire knowledge of power conditioners and their applications.
4. Ability to design power circuit and protection circuit of PSDs and converters.

WIND AND SOLAR SYSTEMS

Subject Code: MELEE1-159 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

Course Objectives: Students will be able to:

1. To get exposure to wind and solar systems.
2. To understand the factors involved in installation and commissioning of a Solar or Wind plant.
3. Learning the dynamics involved when interconnected with power system grid.

UNIT-I (7 Hrs.)

Historical development and current status, characteristics of wind power generation, network integration issues.

UNIT-II (7 Hrs.)

Generators and power electronics for wind turbines, power quality standards for wind turbines, Technical regulations for interconnections of wind farm with power systems.

UNIT-III (7 Hrs.)

Isolated wind systems, reactive power and voltage control, Economic aspects.

UNIT-IV (7 Hrs.)

Impacts on power system dynamics, power system interconnection.

UNIT-V (6 Hrs.)

Introduction of solar systems, Merits and demerits, concentrators, various applications.

UNIT-VI (6 Hrs.)

Solar thermal power generation, PV power generation, Energy Storage device, Designing the solar system for small installations.

Recommended Books:

1. Thomas Ackermann, Editor, 'Wind Power in Power Systems', John Willy and Sons Ltd, , **2005**.
2. Siegfried Heier, 'Grid Integration of Wind Energy Conversion Systems', John Willy and Sons Ltd., **2006**.
3. K. Sukhatme and S.P. Sukhatme, 'Solar Energy', Tata McGraw Hill, 2nd Edn., **1996.**

Course Outcomes: Students will be able to:

1. Appreciate the importance of energy growth of the power generation from the renewable energy sources and participate in solving these problems.
2. Demonstrate the knowledge of the physics of wind power and solar power generation and all associated issues so as to solve practical problems.
3. Demonstrate the knowledge of physics of solar power generation and the associated issues Identify, formulate and solve the problems of energy crises using wind and solar energy.

ELECTRIC POWER DISTRIBUTION SYSTEM

Subject Code: MELEE1-160 **L T P C** **3 0 0 3** **Duration: 40 Hrs.**

Course Objectives: Students will be able to:

1. Learning about power distribution system.
2. Learning of SCADA System.
3. Understanding Distribution Automation.

UNIT-I (8 Hrs.)

Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power system loading, Technological forecasting.

UNIT-II (8 Hrs.)

Advantages of Distribution Management System (D.M.S.) Distribution Automation: Definition, Restoration/Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction.

UNIT-III (8 Hrs.)

Interconnection of Distribution, Control & Communication Systems, Remote Metering, Smart meter and Automatic Meter Reading and its implementation.

UNIT-IV (8 Hrs.)

Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring.

UNIT-V (8 Hrs.)

Maintenance of Automated Distribution Systems: Difficulties in Implementing Distribution, Automation in Actual Practice, Urban/Rural Distribution, Energy Management, introduction to AI techniques applied to Distribution Automation.

Recommended Books:

1. A.S. Pabla, 'Electric Power Distribution', 4th Edn., Tata McGraw Hill Publishing Co. Ltd.
2. M.K. Khedkar, G.M. Dhole, 'A Text Book of Electrical Power Distribution Automation', University Science Press, New Delhi.
3. Anthony J. Panseni, 'Electrical Distribution Engineering', CRC Press.
4. James Momoh, 'Electric Power Distribution, Automation, Protection & Control', CRC Press.

Course Outcomes: Students will be able to:
1. Understand of power distribution system.
2. Study of Distribution automation and its application in practice.
3. To learn SCADA system.

OPTIMIZATION TECHNIQUES FOR POWER ENGINEERING

Subject Code: MELEE1-161 **L T P C 3 0 0 3** **Duration: 40 Hrs.**

Course Objectives: -Students will be able to:
1. To understand the relevance of mathematical methods to solve engineering problems.
2. To understand how to apply these methods for a given engineering problem.

UNIT-I (4 Hrs.)

Introduction to Optimization: Statement of an optimization problem, Classification of optimization problems, Optimization techniques, Engineering applications of optimization, Single variable optimization, Multivariable optimization with no constraints.

UNIT-II (6 Hrs.)

Linear Programming: Standard form of linear programming, Simplex method, Computer implementation of the Simplex method, Duality theory.
Transportation Problem: North-West Corner rule, least cost method, Vogel approximation method, testing for optimality.

UNIT-III (7 Hrs.)

Non-Linear Programming: One–Dimensional Minimization Methods: Unimodal function, Dichotomous search, Fibonacci search, Golden Section, Cubic interpolation method, Direct root, Newton Raphson Method.

UNIT-IV (7 Hrs.)

Unconstrained Multivariable Optimization Techniques: Random search method, Steepest descent method, Conjugate gradient method, Newton Raphson Method, Evolutionary search, Hooke-Jeeves Method, Simplex search Method.

UNIT-V (8 Hrs.)

Constrained Optimization Techniques: Interior Penalty function method, Exterior penalty function method, Method of Multipliers, KKT Conditions.

UNIT-VI (8 Hrs.)

Further Topics in Optimization: Critical path method (CPM), Program evaluation and review technique (PERT), Multi-objective Optimization Techniques, Weighting method, ε-constraint method. Simulated annealing method, Genetic Algorithm, Particle swarm optimization.

Recommended Books:

1. S.S. Rao, 'Optimization: Theory and Application', Wiley Eastern Press, 2nd Edn., **1984**.
2. Deb Kalyanmoy, 'Optimisation for Engineering Design - Algorithms and Examples', Prentice Hall India, **1998.**
3. H.A. Taha, 'Operations Research - An Introduction', Prentice Hall of India, **2003**.
4. R.L. Fox, 'Optimization Methods for Engineering Design', Addition Welsey, **1971**.
5. A. Ravindran, K.M. Ragsdell and G.V. Reklaitis, 'Engineering Optimization: Methods and Applications', Wiley, **2008**.
6. Godfrey C. Onwubolu, B.V. Babu, 'New Optimization Techniques in Engineering', Springer, **2004**.
7. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', Prentice-Hall of India, **2010**.

Course Outcomes: Students will be able to:

1. Knowledge about vector spaces, linear transformation, Eigen values and Eigen vectors of linear operators.
2. To learn about linear programming problems and understanding the simple method for solving linear programming problems in various fields of science and technology.
3. Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems.
4. Understanding the concept of random variables, functions of random variable and their probability distribution.
5. Understand stochastic processes and their classification.

PULSE WIDTH MODULATION FOR POWER ELECTRONICS CONVERTERS

Subject Code: MELEE1-162 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:

1. To understand Necessity and Importance of PWM techniques.
2. Implementation of PWM controllers.

UNIT-I (8 Hrs.)

Introduction to Power Electronics Converters:

Modulation of One Inverter Phase Leg: Fundamental concepts of PWM, Evaluation of PWM schemes, Naturally sampled PWM, PWM analysis by duty cycle variation, Regular sampled PWM, Direct modulation.

Modulation of Single-phase Voltage Source Inverter: Topology of a single phase inverter, Three level modulation of a single phase inverter, Harmonic losses.

Modulation of Three-phase Voltage Source Inverter: Topology of three phase inverter (VSI), Three phase modulation with sinusoidal references, harmonic losses, discontinues modulation.

UNIT-II (8 Hrs.)

Zero Space Vector Placement Modulation Strategies: Space vector modulation, Harmonic losses for SVM, Placement of the Zero space vector, Discontinuous modulation (120,60,30 degree), Harmonic losses for discontinuous PWM.

Modulation of Current Source Inverter: Three phase modulators as state machines, Naturally sampled CSI space vector modulator.

UNIT-III (8 Hrs.)

Over modulation of an Inverter: The over modulation region, naturally sampled and regularly sampled over modulation of one phase leg of an inverter, naturally sampled over modulation of single-phase and three-phase inverters.

Programmed Modulation Strategies: optimized space vector modulation, harmonic elimination PWM, Performance Index for optimality, Optimum PWM, Minimum loss PWM.

UNIT-IV (6 Hrs.)

Pulse Width Modulation for Multilevel Inverters: PWM of cascaded single phase H-bridges, over modulation of cascaded H bridges, PWM alternatives for diode-clamped multilevel inverters, three level naturally sampled PD PWM, over modulation of three level inverters, five level PWM for diode clamped inverters. PWM of higher level inverters.

UNIT-V (4 Hrs.)

Implementation of Modulation Controller: Overview of a power electronic conversion system, Elements of a PWM converter system, Hardware implementation of the PWM process, PWM software implementation.

UNIT-VI (6 Hrs.)

Continuing Developments in Modulation: Random PWM, PWM Rectifier with Voltage unbalance, Effect of minimum pulse width, PWM Dead-Time compensation.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Recommended Books:

1. D. Grahame Holmes, Thomas A. Lipo, 'Pulse width modulation of Power Converter: Principles and Practice', John Wiley & Sons, **2003.**
2. Bin Vew, 'High Power Converter', Wiley Publication.
3. Marian K. Kazimicrczuk, 'Pulse Width modulated dc-dc Power Converter', Wiley Publication.

Course Outcomes: Students will be able to:

1. Appreciate importance of PWM techniques.
2. Implement PWM using different strategies.
3. Control CSI and VSI using PWM.
4. Compare performance of converter for different PWM techniques.

ELECTRIC AND HYBRID VECHILES

Subject Code: MELEE1-163	L T P C 3 0 0 3	Duration: 40 Hrs.

UNIT-I (7 Hrs.)

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, Mathematical models to describe vehicle performance.

UNIT-II (7 Hrs.)

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-Trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT-III (7 Hrs.)

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

UNIT-IV (6 Hrs.)

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT-V (6 Hrs.)

Sizing the Drive System: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology.

UNIT-VI (7 Hrs.)

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies.

Recommended Books:

1. Sira -Ramirez, R. Silva Ortigoza, 'Control Design Techniques in Power Electronics Devices', Springer.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, 'Sliding Mode Control of Switching Power Converters'.

Course Outcomes: Students will be able to:
1. Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. To learn electric drive in vehicles/traction.

ENGLISH FOR RESEARCH PAPER WRITING

Subject Code: MHUMA-101 **L T P C** **2 0 0 0** **Duration: 30 Hrs.**

Course Objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

UNIT-I

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-II

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT-III

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Recommended Books:

1. R. Goldbort, 'Writing for Science', Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses, Vol.-I, **2006**.
2. R. Day, 'How to Write and Publish a Scientific Paper', Cambridge University Press, **2006**.
3. N. Highman, 'Handbook of Writing for the Mathematical Sciences', SIAM. Highman's Book, **1998**.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, **2011**.

DISASTER MANAGEMENT

Subject Code: MCIVE0-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I

Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-II

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-III

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Recommended Books:

1. R. Nishith, A.K. Singh, 'Disaster Management in India: Perspectives, Issues and Strategies', New Royal Book Company, Model Curriculum of Engineering & Technology PG Courses, Vol.-I.
2. Sahni, Pardeep et. al.(Eds.), 'Disaster Mitigation Experiences and Reflections', Prentice Hall of India, New Delhi.
3. S.L. Goel, 'Disaster Administration and Management, Text and Case Studies', Deep & Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE

Subject Code: MHUMA0-102 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature

Alphabets in Sanskrit, Past/Present/Future Tense
Simple Sentences
Order
Introduction of roots
Technical information about Sanskrit Literature
Technical concepts of Engineering-Electrical, Mechanical
Architecture, Mathematics

Recommended Books:

1. Vishwas, 'Abhyaspustakam', Samskrita-Bharti Publication, New Delhi.
2. 'Teach Yourself Sanskrit', Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi, Publication.
3. Suresh Soni, 'India's Glorious Scientific Tradition', Ocean Books Pvt. Ltd., New Delhi.

Course Outcomes:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students.

VALUE EDUCATION

Subject Code: MHUMA0-103 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

UNIT-I

Content Hours Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

UNIT-II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism, Love for nature, Discipline.

UNIT-III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV

Character and Competence –Holy books vs Blind faith, Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women.
All religions and same message, mind your Mind, Self-control, Honesty, Studying effectively.

Recommended Books:

1. S.K. Chakroborty, 'Values and Ethics for Organizations Theory and Practice', Oxford University Press, New Delhi.

Course Outcomes: Students will be able to
1. Knowledge of self-development.
2. Learn the importance of Human values.
3. Developing the overall personality.

CONSTITUTION OF INDIA

Subject Code: MHUMA0-104 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-1

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working). Philosophy of the Indian Constitution: Preamble Salient Features

UNIT-II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
Pachayati Raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments),
Village Level: Role of Elected and Appointed officials, importance of grass root democracy
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Recommended Books:
1. 'The Constitution of India', (Bare Act), Government Publication, **1950**.
2. S.N. Busi, B.R. Ambedkar, 'Framing of Indian Constitution', 1st Edn., **2015**.
3. M.P. Jain, 'Indian Constitution Law', 7th Edn., Lexis Nexis, **2014**.
4. D.D. Basu, 'Introduction to the Constitution of India', Lexis Nexis, **2015**.

Course Outcomes:
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. Discuss the

circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. 4. Discuss the passage of the Hindu Code Bill of 1956.

PEDAGOGY STUDIES

Subject Code: MHUMA0-105 **L T P C** **2 0 0 0** **Duration: 30 Hrs.**

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal, classrooms in developing countries. Curriculum, Teacher education.

UNIT-II

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-III

Professional Development: alignment with classroom practices and follow- up, support Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT IV

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Recommended Books:

1. J. Ackers, F. Hardman, 'Classroom Interaction in Kenyan Primary Schools, Compare', 31 (2): 245-261, **2001**.
2. M. Agrawal, 'Curricular Reform in Schools: The Importance of Evaluation, Journal of Curriculum Studies', 36 (3): 361-379, **2004**.
3. K. Akyeampong, 'Teacher Training in Ghana - Does it Count?', Multi-site Teacher Education Research Project (MUSTER) Country Report 1. London: DFID, **2003**.
4. K. Akyeampong, K. Lussier, J. Pryor, J. Westbrook, 'Improving Teaching and Learning of basic Maths and Reading in Africa: Does Teacher Preparation Count?', International Journal Educational Development, 33 (3): 272–282, **2013**.
5. R.J. Alexander, 'Culture and Pedagogy: International Comparisons in Primary Education, Oxford and Boston', Blackwell, **2001**.
6. M. Chavan, 'Read India: A Mass Scale, Rapid, 'Learning to Read' Campaign, **2003**.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes: Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

STRESS MANAGEMENT BY YOGA

Subject Code: MHUMA0-106 | **L T P C 2 0 0 0** | **Duration: 30 Hrs.**

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

UNIT-I

Definitions of Eight parts of Yog. (Ashtanga)

UNIT-II

Yam and Niyam. Do`s and Don'ts in life:

a) Ahinsa, satya, astheya, bramhacharya and aparigraha
b) Shaucha, santosh, tapa, swadhyay, ishwar pranidhan

UNIT-III

Asan and Pranayam:

a) Various yog poses and their benefits for mind & body
b) Regularization of breathing techniques and its Effects-Types of pranayam

Recommended Books:

1. 'Yogic Asanas for Group Tarining', Part-I, Janardan Swami Yogabhyasi Mandal, Nagpur.
2. 'Rajayoga or Conquering the Internal Nature', Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Subject Code: MHUMA0-107 | **L T P C 2 0 0 0** | **Duration: 30 Hrs.**

Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course Outcomes:

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

UNIT-I

Neetisatakam-Holistic development of personality Verses- 19, 20, 21, 22 (wisdom), Verses- 29, 31, 32 (pride & heroism) Verses- 26,28,63,65 (virtue), Verses- 52, 53, 59 (dont's), Verses- 71, 73, 75, 78 (do's)

UNIT-II

Approach to day to day work and duties.2 Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48

UNIT-III

Statements of basic knowledge.3 Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter 2-Verses 17, Chapter 3-Verses 36, 37, 42, Chapter 4-Verses 18, 38, 39, Chapter18 – Verses 37, 38, 63

Recommended Books:

1. 'Srimad Bhagavad Gita', Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. 'Bhartrihari's Three Satakam (Niti-sringar-vairagya)', P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

DIGITAL PROTECTION OF POWER SYSTEM

Subject Code: MELEE1-205 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

UNIT-1 (6 Hrs.)

Evolution of digital relays from electromechanical relays**,** Performance and operational characteristics of digital protection**,** Recent Advances in Digital Protection of Power Systems.

UNIT-II (10 Hrs.)

Mathematical background to protection algorithms, Interpolation formulae, Forward, backward and central difference interpolation, Curve fitting and smoothing, Finite difference techniques, Numerical differentiation, Differential equation based algorithms, Sample and first derivative (Mann and Morrison) algorithm, least squares method and its algorithms.

UNIT-III (10 Hrs.)

Fourier analysis, Fourier series and Fourier transform, Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm, Walsh function analysis and its algorithm, Sinusoidal wave based algorithms**,** Traveling Wave based Techniques.

UNIT-IV (14 Hrs.)

Basic elements of digital protection**,** Signal conditioning, transducers, surge protection, analog filtering, analog multiplexers**,**

Conversion subsystem: the sampling theorem, signal aliasing**,** Error, sample and hold circuits, multiplexers, analog to digital conversion**,** Digital filtering concepts

Digital relay as a unit consisting of hardware and software, Digital differential protection of Transformers, Digital Differential Protection of Lines.

Recommended Books:

1. A.G. Phadke and J.S. Thorp, 'Computer Relaying for Power Systems', Wiley/Research Studies Press, **2009.**
2. A.T. Johns and S.K. Salman, 'Digital Protection of Power Systems', IEEE Press, **1999.**
3. Gerhard Zeigler, 'Numerical Distance Protection', Siemens Publicis Corporate Publishing, **2006.**
4. S.R. Bhide, 'Digital Power System Protection', PHI Learning Pvt. Ltd., **2014.**

5. T.S. Madhava Rao, 'Power System Protection: Static Relays: with Microprocessor Applications', **2017.**

Course Objectives: To make the students familiar to:
1. Study of numerical relays
2. Developing mathematical approach towards protection
3. Study of algorithms for numerical protection

Course Outcomes: Students will be able to:
1. Learn the importance of Digital Relays.
2. Apply Mathematical approach towards protection.
3. Learn to develop various Protection algorithms.

POWER SYSTEM DYNAMICS-II

Subject Code: MELEE1-206 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit - I (8 Hrs.)

Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Stability (Low Frequency Oscillations) of Unregulated and Regulated System

Unit-II (12 Hrs.)

Large Signal Rotor Angle Stability, Dynamic Equivalents and Coherency, Direct Method of Stability Assessment, Stability Enhancing Techniques, Asynchronous Operation and Resynchronization, Multi-Machine Stability.

Unit-III (10 Hrs.)

Effect of Damper winding, Flux Linkage Variation and Automatic Voltage Regulator, Dynamic Analysis of Voltage Stability, Voltage Collapse.

Unit-IV (10 Hrs.)

Frequency Stability, Automatic Generation Control, Primary and Secondary Control, Sub-Synchronous Resonance and Counter Measures

Recommended Books:

1. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc, **1994.**
2. J. Machowski, Bialek, Bumby, 'Power System Dynamics and Stability', John Wiley & Sons, **1997.**
3. L. Leonard Grigsby (Ed.), 'Power System Stability and Control', 2nd Edn., CRC Press, **2007.**
4. V. Ajjarapu, 'Computational Techniques for voltage stability assessment & control', Springer, **2006.**

Course Objectives: To introduce the students to:
1. Study of power system dynamics
2. Interpretation of power system dynamic phenomena
3. Study of various forms of stability

Course Outcomes: Students will be able to:
1. Gain valuable insights into the phenomena of power system including obscure ones.
2. Understand the power system stability problem.
3. Analyse the stability problems and implement modern control strategies.
4. Simulate small signal and large signal stability problems.

POWER SYSTEM LAB. - III (POWER SYSTEM PROTECTION LAB.)

Subject Code: MELEE1-207 **L T P C**
0 0 4 2

List of Experiments

1. Introduction to Power System Protection.
2. Impact of Induction Motor Starting on Power System.
3. Modeling of Differential Relay using MATLAB.
4. Radial Feeder Protection.
5. Parallel Feeder Protection.
6. Principle of Reverse Power Protection.
7. Differential Protection of Transformer.
8. To study time vs. voltage characteristics of over voltage induction relay.
9. To study the characteristics of CT saturation.

POWER SYSTEM LAB. - IV (ARTIFICIAL INTELLIGENCE LAB)

Subject Code: MELEE1-208 **L T P C**
0 0 4 2

List of Experiments

1. Write A Program for Best Fit Search.
2. Write A Program to Generate the output for A* Algorithm.
3. Write a Program To Show the Tic Tac Toe Game for 0 and X.
4. Write A Program For Expert System By Using Forward Chaining.
5. Comparing the Search Methods.
6. Implement the Greedy Search Algorithm.
7. Implement the min-max Algorithm.
8. Adding a Heuristic.

POWER SYSTEM LAB. - IV (SMART GRID LAB.)

Subject Code: MELEE1-209 **L T P C**
0 0 4 2

List of Experiments

1. To study the components of smart grid.
2. To analyse the geographic information system for smart grid.
3. Formation of micro grid, protection and control of grid.
4. Understand power quality issues in grid connected renewable energy sources.
5. Performance analysis of smart meters.

MINI PROJECT

Subject Code: MELEE1-210 **L T P C**
0 0 4 2

The object of Mini Project is to enable the student to take up investigative study in the broad field of Electrical Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis under the guidance of a supervisor from the department alone or jointly with a supervisor drawn from R&D laboratory/Industry. This is expected to provide a good initiation for the student in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic.
2. Define the objective, formulate the problem and prepare an action plan for conducting the investigation.
3. Then perform the required Experiment/Develop a Simulation Model/Solve the Problem/Develop a Design/Explore the feasibility/Conduct a survey etc. depending upon the action plan.
4. Analyse the results and prepare a written report on the study conducted for presentation to the Department.
5. Final seminar, as oral presentation before a departmental committee.

RESTRUCTURED POWER SYSTEMS

Subject Code: MELEE1-264 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Units-I (8 Hrs.)

Fundamentals of restructured system, Market architecture, Load elasticity**,** Social welfare maximization.

Unit-II (12 Hrs.)

Mathematical Modeling of optimal power flow problem and its solution in restructured electricity markets, Locational marginal price (LMP) Energy, loss and congestion components of LMP.

Unit-III (8 Hrs.)

Congestion management and its methods, Strategic bidding, Risk assessment, Hedging, Transmission pricing and its methods, Tracing of power.

Unit-IV (12 Hrs.)

Ancillary services, Standard market design, distributed generation in restructured markets, Working of restructured power systems, IT applications in restructured markets, Recent developments of restructuring in India, International scenario of restructured power systems.

Recommended Books:

1. Lorrin Philipson, H. Lee Willis, 'Understanding Electric Utilities and De-regulation', Marcel Dekker, **1998**.
2. Steven Stoft, 'Power System Economics: Designing Markets for Electricity', John Wiley and Sons, **2002**.
3. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, 'Operation of Restructured Power Systems', Kluwer Academic Pub., **2001**.
4. Mohammad Shahidehpour, Muwaffaq Alomoush, 'Restructured Electrical Power Systems: Operation, Trading and Volatility', Marcel Dekker.
5. Loi Lee Lei, 'Power system Restructuring and Deregulation', John Wiley & Sons, Ltd., **2002**.

Course Objectives: To make the students to:

1. Understand about the restructuring of the electricity market
2. Understand about the need for deregulation of the electricitymarket
3. Understand about the money, power & information flow in a deregulated power system

Course Outcomes:

Students will be able to:

1. Describe various types of regulations in power systems.
2. Identify the need of regulation and deregulation.
3. Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
4. Identify and give examples of existing electricity markets.

5. Classify different market mechanisms and summarize the role of various entities in the market.

ADVANCED DIGITAL SIGNAL PROCESSING

Subject Code: MELEE1-265 **L T P C** **3 0 0 3** **Duration: 40 Hrs.**

Unit-I (10 Hrs.)

Discrete time signals, Linear shift invariant systems-, Stability and causality, Sampling of continuous time signals, Reconstruction, Zero and First order hold circuit, Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z Transform-Properties, Inverse Z transform and its applications.

Unit-II (8 Hrs.)

Linear convolution using Discrete Fourier Transform (DFT), Computation of DFT Design of IIR (Infinite Impulse Response) digital filters from analog filters, Impulse invariance method, Bilinear transformation method.

Unit-III (12 Hrs.)

Finite Impulse Response (FIR) filter design using window functions, Comparison of FIR and IIR digital filters, Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantization effects in IIR and FIR filters.

Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters.

Unit-IV (10 Hrs.)

A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zero Input limit cycles in IIR filters, Linear signal models, All pole, all zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals, Estimation of power spectrum of stationary random signals.

Recommended Books:

1. Sanjit K. Mitra, 'Digital Signal Processing: A Computer-based Approach ', Tata McGraw Hill Edn.,**1998.**
2. Dimitris G. Manolakis, Vinay K. Ingle and Stephen M. Kogon, 'Statistical and Adaptive Signal Processing', McGraw Hill International Edn., **2000.**
3. John G. Proakis, Dimitris G. Manolakis, 'Digital Signal Processing: Principles, Algorithms, and Applications', 4^{th} Edn., Prentice Hall, **2006.**
4. M.H. Hayes, 'Statistical Signal Processing and Modelling', John Wiley and Sons, **1996**.

Course Objectives: To acquaint the Students with:

1. The difference between discrete-time and continuous-time signals
2. The application of DFT to IIR filter design and window functions to FIR design
3. The optimal design of FIR and IIR filters
4. The linear signal models and power spectrum of stationary random signals.

Course Outcomes: Students will be able to:

1. Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems.
2. Study the design techniques for IIR and FIR filters and their realization structures. Design of optimum FIR and IIR filters.
3. Acquire knowledge about the finite word length effects in implementation of digital filters.
4. Knowledge about the various linear signal models and estimation of power spectrum of stationary random signals.

DYNAMICS OF ELECTRICAL MACHINES

Subject Code: MELEE1-266 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-I (6 Hrs.)

Stability, Primitive four winding commutator machine and its complete voltage equation

Unit-II (12 Hrs.)

Torque Equation, Analysis of simple DC machines using the primitive machine equations, three phase Induction Motor transformed Equations, Different reference frames for Induction Motor Analysis, Transfer function formulation.

Unit-III (8 Hrs.)

Three Phase Salient Pole Synchronous Machine, Parks' transformation, Steady state analysis.

Unit-IV (14 Hrs.)

Large signal transients**,** Small oscillation equations in state variable form, Dynamical analysis of interconnected machines.

Large signal transient analysis using transformed equations, DC generator/DC motor System, Alternator /Synchronous Motor System.

Recommended Books:

1. D.P. Sengupta & J.B. Lynn, 'Electrical Machine Dynamics', The Macmillan Press Ltd., **1980.**
2. R. Krishnan, 'Electric Motor Drives, Modelling, Analysis, and Control', Pearson Education, **2001.**
3. P.C. Kraus, 'Analysis of Electrical Machines', McGraw Hill Book Company, **1987.**
4. I. Boldia & S.A. Nasar, 'Electrical Machine Dynamics', The Macmillan Press Ltd., **1992.**
5. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, London, **1967.**
6. P.S. Bimbhra, 'Generalized Theory of Electrical Machines', Khanna Publishers, **2002.**

Course Objectives: To make the Students to:

1. Learn about the performance characteristics of machines.
2. To understand the dynamics of the machines.
3. To understand how to determine stability of machine.

Course Outcomes: Students will be able to:

1. Formulate the electrodynamics equations of all electric machines and analyze the performance characteristics.
2. Knowledge of transformations for the dynamic analysis of machines.
3. Knowledge of determination of stability of the machines under small signal and transient conditions.
4. Study about synchronous machines.

ELECTRICAL MACHINE DESIGN

Subject Code: MELEE1-267 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-I (10 Hrs.)

Principles of Design of Machines: Specific loadings, choice of magnetic and electric loadings and materials, Real and apparent flux densities, temperature rise calculation, Separation of main dimension for induction machines and synchronous machines, Heating and cooling of machines, Types of ventilation, Continuous and intermittent rating

Unit-II (12 Hrs.)

Design of Transformers: General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size,

design of tank and cooling,
General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling tubes, Calculation of losses, efficiency and regulation, Forces winding during short circuit

Unit-III (10 Hrs.)

Design of Three Phase Induction Motors: Design of stator and rotor winding, Number of slots in stator and rotor, Slot leakage flux, Leakage reactance, Equivalent resistance of squirrel cage rotor, Magnetizing current, Efficiency from design data.

Unit-IV (8 Hrs.)

Design of Alternators: Types of alternators, comparison, specific loadings, output co-efficient, design of main dimensions, Introduction to computer aided electrical machine design of energy efficient machines.

Recommended Books:

1. A.E. Clayton, 'The Performance and Design of D.C. Machines', Sir I. Pitman & Sons, Ltd.
2. M.G. Say, 'The Performance and Design of A.C. Machines', Pitman.
3. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, 5th Edn.,
4. R.K. Aggarwal, 'Principles of Electrical Machine Design', S.K. Kataria & Sons, **2009.**

Course Objectives: To apprise the students with:

1. The modeling and analysis of AC machines.
2. The electromagnetic energy conversion process.
3. The design and rating of machines.

Course Outcomes:

Students will be able to:

1. To give a systematic approach for modeling and analysis of all rotating machines under both transient and steady state conditions with the dimensions and material used.
2. Ability to model and design transformers, three-phase induction motors and alternator.

ADVANCED MICRO-CONTROLLER BASED SYSTEMS

Subject Code: MELEE1-268 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

Unit-I (8 Hrs.)

Basic Computer Organization, Accumulator based Processes-Architecture, Memory Organization-I/O Organization.

Unit-II (12 Hrs.)

Micro-Controllers-Intel 8051 & Intel 8052, Registers, Memories, I/O Ports, Serial Communication, Timers, Interrupts, Programming
Intel 8051 – Assembly language programming, Addressing-Operations, Stack & Subroutines, Interrupts-DMA.

Unit-III (10 Hrs.)

ARDUINO UNO ATMEGA 328 Microcontroller, Architecture, Programming, Interfacing Memory/ I/O Devices, Serial I/O and data communication.

Unit-IV (10 Hrs.)

Microcontroller development for motor control applications, Stepper motor control using micro controllers.
Introduction to Digital Signal Processor (DSP) and its Architecture, Introduction to field Programmable gate arrays and implementation.

Recommended Books:

1. John. F. Wakerly, 'Microcomputer Architecture and Programming', John Wiley and Sons,

1981.
2. Ramesh S. Gaonker, 'Microprocessor Architecture, Programming and Applications with the 8051', Penram International Publishing (India), **1994.**
3. Raj Kamal, 'The Concepts and Features of Microcontrollers', Wheeler Publishing, **2005.**
4. Creig Steiner, 'The 8051/8052 Microcontrollers, Architecture, Assembly language and Hardware Interfacing', Universal Publishers, Boca Raton, Florida, **2005**.
5. Kenneth J. Ayala, 'The 8051 microcontroller', Cengage Learning, **2004.**
6. Kilts Steve, 'Advanced FPGA Design: Architecture, Implementation, and Optimization', A John Wiley & Sons Inc., 1st Edn., **2007**.

Course Objectives: To familiarize the students with:
1. The architecture and programming of advance microcontrollers.
2. The applications of these controllers.
3. The introductory concepts of field programmable gate arrays (FPGA).

Course Outcomes: Students will be able to:
1. To learn how to program a processor in assembly language and develop an advanced processor based system.
2. To learn configuring and using different peripherals in a digital system.
3. To compile and debug a Program.
4. To generate an executable file and use it.

SCADA SYSTEM AND APPLICATIONS

Subject Code: MELEE1-269 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-I (10 Hrs.)

Introduction to SCADA, Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation.

Unit-II (10 Hrs.)

Industries SCADA System Components, Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems.

Unit-III (12 Hrs.)

SCADA Architecture, Various SCADA architectures, advantages and disadvantages of each system, Single unified standard architecture -IEC 61850.

SCADA Communication, various industrial communication technologies, wired and wireless methods and fiber optics, Open standard communication protocols.

Unit-IV (8 Hrs.)

SCADA Applications: Utility applications, Transmission and distribution sector operations, monitoring, analysis and improvement, Industries - oil, gas and water, Case studies, Implementation, Simulation exercises.

Recommended Books:

1. Stuart A. Boyer, 'SCADA-Supervisory Control and Data Acquisition', Instrument Society of America Publications, USA, **2004.**
2. Gordon Clarke, Deon Reynders, 'Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems', Newnes Publications, Oxford, UK, **2004.**
3. William T. Shaw, 'Cyber-security for SCADA Systems', Penn Well Books, **2006.**
4. David Bailey, Edwin Wright, 'Practical SCADA for Industry', Newnes, **2003.**
5. Michael Wiebe, 'A Guide to Utility Automation: AMR, SCADA, and IT Systems for Electric Power', Penn Well Books, **1999**.

6. Bela G. Liptak, Halit Eren, 'Instrument Engineers Process Software and Digital Networks', 4th Edn., Vol.-3, **2016**.

Course Objectives: To make the students to get insight into the:
1. Basic architecture and components of SCADA.
2. Functions and communication in SCADA.
3. Applications of SCADA.

Course Outcomes: Students will be able to:
1. Describe the basic tasks of supervisory control and data acquisition systems (SCADA) as well as their typical applications.
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
3. Knowledge about single unified standard architecture IEC 61850.
4. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
5. Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

POWER QUALITY

Subject Code: MELEE1-270 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-I (8 Hrs.)

Introduction to power quality, voltage quality, overview of power quality phenomena, classification of power quality issues, power quality measures and standards, Total harmonic distortion (THD), Total demand distortion (TDD), Telephone influence factor (TIF), Distortion index (DIN), occurrence of power quality problems, various solutions of these problems.

Unit-II (8 Hrs.)

Harmonics, individual and total harmonic distortion, RMS value of a harmonic waveform, harmonic resonance, Triplex harmonics, important harmonic introducing devices, SMPS, three phase power converters, arcing devices, saturable devices, harmonic distortion of fluorescent lamps, effect of power system harmonics on power system equipment and loads.

Unit-III (8 Hrs.)

Modeling of networks and components under non-sinusoidal conditions transmission and distribution systems, Shunt capacitors, transformers, electric machines, grounding systems, loads that cause power quality problems, Power quality problems created by drives and its impact on drive.

Unit-IV (8 Hrs.)

Power factor improvement, passive and active compensation, Passive and active filtering, Control methods for single phase APFC (active power factor correction) and three phase APFC, Power factor correction (PFC) based on bilateral single phase and three phase converter.

Unit-V (8 Hrs.)

Hybrid Filtering techniques and various types, NEC grounding requirements, reasons for grounding, typical grounding and wiring problems, solutions to grounding and wiring problems

Recommended Books:

1. Angelo Baggini, 'Handbook of Power Quality', Wiley, **2008**.
2. G.T. Heydt, 'Electric Power Quality', McGraw Hill Professional, **2007.**
3. Math H. Bollen, 'Understanding Power Quality Problems', IEEE Press, **2000.**

4. J. Arrillaga, 'Power System Quality Assessment', John Wiley, **2000.**

Course Objectives: To make the students aware about:

1. The different power quality issues to be addressed.
2. The recommended practices by various standard bodies like IEEE, IEC, etc. on voltage, frequency and harmonics.

Course Outcomes: Students will:

1. Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads.
2. Develop analytical skills needed for modeling and analysis of harmonics in networks and components.
3. To introduce the students to active power factor correction based on static VAR compensators and their control techniques.
4. To introduce the students to series and shunt active power filtering techniques for harmonics.

ARTIFICIAL INTELLIGENCE TECHNIQUES

Subject Code: MELEE1-271	**L T P C** **3 0 0 3**	**Duration: 40 Hrs.**

Unit-I (10 Hrs.)

Biological foundations to intelligent systems, Artificial neural networks (ANN), Single layer and multilayer feed forward NN, Least-mean-square (LMS) and back propagation algorithm, Feedback networks and Radial basis function networks.

Unit-III (8 Hrs.)

Genetic algorithm (GA) and its operators; reproduction, cross over, mutation, Introduction to evolutionary programming.

Unit-II (12 Hrs.)

Fuzzy logic, Knowledge representation and inference mechanism, De-fuzzification methods, Introduction to type 2 fuzzy systems.

Fuzzy neural networks, System identification using fuzzy and neural network, some algorithms to learn the parameters of the network like GA.

Unit-IV (10 hrs)

Applications of above mentioned techniques i.e. Artificial neural networks, Fuzzy Neural networks, Genetic algorithms to practical problems.

Recommended Books:

1. J.M. Zurada, 'An Introduction to ANN', Jaico Publishing House, West, **1992**.
2. Simon Haykins, 'Neural Networks', Pearson Prentice Hall, **2005.**
3. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill.
4. Driankov, Dimitra, 'An Introduction to Fuzzy Control', Narosa Publication.
5. Davis E. Goldberg, 'Genetic Algorithms in Search, Optimization, and Machine Learning', Adison Willey Publishing Company, **1989**.
6. Siva Nandam, 'Introduction to Fuzzy Logic using MATLAB', Springer Science & Business Media, **2006**.
7. N.P. Padhy, 'Artificial Intelligence and Intelligent Systems', Oxford University Press, **2005.**

Course Objectives: To make the students to:

1. Understand ANN, fuzzy logic and fuzzy neural networks.
2. Understand Genetic Algorithm and Evolutionary programming.
3. Learn to apply these techniques to practical problems.

Course Outcomes: Students will be able to:

1. Learn the concepts of biological foundations of artificial neural networks.
2. Learn Feedback networks and radial basis function networks and fuzzy logics.
3. Identifications of fuzzy and neural networks.
4. Acquire the knowledge of GA and EP.

MAJOR PROJECT (PHASE – I) DISSERTATION

Subject Code: MELEE1-311 **L T P C**
0 0 20 10

Course Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly.

Course Outcomes:

1. Design a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyse a problem in latest research areas.
3. Formulate and write a research proposal.
4. Synopsis and its Presentation.

POWER SYSTEM TRANSIENTS

Subject Code: MELEE1-372 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit - I (8 Hrs.)

Fundamental circuit analysis of electrical transients, Laplace Transform method of solving simple Switching transients, Damping circuits, Abnormal switching transients, Three-phase circuits and transients, Computation of power system transients.

Unit - II (8 Hrs.)

Principle of digital computation, Matrix method of solution, Modal analysis, Z transform-Computation using EMTP (electromagnetic transients program), Lightning, switching and temporary over voltages, Lightning, Physical phenomena of lightning.

Unit - III (10 Hrs.)

Effect of lightning on power transmission system, Influence of tower footing resistance and earth resistance, switching: Short line or kilometric fault, energizing transients - closing and re-closing of lines, line dropping, load rejection, over voltages induced by faults.

Protective devices, Protection of system against over voltages, Lightning arresters, Substation earthing.

Unit - IV (8 Hrs.)

Switching of HVDC line, travelling waves on transmission line, Circuits with distributed parameters wave equation, Reflection, Refraction, Behaviour of Travelling waves at the line terminations, Lattice Diagrams – attenuation and distortion, Multi-conductor system and Velocity wave.

Unit - V (6 Hrs.)

Insulation Co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), Coordination between insulation and protection level, Statistical approach.

Recommended Books:

1. Allan Greenwood, 'Electrical Transients in Power System', Wiley & Sons Inc. New York, **1991**.
2. J. Arrillaga and C.P. Arnold, 'Computer Aided Power System', John Wiley and Sons,

1994.
3. Sunil S. Rao, 'Switch Gear Protection and Power System', Khanna Publishers, **2008.**

Course Objectives: To make the students aware about:
1. The occurrence of transients in a power system.
2. The change in parameters like voltage and frequency during transients.
3. The lightning phenomenon and its effect on power system.

Course Outcomes: Students will be able to:
1. Knowledge of various transients that could occur in power system and their mathematical formulation.
2. Ability to design various protective devices in power system for protecting equipment and personnel.
3. Coordinating the insulation of various equipment in power system.
4. Modelling the power system for transient analysis.

FACTS AND CUSTOM POWER DEVICES

Subject Code: MELEE1-373 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT-I (10 Hrs.)
Reactive power flow control in Power Systems, Control of dynamic power unbalances in Power System, Power flow control, Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Uncompensated line shunt compensation, Series compensation, Phase angle control, Reactive power compensation, Shunt and Series compensation principles, Reactive compensation at transmission and distribution level.

UNIT-II (8 Hrs.)
Static versus passive VAR compensator, Static shunt compensators: Static Var compensator (SVC) and Static compensator (STATCOM), Operation and control of Thyristor switched capacitor (TSC), Thyristor controlled reactor (TCR) and STATCOM, Compensator control, Comparison between SVC and STATCOM, Multilevel inverter based DSTATCOM (Distributed Static Compensator) and its applications.

UNIT-III (8 Hrs.)
Static Series Compensation: Thyristor switched series capacitor (TSSC), Static synchronous series compensator (SSSC), Static voltage and phase angle regulators, Thyristor-controlled voltage regulators (TCVR) and phase angle regulators (TCPAR): Operation and Control, Applications.

UNIT-IV (8 Hrs.)
Unified power flow controller (UPFC), Circuit arrangement, Operation and control of UPFC, Basic Principle of active power (P) and reactive power (Q) control, Independent real and reactive power flow control- Applications, Comparison of UPFC and UPQC (unified power quality conditioner).

UNIT-V (6 Hrs.)
Introduction to interline power flow controller, Modeling and analysis of FACTS controllers, Simulation of FACTS controllers, Power quality problems in distribution systems, Comparison of various Custom power devices and their applications.

Recommended Books:
1. K.R. Padiyar, 'FACTS Controllers in Power Transmission and Distribution', New Age International Publishers, **2007.**
2. X.P. Zhang, C. Rehtanz, B. Pal, 'Flexible AC Transmission Systems- Modelling and Control', Springer Verlag, Berlin, **2006.**

3. N.G. Hingorani, L. Gyugyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems', IEEE Press Book, Standard Publishers and Distributors, Delhi, **2001**.
4. K.S. Sureshkumar, S. Ashok, 'FACTS Controllers & Applications', e-book Edn., Nalanda Digital Library, NIT Calicut, **2003.**
5. Angelo Baggini, 'Handbook of Power Quality', Wiley, **2008**.

Course Objectives: To make the students:
1. To learn the active and reactive power flow control in power system.
2. To understand the need for static compensators.
3. To develop the different control strategies used for compensation.

Course Outcomes: Students will be able to:
1. Acquire knowledge about the fundamental principles of passive and active and reactive power compensation schemes at transmission and distribution level in power systems.
2. Learn various Static VAR Compensation Schemes like Thyristor/GTO controlled reactive power systems; PWM inverter based reactive power systems and their controls.
3. To develop analytical modelling skills needed for modelling and analysis of such Static VAR Systems.

INDUSTRIAL LOAD MODELING AND CONTROL

Subject Code: MELEE1-374 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit -I (8 Hrs.)

Electric Energy Scenario, Demand side management, Industrial load management**,** Load curves, Load Shaping Objectives, Methodologies, Barriers, Classification of industrial loads, Continuous and Batch processes, Load modeling.

Unit - II (8 Hrs.)

Electricity pricing, Dynamic and spot pricing Models, Direct load control, Interruptible load control, Bottom up approach, Scheduling, Formulation of load Models, Optimization and control algorithms, Case studies.

Unit - III (6 Hrs.)

Reactive power management in industries, Controls, Power quality impacts, Application of filters, Energy saving in industries.

Unit - IV (8 Hrs.)

Cooling and heating loads, load profiling, Modeling cool storage, Types, Control strategies, Optimal operation, Problem formulation, Case studies.

Unit -V (10 Hrs.)

Captive power units, Operating and control strategies, Power Pooling, Operation models, Energy banking, Industrial cogeneration.
Selection of Schemes, Optimal operating strategies, Peak load saving, Constraints problem formulation, Case study, Integrated load management for industries.

Recommended Books:

1. C.O. Bjork, 'Industrial Load Management - Theory, Practice and Simulations', Elsevier, the Netherlands, **1989.**
2. C.W. Gellings and S.N. Talukdar, 'Load Management Concepts', IEEE Press, New York, **1986**.
3. Y. Manichaikul and F.C. Schweppe, 'Physically based Industrial load', IEEE Trans. on PAS, April, **1981.**
4. H.G. Stoll, 'Least Cost Electricity Utility Planning', Wiley Interscience Publication, USA, 1989.
5. I.J. Nagarath and D.P. Kothari, Modern Power System Engineering., Tata McGraw Hill

publishers, NewDelhi, 1995
6. IEEE Bronze Book- ‘Recommended Practice for Energy Conservation and Cost Effective planning in Industrial Facilities’, IEEE Inc., USA.

Course Objectives: To acquaint the students with:
1. The energy demand scenario.
2. The modelling of load and to study load demand industrially.
3. To know electricity pricing models.
4. Study reactive power management in industries.

Course Outcomes: Students will be able to:
1. Knowledge about load control techniques in industries and its application.
2. Learn different types of industrial processes and optimize the process using tools like LINDO and LINGO.
3. Apply load management to reduce demand of electricity during peak time.
4. Apply different energy saving opportunities in industries.

DYNAMICS OF LINEAR SYSTEMS

Subject Code: MELEE1-375 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit - I (12 Hrs.)

State variable representations of systems, transfer function and transfer function matrix, solutions of state equations.
Observability and controllability, minimal realization of MIMO systems, analysis of linear time varying systems, the concepts of stability.

Unit II (10 Hrs.)

Lyapunov stability analysis, Lyapunov function and its properties, controllability by state variable feedback, Kassvoki method for stability.
Ackerman’s Formula, Stabilization by output feedback, Asymptotic observers for state measurement, Observer design.

Unit III (8 Hrs.)

State space representation of discrete systems, Solution of state equations, controllability and Observability stability analysis using Lyapunov method.

Unit IV (10 Hrs.)

State feedback of linear discrete time systems, MATLAB Exercises for above mentioned topics.

Recommended Books:
1. Thomas Kailath, ‘Linear Systems’, Prentice Hall Inc., Englewood Cliffs, N.J., **1980**.
2. K. Ogata, ‘State Space Analysis of Control Systems’, Prentice Hall Inc., Englewood Cliffs, N.J., **1965**.
3. K. Ogata, ‘Modern Control Engineering’, 2^{nd} Edn., Prentice Hall Inc., Englewood Cliffs, N.J., **1990.**
4. M. Gopal, ‘Digital Control and State Variable Methods’, Tata McGraw Hill Publishing Company Ltd., New Delhi, **1997.**
5. C.T. Chen, ‘Linear System Theory and Design’, Holt Rinehart and Winston, New York, **1984.**
6. R.C. Dorf and R.T. Bishop, ‘Modern Control Systems’, Addison Wesley Longman Inc., **1999**.

Course Objectives: To make the students:
1. To understand the linear and discrete systems and their functions.

2. To understand the stability analysis of linear systems and implement the same in MATLAB.

Course Outcomes: Students will be able to:

1. To learn linear system modeling, analysis and design so as to obtain the ability to apply the same to engineering problems in a global perspective.
2. Knowledge on carrying out detailed stability analysis of both linear and nonlinear systems.
3. Design observers and controllers for linear systems.
4. Acquire knowledge of discrete time linear systems modeling, analysis and design.
5. Develop and utilize modern software tools for analysis and design of linear continuous and discrete time systems.

BUSINESS ANALYTICS

Subject Code: MELEE1-391 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-1 (8 Hrs.)

Business analytics, its Overview, Scope, Process, Relationship of Business Analytics Process and organization, Competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods an overview.

Unit-2 (8 Hrs.)

Trendiness and Regression Analysis: Modeling relationships and trends in data, Simple linear regression.
Important resources, Business analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and exploring Data, Business analytics technology.

Unit-3 (8 Hrs.)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information policy, Outsourcing, ensuring data Quality, measuring contribution of business analytics, Managing changes.
Descriptive Analytics, predictive analytics and its modeling, Predictive analytics analysis, Data Mining and its methodologies, Prescriptive analytics and its step in the business analytics process, Prescriptive modeling, Nonlinear optimization.

Unit-4 (8 Hrs.)

Forecasting Techniques: Qualitative and judgmental forecasting, Statistical forecasting models: for stationary time series, for time series with a linear trend, time series with seasonality.
Regression forecasting with casual variables, selecting appropriate forecasting models, Monte Carlo simulation and risk analysis: Monte Carle simulation using analytic solver platform, New-product development model, Newsvendor model, Overbooking model, Cash budget model.

Unit-5 (8 Hrs.)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Recommended Books:

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, 'Business Analytics Principles, Concepts and Applications', Pearson F.T. Press.

2. James Evans, 'Business Analytics', Persons Education.

Course Objectives:
1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes:
1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

Students will demonstrate the ability to translate data into clear, actionable insights.

INDUSTRIAL SAFETY

Subject Code: MELEE1-392 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Unit-I (8 Hrs.)

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II (6 Hrs.)

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III (8 Hrs.)

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i) Screw down grease cup, ii) Pressure grease gun, iii) Splash lubrication, iv) Gravity lubrication, v) Wick feed lubrication vi) Side feed lubrication, vii) Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV (8 Hrs.)

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i) Any one machine tool, ii) Pump iii) Air compressor, iv) Internal combustion engine, v) Boiler, vi) Electrical motors, Types of faults in machine tools and their general causes.

Unit-V (10 Hrs.)

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets,
Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Recommended Books:

1. Higgins & Morrow, 'Maintenance Engineering Handbook', Da Information Services.
2. H.P. Garg, 'Maintenance Engineering', S. Chand and Company.
3. Audels, 'Pump-hydraulic Compressors', McGraw Hill Publication.
4. Winterkorn, Hans, 'Foundation Engineering Handbook', Chapman & Hall London.

OPERATIONS RESEARCH

Subject Code: MELEE1-393 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT – I (8 Hrs.)

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

UNIT – II (8 Hrs.)

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

UNIT – III (8 Hrs.)

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

UNIT – IV (8 Hrs.)

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT – V (8 Hrs.)

Competitive Models, Single and Multi-Channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Recommended Books:

1. H.A. Taha, 'Operations Research, An Introduction', PHI, **2008.**
2. H.M. Wagner, 'Principles of Operations Research', PHI, Delhi, **1982**.
3. J.C. Pant, 'Introduction to Optimisation: Operations Research', Jain Brothers, Delhi, **2008.**
4. Hitler Libermann, 'Operations Research: McGraw Hill Pub.', **2009.**
5. Pannerselvam, 'Operations Research', Prentice Hall of India, **2010.**
6. Harvey M. Wagner, 'Principles of Operations Research', Prentice Hall of India, **2010.**

Course Outcomes: At the end of the course, the students should be able to:

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming.
3. Students should able to carry out sensitivity analysis.

NOTE: Student should able to model the real world problem and simulate it.

COST MANAGEMENT & ENGINEERING PROJECTS

Subject Code: MELEE1-394 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT-I (8 Hrs.)

Introduction and Overview of the Strategic cost management process, Cost Concepts in Decision-Making; Relevant Cost, Differential Cost, Incremental Cost and Opportunity Cost. Objectives of a Cost Management, Inventory Management, Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-II (12 Hrs.)

Project: Meaning, Different types, why to manage, cost over runs centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed engineering activities. Pre project execution, main clearances and documents.

Project Team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution, Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT-III (10 Hrs.)

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Standard Costing and Variance Analysis, Pricing Strategies: Target Costing, Life Cycle Costing.

Budgetary Control: Flexible Budgets, Performance Budgets, Zero-Based Budgets, Pricing Decisions: Transfer Pricing.

UNIT IV (10 Hrs.)

Costing of service sector, Just-in-Time Approach, Material requirement planning, Enterprise Resource Planning, Total Quality Management Principles, Theory of Constraints, Activity-Based Cost Management, Benchmarking, Balanced Score Card and Value-Chain Analysis.

Quantitative Techniques for Cost Management: Linear Programming formulation and graphical, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Recommended Books:

1. Charles T. Horngren, ‘Cost Accounting: A Managerial Emphasis’, Prentice Hall of India, NewDelhi, **2012.**
2. Charles T. Horngren and George Foster, ‘Advanced Management Accounting’.
3. Robert S. Kaplan, Anthony A. Alkinson, ‘Management & Cost Accounting’.
4. Ashish K. Bhattacharya, ‘Principles & Practices of Cost Accounting’, A.H. Wheeler Publisher.
5. N.D. Vohra, ‘Quantitative Techniques in Management’, Tata McGraw Hill Book Co. Ltd.

COMPOSITE MATERIALS

Subject Code: MELEE1-395 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT–I (8 Hrs.)

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II (8 Hrs.)

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III (10 Hrs.)

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV (6 Hrs.)

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V (8 Hrs.)

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Recommended Books:

1. R.W. Cahn, 'Material Science and Technology – Composites', Vol-13, VCH, West Germany.
2. W.D. Callister, Jr., Adapted by R. Balasubramaniam, 'Materials Science and Engineering, An introduction', John Wiley & Sons, NY, Indian Edn., **2007**.
3. Lubin ed, 'Hand Book of Composite Materials'.
4. K.K. Chawla, 'Composite Materials'.
5. Deborah D.L. Chung, 'Composite Materials Science and Applications'.
6. Danial Gay, Suong V. Hoa, and Stephen W. Tasi., 'Composite Materials Design and Applications'.

WASTE TO ENERGY

Subject Code: MELEE1-396 | **L T P C 3 0 0 3** | **Duration: 40 Hrs.**

UNIT – I (6 Hrs.)

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT – II (8 Hrs.)

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT – III (8 Hrs.)

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT - IV (8 Hrs.)

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT - V (10 Hrs.)

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification.

Biomass Conversion Processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Recommended Books:

1. Desai, Ashok V., 'Non-Conventional Energy', Wiley Eastern Ltd., **1990**.
2. K.C. Khandelwal and S.S. Mahdi, 'Biogas Technology - A Practical Hand Book', Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., **1983**.
3. D.S. Challal, 'Food, Feed and Fuel from Biomass', IBH Publishing Co. Pvt. Ltd., **1991**.
4. C.Y. WereKo-Brobby and E.B. Hagan, John, 'Biomass Conversion and Technology'.

MAJOR PROJECT (PHASE – II) DISSERTATION

Subject Code: MELEE1-412 **L T P C**
0 0 32 16

Course Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Course Outcomes:

1. Execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Able to learn effectively record data and experiments so that others can understand them.
3. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the final semester of M. Tech Course.

The Dissertation will carry 24 credits and will be evaluated as under:

Dissertation will be evaluated as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Originality	12	08
2	Presentation	12	08
3	Contents & Volume of Work	18	12
4	Discussion (Contribution of Candidate)	18	12
Total		**60**	**40**

1ST SEMESTER

Total Contact Hours = 12 **Total Marks = 300** **Total Credits = 12**

1ST SEMESTER		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-102	Modern Control Theory	4	0	0	40	60	100	4
MELE1-103	Applied Instrumentation & Measurements	4	0	0	40	60	100	4
Departmental Elective-I (Select any one)		4	0	0	40	60	100	4
MELE1-160	EHVAC & HVDC Transmission Systems							
MELE1-161	Digital Signal Processing & its Applications							
MELE1-162	Adaptive Control							
MELE1-163	Discrete Time Control Systems							
Total		**12**	**0**	**0**	**120**	**180**	**300**	**12**

2ND SEMESTER

Total Contact Hours = 12 **Total Marks = 400** **Total Credits = 10**

2ND SEMESTER		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-101	Advanced Power System Analysis & Design	4	0	0	40	60	100	4
MELE1-104	Power System Software Lab	0	0	2	60	40	100	1
MELE1-208	Simulation Lab.	0	0	2	60	40	100	1
Departmental Elective-II (Select any one)		4	0	0	40	60	100	4
MELE1-156	Energy Management and Energy Auditing							
MELE1-157	Microprocessors & Embedded Control							
MELE1-158	Non-Conventional Energy Resources							
MELE1-159	Wind Energy and Small Hydro Energy Station							
Total		**8**	**0**	**4**	**200**	**200**	**400**	**10**

3RD SEMESTER

Total Contact Hours = 12 **Total Marks = 300** **Total Credits = 12**

3RD SEMESTER		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-205	Power System Operation and Control	4	0	0	40	60	100	4
MELE1-206	Advanced Electrical Machines	4	0	0	40	60	100	4
Departmental Elective-III (Select any one)		4	0	0	40	60	100	4
MELE1-264	Power System Modeling & Dynamics							
MELE1-265	Customized Power Devices							
MELE1-266	Advanced Electrical Machine Design							
MELE1-267	Artificial Intelligent Techniques							
Total		**12**	**0**	**0**	**120**	**180**	**300**	**12**

4TH SEMESTER

Total Contact Hours = 12 **Total Marks = 300** **Total Credits = 10**

4TH SEMESTER		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-207	Power Electronic Devices & Controllers	4	0	0	40	60	100	4
MELE1-311	Research Lab.	0	0	4	60	40	100	2
Departmental Elective-IV (Select any one)		4	0	0	40	60	100	4
MELE1-368	Power System Dynamics & Stability							
MELE1-369	Advanced Power System Protection							
MELE1-370	Smart Grid Technologies							
MELE1-371	Engineering Optimization							
Total		**8**	**0**	**4**	**140**	**160**	**300**	**10**

5TH SEMESTER

Total Contact Hours = 20 **Total Marks = 300** **Total Credits = 22**

5TH SEMESTER		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-309	Project	0	0	8	60	40	100	12
MELE1-310	Seminar	0	0	4	100	0	100	2
Departmental Elective-V (Select any one)		4	0	0	40	60	100	4
MELE1-372	Power System Planning							
MELE1-373	Electric Traction System							
MELE1-374	Power System Reliability							
MELE1-375	Distribution System Operation & Analysis							
	Open Elective-I	4	0	0	40	60	100	4
Total		**8**	**0**	**12**	**200**	**100**	**300**	**22**

6TH SEMESTER

Total Credits = 24

6TH SEMESTER		Contact Hrs.			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MELE1-412	Dissertation	0	0	24		24

Overall Credits

Semester	Marks	Credits
1st	300	12
2nd	400	10
3rd	400	12
4th	300	10
5th	300	22
6th	--	24
Total	**1700**	**90**

ADVANCED POWER SYSTEM ANALYSIS AND DESIGN

Subject Code: MELE1-101/MELE3-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Load Flow (8 Hrs.)
Network modeling – Conditioning of Y Matrix – Load Flow-Newton Rapson method- Decoupled – Fast decoupled Load flow -three-phase load flow.

UNIT-2

2. DC Power Flow (9 Hrs.)
Single phase and three phase -AC-DC load flow - DC system model – Sequential Solution Techniques – Extension to Multiple and Multi-terminal DC systems – DC convergence tolerance – Test System and results.

UNIT-3

3. Fault Studies (9 Hrs.)
Analysis of balanced and unbalanced three phase faults – fault calculations – Short circuit faults – open circuit faults.

4. System Optimization (12 Hrs.)
Strategy for two generator systems – generalized strategies – effect of transmission losses - Sensitivity of the objective function- Formulation of optimal power flow-solution by Gradient Method-Newton's method.

UNIT-4

5. State Estimation (7 Hrs.)
Method of least squares – statistics – errors – estimates – test for bad data – structure and formation of Hessian matrix – power system state estimation.

RECOMMENDED BOOKS:

1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', Tata McGraw Hill, New Delhi, **2003**.
2. J. Arrillaga and C.P. Arnold, 'Computer Analysis of Power Systems', John Wiley and Sons, New York, **1997**.
3. M.A. Pai, 'Computer Techniques in Power System Analysis', Tata McGraw Hill, New Delhi, **2006**.

MODERN CONTROL THEORY

Subject Code: MELE1-102/ **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-1

1. Mathematical Preliminaries (12 Hrs.)
Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-2

2. State Variable Analysis (10 Hrs.)
Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems –

Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-3

3. Non Linear Systems (8 Hrs.)

Introduction – Non Linear Systems - Types of Non-Linearties – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc.; Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-4

4. Stability Analysis (7 Hrs.)

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

5. Optimal Control (7 Hrs.)

Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

RECOMMENDED BOOKS:

1. M. Gopal 'Modern Control System Theory', New Age International, **1984.**
2. K. Ogata 'Modern Control Engineering', Prentice Hall, **1997.**
3. I.J. Nagarath and M. Gopal, 'Control Systems Engineering', New Age International (P) Ltd.
4. M. Gopal, 'Digital Control and State Variable Methods', Tata Mc Graw-Hill Companies, **1997**.
5. H. Zak, 'Systems and Control by Stains Law', Oxford Press, **2003**.
6. Kuo, 'Digital Control Systems', 2nd Edn., Oxford University Press, **2003**.

APPLIED INSTRUMENTATION & MEASUREMENT

Subject Code: MELE1-103	L T P C 4 0 0 4	Duration: 40 Hrs.

UNIT-1

1. Transducers (10 Hrs.)

Classification of Transducers including analog and digital transducers, Selection of Transducers, Static and Dynamic response of transducer System, Measurement of length & thickness, linear Displacement, Angular Displacement, force, weight, torque, Moisture, Level, Flow, pH & Thermal Conductivity, Measurement of Frequency, Proportional, Geiger Muller & Scintillation Counters.

UNIT-2

2. Telemetry (8 Hrs.)

Basic Principles, Proximity & remote Action Telemetry systems, Multiplexing; Time Division and frequency division.

UNIT-3

3. Display Devices (10 Hrs.)

Various types of Display Device, Digital Voltmeters, Dual Slope DVMS, Digital encoders, Analog and Digital encoders, Analog and Digital Data Acquisition System, A/D Converter. Fiber Optic

Technology for data transmission, Supervisory Control and Data Acquisition Systems (SCADA), Q-meter. Electrical noise in control signals, its remedial measures.

UNIT-4

4. Virtual Instrumentation (12 Hrs.)

Introduction to Virtual Instrumentation, conventional vs. Virtual instrumentation, advantages and basic representations. Introduction to Lab view. Applications of virtual instrumentation in various fields like Industrial applications, defense, Medical.

RECOMMENDED BOOKS:

1. W.D. Cooper & A.D. Helfrick, 'Electronic Instrumentation and Measurement Techniques', PHI.
2. B.C. Nakra and K.K. Chaudhary, 'Instrumentation Measurement Analysis', Tata McGraw-Hill.
3. Hermann, K.P. Neubert, 'Instrument Transducers'.
4. pH Mansfleld, 'Electrical Transducers for Industrial Measurement'.
5. Mani Sharma, Rangan,'Instrumentation systems'.
6. Borden & Thgnel, 'Principles & Methods of Telemetry'.
7. Foster, 'Telemetry Method'.
8. Sanjay Gupta & Joseph John, 'Virtual Instrumentation Using Lab VIEW', TMG; Tata McGraw Hills, **2005**.
9. Robert H. Bishop, 'Course with Lab VIEW 7 Express', Pearson Education, **2005**.
10. Related IEEE/IEE Publications.

POWER SYSTEM SOFTWARE LAB.

Subject Code: MELE1-104 **L T P C**
0 0 2 1

Development of algorithms & flowcharts and digital simulation of the following using ETAP/MATLAB Software package:

1. Z-bus and Y-bus formulation
2. Load flow studies
3. Fault analysis
4. Transient stability studies
5. Economic load dispatch

ENERGY MANAGEMENT & ENERGY AUDITING

Subject Code: MELE1-156 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. Energy Scenario (9 Hrs.)

Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act- 2001 and its features.

UNIT-2

2. Energy Management and Audit (9 Hrs.)

Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

3. Data Gathering (6 Hrs.)
Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering.

UNIT-3

4. Analytical Techniques (5 Hrs.)
Incremental cost concept, mass and energy balancing techniques, Inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation.

UNIT-4

5. Evaluation of Saving Opportunities (5 Hrs.)
Determining the savings in rupees' Noneconomic factors, Conservation opportunities, estimating cost of implementation.

6. Energy Audit and Instruments (6 Hrs.)
The plant energy study report- Importance, contents, effective organization, report writing and presentation, Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy.

RECOMMENDED BOOKS:

1. W.R. Murphy, G. Mckay, 'Energy Management', Butterworths.
2. C.B. Smith, 'Energy Management Principles', Pergamon Press.
3. I.G.C. Dryden, 'Efficient Use of Energy', Butterworth Scientific.
4. A.V. Desai, 'Energy Economics', Wiley Eastern.
5. D.A. Reay, 'Industrial Energy Conservation', Pergammon Press.
6. W.C. Turner, 'Energy Management Handbook', John Wiley and Sons, A Wiley Interscience.
7. Publication.
8. 'CIBSI Guide – User's Manual', U.K.
9. 'CRC Handbook of Energy Efficiency', CRC Press.

MICROPROCESSORS AND EMBEDDED CONTROL

Subject Code: MELE1-157 | **L T P C 4 0 0 4** | **Duration: 42 Hrs.**

UNIT-1

1. Overview (9 Hrs.)
Microprocessor 8086, Architecture, PIN Diagram, BIU and EU, memory addressing, Clock generator 8284, buffers and latches, maximum and minimum modes.

UNIT-2

2. Addressing Modes (10 Hrs.)
Addressing modes of 8086, Assembly language Programming, Assemblers and Procedures, Macros, Interrupts. Interfacing of 8086: IC 8155 (Static RAM with ports and timers), 8755 (EPROM with I/O ports), 8251A (USART), 8255 A, 8253/8254,8257 and 8259 controllers.

UNIT-3

3. Microcontroller (10 Hrs.)
Introduction to microcontrollers, Architecture, Pin Diagram, I/O ports, Internal RAM and registers, Interrupts, addressing modes, memory organization and external addressing, Instruction set. Interfacing with LCD, ADC, DAC, Stepper motor, Key Board and sensors.

UNIT-4

4. Embedded Systems (13 Hrs.)
Introduction, Classification, Processors, Hardware units, Software embedded into systems, applications and products of embedded systems, Structural Units in processor, Memory Devices,

I/O Devices, Buses, Interfacing of Processor memory and I/O devices. Case Study of an embedded system for a smart card.

RECOMMENDED BOOKS

1. Mazidi, Mazidi & McKinlay, 'The 8051 Microcontroller and Embedded Systems using Assembly and C', PHI.
2. Myke Predko, 'Programming and Customizing the 8051 Micro-controller', Tata McGraw-Hill edn.
3. R.A. Gaonkar, 'Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)', Penram Publishing India.
4. K. Shibu, 'Embedded Systems', Tata McGraw Hill Publishing, New Delhi, **2009**.
5. Barry B. Brey, 'The Intel Microprocessors 8086/8088, 8086, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing', Prentice Hall of India Private Limited, New Delhi, **2003**.
6. John Peatman, 'Design with Microcontroller', McGraw Hill Publishing Co. Ltd, New Delhi.

NON-CONVENTIONAL ENERGY RESOURCES

Subject Code: MELE1-158 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-1

1. Introduction to Energy Sources (5 Hrs.)

World Energy Futures, Conventional Energy Sources, Non-Conventional Energy Sources, Prospects of Renewable Energy Sources.

UNIT-2

2. Solar Energy (10 Hrs.)

Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage. Applications of Solar Energy: Solar, Thermal Electric Conversion Systems, Solar Electric power Generation, Solar Photo-Voltaic, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photovoltaic System for Power Generation.

UNIT-3

3. Wind Energy (9 Hrs.)

Introduction to wind energy Conversion, the nature of the wind, Power in the wind. Wind data and energy estimation, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-4

4. Direct Energy Conversion Processes (11 Hrs.)

Magneto Hydro Dynamic Power Generation: Principles of MHD power generation, Open Cycle Systems, Closed Cycle Systems, Voltage and power output, Materials for MHD generators. Basic principles of thermo-electric power-generation, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, Analysis, materials. Thermionic emission and work function, Basic thermionic generation. Classification of Fuel Cells, Types, Advantages, Electrodes, Polarization. The basic Nuclear Function and Reactions Plasma Confinement, Thermo Nuclear Function Reactions.

5. Energy from Biomass (6 Hrs.)

Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants. Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

RECOMMENDED BOOKS:

1. G.D. Rai, 'Non-Conventional Sources of Energy', Khanna Publishers.
2. David Boyles, 'Bio Energy', Elis Horwood Ltd.

3. N.K. Bansal and M. Kleemann, M. Heliss, 'Renewable Energy Sources and Conversion Technology, Tata McGraw Hill, **1990**.
4. R.A. Coombie, 'Direct Energy Conversion', Pitman.
5. O.P. Vimal and P.D. Tyagi, 'Bio Energy Spectrum', Bio Energy and Wasteland Development Organization.

WIND ENERGY AND SMALL HYDRO POWER STATION

Subject Code: MELE1-159 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. Wind Energy (12 Hrs.)
Introduction, general theory of wind machines, basic laws and concepts of aerodynamics, Micro-siting, Description and performance of the horizontal–axis wind machines. Introduction to blade design, Description and performance of the vertical–axis wind machines, generation of electricity by wind machines and case studies.

UNIT-2

2. Hydro Power Plant (10 Hrs.)
Overview of micro mini and small hydro, site selection and civil works. Penstocks and turbines, speed and voltage regulation, investment issues,

UNIT-3

3. Tariffs (8 Hrs.)
Study of load management and tariff scheme, distribution and marketing issues related to power generation.

UNIT-4

4. Hybrid Power System (10 Hrs.)
Wind and hydro based stand-alone / hybrid power systems, control of hybrid power systems, wind diesel hybrid systems

RECOMMENDED BOOKS:

1. J.F. Manwell, J.G. McGowan and A.L. Rogers, 'Wind Energy Explained – Theory, Design and Application', John Wiley & Sons, Ltd., **2002**.
2. O.L. Martin Hansen, 'Aerodynamics of Wind Turbines', Earthscan, **2008**.
3. Fernando D. Bianchi, Hernan De Battista and Ricardo J. Mantz, 'Wind Turbine Control Systems- Principles, Modelling and Gain Scheduling Design', Springer, **2007.**
4. Adam Harvey, Andy Brown and Priyantha Hettiarachi, 'Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes', ITDG, **1993**.
5. Maria Laguna, 'Guide on How to Develop a Small Hydropower Plant', ESHA, **2004**.
6. 'Good & Bad of Mini Hydro Power', edited by Roman Ritter, GTZ, **2009**.

EHVAC AND HVDC TRANSMISSION SYSTEM

Subject Code: MELE1-160 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Overview (6 Hrs.)
Comparison of EHV AC and DC transmission, description of DC transmission systems, modern trends in AC and DC transmission.

2. EHV AC Systems (8 Hrs.)
Limitations of extra-long AC transmission, Voltage profile and voltage gradient of conductor, Electrostatic field of transmission line, Reactive Power planning and control, traveling and standing waves, EHV cable transmission system.

UNIT-2

3. Static Var System (6 Hrs.)
Reactive VAR requirements, Static VAR systems, SVC in power systems, design concepts and analysis for system dynamic performance, voltage support, damping and reactive support.

4. HVDC System (7 Hrs.)
Converter configurations and their characteristics, DC link control, converter control characteristics; Monopolar operation, converter with and without overlap, smoothing reactors, transients in DC line, converter faults and protection, HVDC Breakers.

UNIT-3

5. Corona and Interference (7 Hrs.)
Corona and corona loss due to EHV AC and HVDC, Radio and TV interference due to EHV AC and HVDC systems, methods to reduce noise, radio and TV interference.

6. Harmonic Filters (5 Hrs.)
Generation of harmonics, Design of AC filters, DC filters.

UNIT-4

7. Power Flow Analysis in AC/DC Systems (6 Hrs.)
Component models, solution of DC load flow, per unit system for DC quantities, solution techniques of AC-DC power flow equations, Parallel operation of HVDC/AC systems, Multi terminal systems.

RECOMMENDED BOOKS:

1. K.R. Padiyar, 'HVDC Power Transmission Systems', Wiley Eastern Ltd., New Delhi.
2. E. Kimbark, 'Direct Current Transmission', Vol-I, John-Wiley and Sons, NY.
3. J. Arrillaga, 'HVDC Transmission', IEE Press, London.
4. R.D. Begamudre, 'EHV AC Transmission Engineering', Wiley Eastern Press.

DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Subject Code: MELE1-161 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Introduction (10 Hrs.)
Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT-2

2. Z Transform (6 Hrs.)
Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT-3

3. Design of Digital Filters (12 Hrs.)
Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation,

Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects: Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles.

UNIT-4

4. DSP Processors (10 Hrs.)

Architectures of ADSP and TMS series of processor. Digital Signal Processing Principles, Algorithms and Application.

RECOMMENDED BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer, 'Discrete-Time Signal Processing', John R. Back, Prentice Hall.
2. S. Salivahan, A. Vallavaraj, Gnanpiya, 'Digital Signal Processing', Tata McGraw Hill.
3. S.K. Mitra, 'Digital Signal Processing - A Computer based Approach', Tata McGraw Hill.
4. Jervis, 'Digital Signal Processing', Pearson Education India.
5. 'Introduction to Digital Signal Processing', 1st Edn., Johny R. Johnson, Prentice Hall, **2006.**

ADAPTIVE CONTROL SYSTEM

Subject Code: MELE1-161 | **L T P C 4 0 0 4** | **Duration: 40 Hrs.**

UNIT-1

1. Introduction to Adaptive Control (6 Hrs.)

Development of adaptive control problem-The role of Index performance (IP) in adaptive systems-Development of IP measurement process model.

UNIT-2

2. System Response Identification (10 Hrs.)

Identification by Cross Correlation - Synthesis techniques for flat spectrum Pseudo random signals - Quasi Linearization-Impulse Response Expansion-Identification using matched filter, Adaptive control using steepest Descent.

3. Perturbation Systems (5 Hrs.)

Single and Multi-dimensional adaptive systems – Stability Analysis of Sinusoidal perturbation adaptive controllers – Formulation of signal synthesis system.

UNIT-3

4. Self-Tuning Regulators (Str) and Model Reference Adaptive Systems (10 Hrs.)

Introduction - Pole Placement Design-Indirect Self-tuning regulators - Continuous Time Self-Tuners - Direct self-tuning regulators - Linear quadratic self - Tuning regulators - Adaptive predictive control. The MIT rule – Determination of Adaptation Gain – Design of MRAS using Liapunov theory – BIBO Stability – Applications to Adaptive control- Model Free Adaptive Control.

UNIT-4

5. Gain Scheduling (9 Hrs.)

Principle-Design of Gain Scheduling Controllers - Nonlinear Transformations of second Order Systems Applications of Gain Scheduling. Case study - ABB Adaptive Controllers, Satt Control ECA40, The First Control Adaptive Controller.

RECOMMENDED BOOKS:

1. Karl J. Astrom and Bjorn Wittenmark, 'Adaptive Control', 2nd Edn., Pearson Education Inc., New Delhi, **2008**.
2. Shankar Sastry and Marc Bodson, 'Adaptive Control – Stability, Convergence and Robustness', Prentice Hall, Englewood Cliffs, New Jersey, **1989**.
3. L. Ljung, 'System Identification: Theory for the User', Prentice Hall, Englewood Cliffs, **1999**.

4. V.V. Chalam, 'Adaptive Control Systems – Techniques and Applications', Marcel Dekker Inc., New Jersey, **1987**.
5. Kumpathi S. Narendra, Romeo Ortega and Peder Dorator, 'Advances in Adaptive Control', IEEE Press, New Jersey, 1991.
6. Petros A. Loannov and Jing Sun, 'Robust Adaptive Control', Prentice Hall Inc.

DISCRETE TIME CONTROL SYSTEMS

Subject Code: MELE1-163 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Introduction (7 Hrs.)
Configuration of the basic Digital Control Systems, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals.

UNIT-2

2. Analysis of Digital Control Systems (9 Hrs.)
Z-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems.

UNIT-3

3. Stability Methods (8 Hrs.)
Mapping between s-plane and z-plane, stability methods: Modified Routh Criterion, Jury's method, modified Schur-Cohn criterion.

4. Models of Digital Control Systems (5 Hrs.)
Digital temperature control System, Digital position control system, stepping motors and their control.

UNIT-4

5. Control Systems Analysis Using State Variable Methods (8 Hrs.)
State variable representation, conversion of state variable models to transfer function and vice-versa, Eigen values and Eigen vectors, Solution of state equations, Concepts of controllability and observability.

6. State Variable analysis of Digital Control Systems (8 Hrs.)
State variable description of digital control systems, conversion of state variable models to pulse transfer function and vice versa, solution of state difference equations, controllability and observability.

RECOMMENDED BOOKS:

1. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw-Hill.
2. K. Ogata, 'Discrete Time Control Systems', Pearson Education, Singapore, Thomson Press India.
3. B.C. Kuo, 'Digital Control Systems', Prentice Hall.
4. I.J. Nagrath & Gopal, 'Control System Engineering', John Wiley & Sons.
5. K.K. Aggarwal, 'Control System Analysis and Design', Khanna Publishers.

POWER SYSTEM OPERATION AND CONTROL

Subject Code: MELE1-205/MELE3-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives:

- To impart Course about the power system controls namely load frequency and AVR control for both single-machine infinite bus system and multi machine systems.

- To learn optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling and their implementation through various classical methods

Course Outcomes:

- Understanding about the power system controls namely load-frequency and AVR control for both single-machine infinite bus system and multi machine systems,
- Student will understand the optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling and their implementation through various classical methods.

Unit-1

INTRODUCTION: Characteristics of power generation units (thermal, nuclear, hydro, pumped hydro), variation in thermal unit characteristics with multiple valves, Economic dispatch with and without line losses, lambda iteration method, gradient method, Economic dispatch without line losses, economic dispatch with line losses, Newton Raphson method, base point and participation factors.

Unit-2

TRANSMISSION LOSSES: Coordination equations, incremental losses, penalty factors, B matrix loss formula (without derivation), methods of calculating penalty factors.

UNIT COMMITMENT: constraints in unit commitment, priority list method, Dynamic programming method and Lagrange relaxation methods.

Unit-3

HYDRO THERMAL CO-ORDINATION: Introduction to long range and short range hydro scheduling, Types of short range scheduling problem, Scheduling energy. The short term hydro-thermal scheduling problems and its solution by Lambda-Gamma iteration method and gradient method

GENERATION WITH LIMITED ENERGY SUPPLY: take or pay fuel supply contract, composite generation production cost function, gradient search techniques.

Unit-4

OPTIMAL POWER FLOW FORMULATION: gradient and Newton method, linear programming methods.

AUTOMATIC GENERATION CONTROL: load frequency control, single area system, multi-area system, tie line control, automatic voltage control.

RECOMMENDED BOOKS:

1. D.P. Kothari and J.S. Dillon, 'Power System Optimization', Prentice-Hall of India Pvt. Ltd. New Delhi, **2011.**
2. G.L.K. Kirchmayer, 'Economic Operation of Power Systems', John Willey & Sons, N.Y., **2004.**
3. A.J. Wood, B.F. Wollenberg, 'Power Generation Operation and Control', **1998.**
4. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Tata McGraw Hill Publishing Company Ltd., New Delhi, **1999.**

ADVANCED ELECTRICAL MACHINES

Subject Code: MELE1-206	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

Course Objectives:

1. To give a systematic approach for modelling and analysis of all rotating machines under both transient and steady state conditions.

Course Outcomes:

1. The students will be able to analyse all types of electrical machines.

2. Students attain complete knowledge about electromagnetic energy conversion and time response analysis of reference frame theories for modelling of machines.

Unit-1

POLYPHASE SYNCHRONOUS MACHINES: Mathematical: Basic Synchronous machine parameters, Voltage, Flux linkage and inductance relations, Park's transformation – its physical concept, equations of performance.

BALANCED STEADY STATE ANALYSIS: Phasor equations and phasor diagrams, Power-angle characteristics, cylindrical rotor and Salient pole machines, Short circuit ratio

Unit-2

TRANSIENT ANALYSIS & MACHINE DYNAMICS: Three phase short-circuits, Armature and field transients, Transient torque, Sudden reactive loading and Unloading. Transient Analysis-a qualitative approach, Reactance and Time –Constants from equivalent circuits, Measurement of reactance, Transient Power-angle characteristics, The basic electromechanical equation, Linearized analysis, Large Angular/oscillation, Non-linear analysis.

Unit-3

TRANSFORMERS & ITS TRANSIENTS: Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformer, Determination of parameters. In-rush current phenomena, Qualitative approach, Analytical approach, In-rush current in 3-phasetransformers.

Unit-4

EXCITATION PHENOMENA IN TRANSFORMERS: study of excitation and its effect on transformer performance, Harmonics in: Single phase transformers, three-phase transformers, Disadvantages of harmonics, Suppression of harmonics.

UNBALANCED OPERATION OF THREE-PHASE TRANSFORMERS: Single-phase load on three-phase transformers, Single-Phasing in 3-phase transformers, Effect of using tertiary winding.

RECOMMENDED BOOKS

1. B. Edikins 'Generalized Theory of Electrical Machines'.
2. Concordia, 'Synchronous Machines'.
3. E.W. Kim Bark, 'Power System Stability', Vol. III., Wiley.
4. P.S. Bimbhra, 'Generalized Theory of Electrical Machines', **2010.**
5. E.W. Kimbark., 'Power System Stability', Vol. III, **1998**.
6. A. Draper, 'Electrical Machines', **2011.**
7. 'Magnetic Circuits and Transformer', MIT Staff, **2004.**

POWER ELECTRONIC DEVICES AND CONTROLLERS

Subject Code: MELE1-207/MELE3-102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives:

- Learn the physics of device operation, static and dynamic characteristics, ratings, protection, operating limitations and safe operating area
- Know about the design issues of drive circuits and their usage
- Understanding the different types of inverters and cyclo-converters

Course Outcomes:

- Knowledge of power semiconductor devices and their Gate and base drive circuits
- Develop skills to utilize the different PWM schemes
- Know about the different types of power converters and their applications

UNIT-1

REVIEW OF SEMICONDUCTOR DEVICES: Conduction Process in semiconductors, pn Junction, Charge control description, Avalanche breakdown, Power diodes, Thyristors, Gate Turn Off Thyristor (GTO), VI characteristics, Dynamic characteristics, ratings, protection.

UNIT-2

POWER MOSFET AND IGBT: Basic structure, I-V Characteristic, Physics of device operation, switching characteristics, operating limitation and safe operating area.

EMERGING DEVICES AND CIRCUITS: Power junction Field effect transistor (FET), Integrated Gate-Commutated Thyristor (IGCT), Field Control Thyristor, Metal oxide semiconductor (MOS) Control Thyristor etc. Power ICs, New semiconductor materials.

UNIT-3

SNUBBER CIRCUITS: Types of Snubber circuits, needs of Snubber circuit with diode, thyristor and transistors, Turn-off Snubber, over voltage snubber, turn on snubber, Snubber for bridge circuit configurations, GTO Snubber circuit.

UNIT-4

GATE AND BASIC DRIVE CIRCUITS: Design Consideration, De-coupled drive circuits, electrically isolated drive circuits, cascade connected drive circuits, Power device protection in drive circuits, circuit layout considerations.

RECOMMENDED BOOKS:

1. Mohan, Undeland and Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and Sons.
2. M.H. Rashid, 'Power Electronics Handbook', Elsevier Press (Academic Press Series).
3. D. Finney, 'The Power Thyristor and its Applications', McGraw Hill, New York.
4. C.W. Lander, 'Power Electronics', McGraw Hill Book Co., U.K.
5. M.H. Rashid, 'Power Electronics - Circuits, Devices and Applications', PHI, India.

SIMULATION LAB.

Subject Code: MELE1-208/MELE3-208 L T P C
0 0 2 1

EXPERIMENTS

1. Introduction to MATLAB and its basic commands.
2. MATLAB program to simulate Ferranti effect.
3. MATLAB program to model transmission lines.
4. MATLAB program to solve load flow equations by Gauss-Seidel method.
5. MATLAB program to find optimum loading of generators neglecting transmission losses.
6. MATLAB program to find optimum loading of generators with penalty factors.
7. MATLAB program to solve swing equation using point-by-point method.
8. Simulink model of single area load frequency control with and without pi controller and without pi controller in Simulink.
9. Simulink model for two area load frequency control.
10. Simulink model for evaluating transient stability of single machine connected to infinite bus.
11. Gauss Seidel load flow analysis using MATLAB Software.
12. Newton Raphson method of load flow analysis using MATLAB Software.
13. Fast decoupled load flow analysis using MATLAB Software.
14. Fault analysis using MATLAB Software.
15. Economic dispatch using MATLAB Software.

POWER SYSTEM MODELLING AND DYNAMICS

Subject Code: MELE1-264 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives:

1. This course aims to give basic knowledge about the dynamic mechanisms behind angle and voltage stability problems in electric power systems, including physical phenomena and modelling issues.

Course Outcomes:

At the end of this course,

1. Will be able to solve the reactive power problems in power system
2. Students will be able to analyse and understand the electromagnetic and electromechanical phenomena taking place around the synchronous generator.

UNIT-I

Static Model of Power System Components:

Generator, single circuit & multi-circuit transmission line, regulating & phase shifting transformer, VAr compensators and Loads for balanced and unbalanced conditions. Formulation of Admittance and Impedance Matrices for balanced and unbalanced conditions, their modifications, Sparcity and Optimal ordering,

UNIT-II

TRANSIENT STABILITY ANALYSIS

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned –explicit and implicit approaches –Interfacing SVC with TSA-methods to enhance transient stability.

UNIT III

UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS

Need for unified algorithm-numerical integration algorithmic steps-truncation error-variable step size –handling the discontinuities-numerical stability-application of the algorithm for transient. Mid-term and long-term stability simulations.

UNIT IV

TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS

Review of transmission aspects –Generation Aspects: Review of synchronous machine theory –Voltage and frequency controllers –Limiting devices affecting voltage stability –Voltage-reactive power characteristics of synchronous generators –Capability curves – Effect of machine limitation on deliverable power –Load Aspects –Voltage dependence of loads –Load restoration dynamics –Induction motors –Load tap changers –Thermostatic load recovery –General aggregate load models.

RECOMMENDED BOOKS:

1. R. Ramnujam, 'Power System Dynamics Analysis and Simulation', PHI, Course Private Limited, New Delhi, **2009.**
2. P. Kundur, 'Power System Stability and Control', McGraw-Hill, **1993**.
3. J.D. Grainger, 'Power System Analysis', Tata McGraw Hill Publishing Company, **2008**.
4. L.P. Singh, 'Advanced Power System Analysis and Dynamics', 3rd Edn., Wiley Eastern, New Delhi, **2012.**

CUSTOMIZED POWER DEVICES

Subject Code: MELE1-265 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

1. To study of advances in Power Electronics Industry led to rapid development of Power Electronics controllers for fast real and reactive power control and to introduce these advancements.

Course Outcomes

1. Upon successful completion of this course, students will be able to select suitable FACTS device for the enhancement of power transfer capability and to control the power flow in an efficient manner.

UNIT-I

Static Power Frequency Changers

Fundamental Ideas: Historical Background, Basic Operational features and Operating Principles. Mathematical Representation (output voltage and Input Current) of Static Frequency Changers. Synthesis of the Output Voltage Waveform, Control of the Output Voltage (PWM, Amplitude Dependent Frequency Modulation, Phase Shift). Unwanted Components of Output Voltage, Analysis of the Input Current. Extra basal Components of the Input Current. Control Circuit Principles: Implementation of Modulating Functions. End Stop Control, Control of UDFFC, NCC and CDFFC. Forced Commutation of Frequency Changers: Fundamental Principles of Hard and Soft Commutation, Points of Connection of Commutating Circuits. Some Basic Commutating Circuits. Application of Static Frequency Changers: Speed Control of AC Machines, Constant Frequency Power Supplies and Static VAR Generators.

UNIT-II

Compensators and Power Flow Controllers:

Static shunt compensators, Static series compensators, Static Voltage and phase angle regulators, Principle of operation of Controllers, Control and characteristics, Model of IPFC for power flow and optimum power flow studies. FACTS Controller interactions –SVC–SVG interaction -co-ordination of multiple controllers using linear control techniques –Quantitative treatment of control coordination.

UNIT-III

Power Quality Improvement:

Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P-Q theory, Synchronous detection method –Custom power park –Status of application of custom power devices.
Difference in role of FACTS devices in transmission and distribution networks

UNIT-IV

Recent Trends:

Application of basic active filters, multilevel and multipulse converters and Z-source inverter in various FACTS and FACDS devices for improving the performances of transmission system net work and distribution system network, respectively.

RECOMMENDED BOOKS:

1. Y.H. Song and A.T. Johns, 'Flexible AC Transmission Systems', IEEE Press, **1999**.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS (Concepts and Technology of Flexible AC Transmission System)', Standard Publishers & Distributors, **2001**.
3. R.M. Mathur and R.K. Verma, 'Thyristor based FACTS Controllers for Electrical Transmission Systems', IEEE Press, **2002**.

ADVANCED ELECTRICAL MACHINES DESIGN

Subject Code: MELE1-266 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives:

1. To give a systematic approach for modelling and analysis of all rotating machines under both transient and steady state conditions.

Course Outcomes:

1. Develop the basic elements of generalized theory and derive general equations for voltages and currents applicable to all types of rotating machines, to deal comprehensively with their steady-state, dynamic and transient analysis.
2. Obtain the voltage and torque equations for a symmetrical induction machine in terms of machine variables and transform these equations by applying reference-frame theory to Analyse the dynamic performance of the machine.
3. Apply Park"s transformation to transform the time varying synchronous machine equations to a time-invariant set of equations and study the dynamic performance.
4. Linearize the nonlinear equations of induction and synchronous machines to study the dynamic behaviour of small displacements about the operating point.

UNIT-I

Introduction: Design of Machines, Factors, limitations, Modern trends. Materials: Conducting, magnetic and insulating materials. Calculations of mmf for air gap and teeth, real and apparent flux densities, iron losses, field form, leakage flux, specific permanence. Modes of heat dissipation, Temperature gradients, types of enclosures, types of ventilation, conventional and direct cooling, amount of coolants used, Ratings.

UNIT-II

Transformer and DC Machine

Transformer: Magnetic circuit, core construction and design, winding types, insulation, Loss allocation and estimation, Reactance, Temperature rise.

D C Machine:

No. of poles and main dimensions, armature, windings, Magnetic circuit and Magnetisation curve, Commutator and brushes.

UNIT-III

AC Machine

Induction Machine-3 Phase: Rating specifications, standard frame sizes, Main dimensions' specific loadings, Design of stator windings, Rotor design –slots and windings, calculations of equivalent circuit parameters.

Synchronous Machine: Main dimensions, Magnetization characteristic, Field winding design.

UNIT-IV

Computer Aided Design of Electrical Machines

Analysis and synthesis approaches, design algorithms, Introduction to optimization techniques, Implementing computer program for design of three phase induction motor.

RECOMMENDED BOOKS:

1. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai & Co.
2. A.E. Clayton & N.N. Hancock, 'The Performance and Design of Direct Current Machines', CBS Publishers and Distributors.
3. E.S. Hamdi, 'Design of Small Electrical Machine', John Wiley and Sons, **1994**.
4. M. Ramamoorty, 'Computer Aided Design of Electrical Equipment', Eastern Press Private Limited, **1989**.
5. M.G. Say, 'Design and Performance of Machines', CBS Publications, **1981**.

ARTIFICIAL INTELLIGENT TECHNIQUES

Subject Code: MELE1-267/ MELE2-267/ MELE3-267 | **L T P C 4 0 0 4** | **Duration: 45 Hrs.**

Course Objectives:
1. To apply artificial neural networks in various electrical and electronics engineering applications.
2. To expose students to fuzzy methods of analysing problems which involve incomplete or vague criteria rather than crisp values.
3. To investigates requirements analysis, logical design, and technical design of components for fuzzy systems development.

Course Outcomes:
1. The students acquire the skills required to innovate and build, smart and intelligent applications in electrical and electronics engineering.
2. They will understand review of Neural Networks: models of a neuron, various activation functions, Threshold function, piecewise – linear function, stochastic model of a neuron, feedback.
3. They will be able to take up fuzzy systems approach to solve applications in engineering.

UNIT I

NEURAL NETWORKS (9 hours)
Neural Networks – biological neurons – Artificial neurons – activation function – Course rules – feed forward networks – supervised & Unsupervised Course –perceptron network- linear separability – back propagation networks Algorithms-Radial basis function networks.

UNIT II

ASSOCIATIVE MODELS AND CONTROL SCHEMES IN NN (9 hours)
Auto & hetero associative memory – bi-directional associative memory – Self organizing feature Maps-Hopfield Networks-Neural Networks for non – linear system – Schemes of Neuro control – System identification – forward model and – Inverse model – Case studies.

UNIT III

FUZZY LOGIC AND GENETIC ALGORITHM (9 hours)
Fuzzy set - Crisp set – vagueness – uncertainty and imprecision – fuzzy set – fuzzy operation- properties – crisp versus fuzzy relations – fuzzy relations –fuzzy Cartesian product and composition – composition of fuzzy Relations-Fuzzy to crisp conversion –structure of fuzzy logic controller – database – rule base – Inference engine.
GA: Working principles – terminology – Importance of mutation – comparison with traditional methods – constraints and penalty function – GA operators – Real coded GAs.

UNIT IV

APPLICATIONS (9 hours)
Applications of Neural network, Fuzzy system & Genetic algorithms for power systems and power electronics Systems-Designing of controllers using Simulation Software, NN tool box & Fuzzy Logic Toolbox.

RECOMMENDED BOOKS:
1. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill International Edition, USA, **1997**.
2. Awrence Fausatt, 'Fundamentals of Neural Networks', Prentice Hall of India, New Delhi, **1994**.
3. Simon Haykin, 'Neural Networks – A Comprehensive Foundation', Pearson Education Asia, **2002**.

POWER SYSTEM DYNAMICS & STABILITY

Subject Code: MELE1-368/ MELE3-207 L T P C Duration: 45 Hrs.
4 0 0 4

Course Objectives:
1. To know the elementary mathematical model and system response to small disturbances.
2. To impart the concepts of transient stability.
3. To impart knowledge on voltage stability.

Course Outcomes:
After Completion of this course students will be able to
1. Solve mathematical calculations and swing equation and obtain classical model of an infinite bus system.
2. Analyse the effect of small speed changes in multi machine synchronous machines and voltage regulator governor system.
3. Understand the transient stability analysis under common disturbances including the short circuits and find clearing time to solution for swing equation by step by step method.

UNIT-I

1. Overview: Angular Stability, Transient stability, steady state stability, dynamic stability, Small Signal, Voltage Stability.

2. Transient Stability Analysis: Single Machine - Infinite Bus System, Equal Area Criterion, Multi-machine Stability, Network Reduction and Numerical Integration Methods, Methods of Improvement.

UNIT-II

3. Small Signal Stability Analysis: Eigen Value and Participation Factor Analysis; Single machine -Infinite Bus and Multi-machine Simulation; Effect of Excitation System and AVR, improvement of Damping, Power System Stabilizer and Static VAR System (SVS) supplementary controls.

UNIT-III

4. Sub Synchronous Oscillations: Sub Synchronous Resonance (SSR) Phenomenon, Counter measures to SSR problems.

UNIT-IV

5. Voltage Stability: PV and QV curves, Impact of Load and Tap changer Dynamics; Static Analysis, Sensitivity and Continuation Methods; Dynamic Simulation, Introduction to Bifurcation Analysis; Proximity Indices, Methods to enhance Stability Margin.

RECOMMENDED BOOKS:
1. P. Kundur, 'Power System Stability and Control', McGraw Hill.
2. C.W. Taylor, 'Power System Voltage Stability', McGraw Hill.
3. P.M. Anderson and A.A. Foud, 'Power System Control and Stability', IEEE Press.
4. E. Kimbark, 'Power System Stability', Vol. I, II & III, IEEE Press.

ADVANCED POWER SYSTEM PROTECTION

Subject Code: MELE1-369 / MELE3-206 L T P C Duration: 45 Hrs.
4 0 0 4

Course Objectives:
1. To facilitate the students, understand the basic concepts and recent trends in power system protection.
2. To enable the students design and work with the concepts of digital and numerical relaying.

Course Outcomes:
On completion of the course the students would be skilled enough to work with various type of schemes used for different apparatus protection.

UNIT-I

1. **Fundamentals:** Types of relays, their classifications and theory Phase and amplitude comparators. Static Comparators Computer Applications to protective relaying.
2. **Circuit Breakers:** Physical stress in circuit breakers, Vacuum circuit breakers, SF6 Circuit breakers Direct current C.B's, Short circuit testing of circuit breakers, Comparison of different types of circuit breakers.

UNIT-II

3. **Transmission Line Protection:** Carrier Current Protection, Applications of microwave Channels for protective relaying, Selection of suitable static relaying scheme for transmission line protection. Performance specifications of distance relays, effect of fault resistance and effects of power swings on operation of relays and Distance relay settings.

UNIT-III

4. **Generators and Transformers Protection:** CT's and PTs burden and accuracy and their connections. Protection of rotor winding. Miscellaneous protection schemes for generators and transformers, Over fluxing protection of transformers.

UNIT-IV

5. **Differential Relays:** Operating Characteristics, Restraining Characteristics, Analysis of Electromagnetic and differential Static relays schemes.
6. **Bus zone Protection:** Types of bus bar faults, Protection requirements, protection schemes and modern trend in bus-bar protection.

RECOMMENDED BOOKS:

1. T.S. Madhava Rao, 'Power System Protection (Static Relays)', Tata McGraw-Hill, **1989**.
2. A.R. Van C. Warrington, 'Protective Relays', Chapman and Hall, London, **1968**.
3. S.K. Basu and S. Chaudhary, Raju Primlan 'Power System Protection', Oxford and IBH Press, **1983**.
4. Ravindra Nalh, M. Chander, 'Power System Protection and Switch Gear', John Wiley Eastern, **1989**.
5. Sunil S. Rao., 'Power System Protection and Switch Gear', Khanna Publishers, **1989**.
6. Related IEEE/IEE Publications.

SMART GRID TECHNOLOGIES

Subject Code: MELE1-370/ MELE3-162 L T P C Duration: 45 Hrs.
4 0 0 4

UNIT- I

1. **Introduction to Smart Grid (10 Hrs.)**: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

UNIT-II

2. Smart Grid Technologies (10 Hrs.)

Part 1: Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

UNIT-III

3. Micro grids and Distributed Energy Resources (10 Hrs.): Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources

UNIT-IV

4. Power Quality Management in Smart Grid (10 Hrs.): Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

5. Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

BOOKS RECOMMENDED:

1. Ali Keyhani, N. 'Integration of Green and Renewable Energy in Electric Power Systems', Marwali, Min Dai, Wiley.
2. Clark W. Gellings, 'The Smart Grid: Enabling Energy Efficiency and Demand Response', CRC Press.
3. Akihiko Yokoyama, Janaka E kanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, 'Smart Grid: Technology and Applications', Wiley.
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, 'Smart Grids', Wiley Blackwell.

ENGINEERING OPTIMIZATION

Subject Code: MELE1-371/ MELE3-371/ MELE0-F94	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT I

Introduction: Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.

UNIT II

Linear Programming (LP) and Non Linear Programming (NLP): Simplex method of solving LP, revised simplex method, duality, Constrained Optimization, Theorems and procedure, linear programming, mathematical model, solution technique, duality. Steepest descent method, Conjugate gradient method, Newton Method, Sequential quadratic programming, Penalty function method, augmented Lagrange multiplier method.

UNIT III

Dynamic Programming (DP): Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm.

UNIT IV

Genetic Algorithm (GA): Introduction to Genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between GA and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded GA, Advanced GA, global optimization using GA, Applications to power system.

RECOMMENDED BOOKS:

1. D.A. Pierre, 'Optimization Theory with Applications', Wiley Publications.
2. H.A. Taha, 'Operations Research: An Introduction', 7th Edn., Pearson Education Edition, Asia, Delhi.
3. S.S. Rao, 'Optimization –Theory and Applications', Wiley-Eastern Limited.

4. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', PHI Publishers.
5. Donald E. Kirk, 'Optimal Control Theory', Dover Publications, New York.
6. Kalyanmoy Deb, 'Optimization for Engineering Design: Algorithms and Examples', PHI Publishers.

POWER SYSTEM PLANNING

Subject Code: MELE1-372 / MELE3-205 L T P C 4 0 0 4 Duration: 45 Hrs.

Course Objectives:

1. To acquire skills in planning and building reliable power system.

Course Outcomes:

1. The scope of employability in power utilities will increase.
2. The management skills required in the field of power system engineering is enhanced.

UNIT-I

1. Introduction: power system planning, objective, stages in planning and design, the electric utility industry, growth characteristics generation, transmission and distribution systems.

2. Demand/energy forecasting: electricity consumption pattern, peak demand and energy forecasting by trend and economic projection methods. Review of load forecasting.

UNIT-II

3. Power System Planning: Investment planning: traditional generation expansion planning models, integrated resource planning models, production cost simulation models.

4. Generating system capability planning: probabilistic models of generating units, growth rate, rate of generation capacity, outage performance and system evaluation of loss of load and loss of energy indices, power supply availability assessment, Expansion planning, unit maintenance schedule, unit effective load carrying capability.

5. Transmission system planning: automatic transmission system expansion planning, automatic transmission planning using interactive graphics.

UNIT-III

6. Distribution system planning and automation: load characteristics, design of sub transmission lines and distribution, substations, design considerations of' primary and secondary distribution systems, voltage drop and power loss calculations.

7. Interconnected systems: multi-area reliability analysis, power pool operation and power exchange energy contracts, quantification of economic and reliability benefits of pool operation.

UNIT-IV

8. Power system Expansion planning: formulation of least cost optimization problem involving capital, operation and maintenance costs of candidate units of different types.

RECOMMENDED BOOKS:

1. Y. Wallach, 'Power System Planning', McGraw Hill International.
2. P. Sullivan, 'Power System Planning', McGraw Hill International.
3. S. Dasari, 'Electric Power System Planning', IBT Publishers, New Delhi.
4. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
5. Endreyni, 'Reliability Modelling in Electric Power System', John Wiley, New York.
6. J.R. McDonald, 'Modern Power System Planning', McGraw Hill International.
7. A.S. Pabla, 'Electrical Power System Planning', Macmillan, **1998**.

ELECTRIC TRACTION SYSTEM

Subject Code: MELE1-373 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

1. Traction Systems and Latest Trends: Present scenario of Indian Railways – High speed traction, Metro, Latest trends in traction-Metro, monorail, Magnetic levitation Vehicle, Steam, diesel, diesel-electric, Battery and electric traction systems, General arrangement of D.C., A.C. single phase and 3-phase, Composite systems, Choice of traction system - Electric and Diesel-Electric.

UNIT-II

2. Mechanism of Train Movement: Analysis of speed time curves for main line, suburban and urban services, Simplified speed time curves. Relationship between principal quantities in speed time curves, Requirement of tractive effort, Specific energy consumption and Factors affecting it.

UNIT-III

3. Traction Motors and their Control: Features of traction motors, Significance of D.C. series motor as traction motor, A. C. Traction motors-single phase, Three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Pulse Width Modulation control of induction motors, Types of electric braking system.

UNIT-IV

4. Electric Locomotives: Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment, Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station.

RECOMMENDED BOOKS:

1. R.B. Brooks, 'Electric Traction Hand Book', Sir Isaac Pitman and sons Ltd., London.
2. A.T. Dover, Mac Millan, 'Electric Traction', Dhanpat Rai and Sons, New Delhi.
3. J. Upadhyay S.N. Mahendra, 'Electric Traction', Allied Publishers Ltd., Dhanpat Rai and Sons, Delhi.
4. H. Partab, 'Modern Electric Traction', Dhanpat Rai and Sons, New Delhi.
5. J.B. Gupta, 'Electric Power Utilization', Kataria and Sons, New Delhi.

POWER SYSTEM RELIABILITY

Subject Code: MELE1-374/ MELE3-264 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

To develop an understanding of power system reliability evaluation by using deterministic and probabilistic techniques.

Course Outcomes

Upon successful completion of this course, a student will be able to:

Understand the application of basic probability theory and distribution to power system

Identify the main subsystems of a power system and their constituent components

To produce mathematical models for generator, transmission line and load

Apply techniques for reliability evaluation of individual systems

Apply techniques for reliability evaluation of composite systems

UNIT-I

1. Basic Reliability Concepts: The General reliability function, Hazard rate, MTTF, Markov processes.

2. Static Generating Capacity Reliability Evaluation: Capacity outage probability tables, loss of load probability method, Frequency and duration approach.

UNIT-II

3. Spinning Generation Capacity Reliability Evaluation: Spinning reserve, spinning reserve capacity evaluation, Load forecasting methods, Load forecast uncertainty, maximum capacity levels, Derated capacity levels.

UNIT-III

4. Transmission System Reliability Evaluation: Average interruption rate method, Frequency and duration method, Stormy and normal weather effects, The Markov process approach.

UNIT-IV

5. Composite System Reliability Evaluation: Conditional probability approach, two–plant single load system, multi plant multi load system

RECOMMENDED BOOKS:

1. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
2. Endreyni, 'Reliability Modelling in Electric Power System', John Wiley, New York.
3. Ali Chowdhury Don Koval, 'Power Distribution System Reliability: Practical Methods and Applications', Wiley-IEEE Press.

DISTRIBUTION SYSTEM OPERATION AND ANALYSIS

Subject Code: MELE1-375/ MELE3-369 L T P C
4 0 0 4

UNIT-I

1. System Planning: Introduction, Distribution system planning, Factors affecting system planning, present planning techniques, planning models, Introduction to optimum line network. future trends in planning, systems approach, distribution automation. Load Characteristic: Basic definitions, relation between load and loss factors, maximum diversified demand, load forecasting, Load management.

UNIT-II

2. System Design and Operation: Criteria, system developers, dispersed generation, distribution systems, economics and finance, mapping, Design of substation and feeder, Operation criteria, voltage measurements, harmonics, load variations, system losses, Introduction to energy management.

UNIT-III

3. Voltage Regulation and Automation: Quality of Service and Voltage Standards, Voltage Control, Line Drop Compensation, Distribution capacitor automation, Voltage fluctuations, SCADA and Communication with Load Dispatch Centres.

UNIT-IV

4. Distribution System Protection: Objective of distribution system protection, high impedance faults coordination of protective devices: fuse to fuse co-ordination, re-closer to re-closer coordination, re-closer to fuse coordination, re-closer to substation transformer high side fuse coordination, fuse to circuit breaker coordination, re-closer to circuit breaker coordination, lightning protection.

RECOMMENDED BOOKS:

1. Gonen, Turan, 'Electric Power Distribution System Engineering', CRC PRESS, **2012**, 3rd Indian Reprint.
2. A.S. Pabla, 'Electric Power Distribution', 6th Edn., TMH, **2011**,

3. 'Electric Power Distribution Handbook', Thomas Allen Short.

PROJECT

Subject Code: MELE3-309/ MELE1-309/ MELE2-309 **L T P C**

Course Objectives:

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Course Outcomes:

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields. The project will carry 10 credits. Its evaluation will be done as under:

Internal Marks		**External Marks**	
1. Formulation of Problem	10	Implementation	10
2. Design	10	Result & Analysis	10
3. Implementation	20	Report	10
4. Testing & Analysis	10	Viva-Voce	10
5. Report	10	----	---
Total Marks	60	**Total Marks**	40

SEMINAR

Subject Code: MELE1-310/ MELE2-310/ MELE3-310 **L T P C**

Course Objectives:

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature
3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Course Outcomes:

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields.

Seminar will carry 4 credits. It will be done on any topic within/outside the curriculum. Its evaluation will be done as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Depth & Coverage of Topic	40	-
2	PPT Presentation & Report	20	-
3	Presentation	20	-
4	Questions & Answers	20	-
Total		**100**	**-**

RESEARCH LAB.

Subject Code: MELE1-311/ MELE2-311/ MELE3-311 **L T P C**

Students will be made familiar with one or more available softwares like MATLAB, ETAP, GAMS, Power System Toolbox, Power world Simulator, Network Simulator, LABVIEW, etc. so that students can use any one or more of them for their dissertation. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

DISSERTATION

Subject Code: MELE1-412/ MELE2-412/ MELE3-412 **L T P C**

Course Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Course Outcomes:

1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyse a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.
The thesis will carry 24 credits and will be evaluated as under:
Dissertation will be evaluated as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Originality	12	08
2	Presentation	12	08
3	Contents & Volume of work	18	12
4	Discussion (Contribution of candidate)	18	12
Total		**60**	**40**

Study Scheme

M Tech (Mechanical Engineering) Part time

1st Semester		Contact Hours			Assessment			Credits
Subject Code	Subject Name	L	T	P	Internal Marks	External Marks	Total	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMEE2-102	Advanced Heat & Mass Transfer	4	0	0	40	60	100	4
MMEE2-103	Advanced Manufacturing Processes	4	0	0	40	60	100	4
Total	**Theory Subjects 03**	**12**	**0**	**0**	**120**	**180**	**300**	**12**

2nd Semester		Contact Hours			Assessment			Credits
Subject Code	Subject Name	L	T	P	Internal Marks	External Marks	Total	
MMEE2-104	Advanced Machine Design	4	0	0	40	60	100	4
MMEE2-105	Lab I	0	0	4	100	---	100	2
Departmental Elective – I (Select any one)								
MMEE2-156	Composite Material	4	0	0	40	60	100	4
MMEE2-157	Mechatronics							
MMEE2-158	Finite Element Modelling							
Open Elective - I (Select any one)		3	0	0	40	60	100	3
Total	**Theory Subjects 03; Lab 01**	08	**0**	4	**320**	**180**	**400**	**13**

3rd Semester		Contact Hours			Assessment			Credits
Subject Code	Subject Name	L	T	P	Internal Marks	External Marks	Total	
MMEE2-206	Computational Fluid Dynamics	4	0	0	40	60	100	4
MMEE2-207	Advanced CAD/CAM	4	0	0	40	60	100	4
MMEE2-208	Industrial Automation	4	0	0	40	60	100	4
Total	**Theory Subjects 03**	**12**	**0**	**0**	**120**	**180**	**300**	**12**

4th Semester		Contact Hours			Assessment			Credits
Subject Code	Subject Name	L	T	P	Internal Marks	External Marks	Total	
MMEE2-209	Advanced Optimization Techniques	4	0	0	40	60	100	4
MMEE2-210	Lab II	0	0	4	100	---	100	2
MMEE2-311	Maintenance & Reliability Engineering	4	0	0	40	60	100	4
Departmental Elective – II (Select any one)								
MMEE2-259	Modelling & Simulation of Mechanical Systems	4	0	0	40	60	100	4
MMEE2-260	Welding Metallurgy							
MMEE2-261	Gas Dynamics							
Total	**Theory Subjects 03; Lab 01**	08	**0**	4	**320**	**180**	**400**	**14**

5th Semester		Contact Hours			Assessment			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal Marks**	**External Marks**	**Total**	
MMEE2-312	Total Quality Management	4	0	0	40	60	100	4
MMEE2-313	Project & Seminar	0	0	4	50	50	100	4
MMEE2-314	Thesis Synopsis	0	0	4	---	100	100	10
Total	**Theory Subjects 01; Lab 02**	**12**	**0**	**08**	**90**	**210**	**300**	**18**

6th Semester		Contact Hours			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**		
MMEE2-415	Final Thesis	0	0	0	Satisfactory/ Not satisfactory	20

Semester	Credits	Total marks
1	12	300
2	13	400
3	12	300
4	14	400
5	18	300
6	20	----
Total	**79**	**1700**

M. Tech Textile Technology (1st Year)

Total Contact Hours = 12 Total Marks = 300 Total Credits = 12

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MTEX1-101	Advances in Fibre Production Technologies	4	0	0	40	60	100	4
MTEX1-102	Advances in Yarn Production Technologies	4	0	0	40	60	100	4
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MTEX1-156	Process Control in Spinning and Weaving							
MTEX1-157	Production Management in Textiles							
Total	**Theory = 3 Lab = 0**	12	0	0	120	180	300	12

M. Tech Textile Technology (1st Year)

Total Contact Hours = 12 Total Marks = 300 Total Credits = 12

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MTEX1-103	Advances in Fabric Production Technologies	4	0	0	40	60	100	4
MTEX1-205	Structural Mechanics of Yarns	4	0	0	40	60	100	4
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MTEX1-158	Textile Product Design							
MTEX1-159	Physical Properties of Fibres							
Total	**Theory = 3 Lab = 0**	12	0	0	120	180	300	12

M. Tech Textile Technology (2nd Year)

Total Contact Hours = 12 Total Marks = 300 Total Credits = 12

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MTEX1-206	Structural Mechanics of Fabrics	4	0	0	40	60	100	4
MTEX1-104	Garments Manufacturing Technology	4	0	0	40	60	100	4
Departmental Elective – III (Select any one)		4	0	0	40	60	100	4
MTEX1-260	Research Methodology							
MCAP0-195	Computer Programming and Its Application							
Total	**Theory = 3 Lab = 0**	12	0	0	120	180	300	12

M. Tech Textile Technology (2nd Year)

Total Contact Hours = 12 **Total Marks = 300** **Total Credits = 12**

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MTEX1-307	Profession Skill	4	0	0	40	60	100	4
Departmental Elective – V (Select any one)		4	0	0	40	60	100	4
MTEX1-261	Advance Knitting Technology							
MTEX1-262	Post Spinning Operation							
Open Elective – I (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 3 Lab = 0**	12	0	0	120	180	300	12

M. Tech Textile Technology (3rd Year)

Total Contact Hours = 8 **Total Marks = 400** **Total Credits = 22**

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MTEX1-308	Project Part-I	-	-	-	50	50	100	10
MTEX1-309	Seminar	-	-	-	100	-	100	4
Open Elective – II (Select any one)		4	0	0	40	60	100	4
Departmental Elective – V (Select any one)		4	0	0	40	60	100	4
MTEX1-363	High Performance Fibres and Composites Textile Structural Composite							
MTEX1-364	Environmental Practices in Textiles							
MTEX1-365	Technical Textiles							
Total	**Theory = 1 Lab = 0**	8	0	0	230	170	400	22

**The credits shall be consolidated on the completion of Project part –*

M. Tech Textile Technology (3rd Year)

Total Credits = 20

SEMESTER 6th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MTEX1- 410	Project Part – II	0	0	0		20

Overall

Semester	Marks	Credits
1st	300	12
2nd	300	12
3rd	300	12
4th	300	12
5th	400	22
6th	--	20
Total	**1600**	**90**

M. Tech.

Textile Technology

FIRST SEMESTER

SYLLABUS

ADVANCES IN FIBER PRODUCTION TECHNOLOGIES

Subject Code - MTEX1-101 **L T P C** **Duration - 40 Hrs**
4 0 0 4

UNIT – I (10 Hrs)

General Definition of Man Made or Manufactured Fibres, Introduction to General Principles of Spinning and Spinning Processes, Basic Principles of Fluid Flow during Fiber Spinning, Factors Affecting Shear Viscosity. Elongational Flow, Spinnability and Flow Instabilities

UNIT - II (10 Hrs)

Extruder Design, Spin Head, Spinneret, Quench Chamber, Spin Finish Application, Wind Up Mechanism, Manufacture and Specifications of Raw Materials and Monomers.

UNIT - III (10 Hrs)

Types, Methods of Manufacture, Mechanism of Polymerisation and Production Techniques of Viscose, Nylon 6 And 66, PET, PAN And PP, Introduction to New Developments, other Fibres including PU, PVA, PE, PVC and Polyvinylidene Chloride.

UNIT-IV (10 Hrs)

Primary and Secondary Variables and Their Effect on Melt Spinning, High Speed Spinning, Spinning of Microfibre, Solution Spinning Process: Dry and Wet Spinning, Heat-Setting of Fibres

Recommended Books

1. A.A. Vaidya, "Production of Synthetic Fibres", 1st Edn., Prentice Hall of India, New Delhi, **1988.**
2. V.B. Gupta and V.K. Kothari, "Manufactured Fibre Technology", 1st Edn., Chapman and Hall, London, **1997.**
3. H.F. Mark, S.M. Atlas and E. Cernia, "Man Made Fibre Science and Technology", Vol. 1, 2, 3, 1st Edn., Willey Inter Science Publishers, New York, **1967.**
4. J.E. Macintyre, "Synthetic Fibres", Woodhead Fibre Science Series, UK, **2003.**
5. F. Fourne, "Synthetic Fibres: Machines and Equipment, Manufacture, Properties", Hanser Publisher, Munich, **1999.**

ADVANCES IN YARN PRODUCTION TECHNOLOGIES

Subject Code - MTEX1-102 **L T P C** **Duration – 40 Hrs**
4 0 0 4

UNIT – I (10 Hrs)

Fiber Quality Requirements for Different Spinning Technologies, Systems of Yarn Manufacture in Cotton, Worsted, Woolen and Semi Worsted System, Comparative Study of New Spinning Technologies, Concept of Opening and Cleaning

UNIT-II (10 Hrs)

Aerodynamics and its Role in Blowroom, Theories of Cardin, Drafting Theories, Developments in Comber, Quality Aspects of Roving, Balloon Theory in Spinning, Significance of Modern Developments in Spinning Process, Modern High Speed Draft Spinning Systems

UNIT-III (10Hrs)

Machine and Process Variables Affecting The Structure and Properties of Spun Yarns, Introduction to Core Spinning, Cover Spinning, Siro-Spinning and Compact Spinning.

UNIT-IV (10 Hrs)

Processing of Wool and Man Made Fibres in New Spinning Systems, Non Conventional Methods of Yarn Manufacture, Air-Vortex Yarn, Quality Standards of Different Yarns with Emphasis on USTER Standard

Recommended Books

1. P. Grosberg and C. Iype, "Yarn Production-Theoretical Aspects", 1st edition, The Textile Institute, UK, **1999.**
2. R. Chattopadhyay, "Advances in Technology of Yarn Production", 1st Edn., NCUTE, New Delhi, **2002.**
3. M.V.S. and A.B. Talele, "A Guide to Crimping / Texturing Technology", 1st Edn., Nasnal Printers and its Associates, Surat,**1992.**
4. Klein W, "Manual of Textile Technology-New Spinning Systems", Vol.5, 1st Edn., The Textile Institute, UK, **1993.**

ADVANCES IN FABRIC PRODUCTION TECHNOLOGIES

Subject Code - MTEX1-103	L T P C 4 0 0 4	Duration – 40 Hrs

UNIT-I (14 Hrs)

Development Trends in Winding, Warping and Sizing Machines for Improving Quality of Preparation and Cost Reduction, Loom Development Trends and Objectives, Kinematics of Sley and Heald Motion with Reference to Shuttle Loom, Mechanics of Shuttle Checking, Analysis of Warp Tension during Weaving, Cloth Fell Position, Beat Up Force and Pick Spacing

UNIT-II (10 Hrs)

Theoretical Analysis of Weft Insertion in Shuttleless Loom, Electronic Control of Different Motions of Loom, Techno-Economics of Different Methods of Fabric Production

UNIT-III (4 Hrs)

Weft Knitted Fabric Manufacturing by Circular Knitting and Flat Bed Knitting Machine, Warp Knitting Manufacturing

UNIT-IV (12 Hrs)

Classification and Areas of Application of Nonwoven Fabrics, Different Methods of Production of Nonwoven Fabrics, Effect of Machines, Fibre and Process Variables on Properties of Nonwoven Fabrics, Failure Mechanism of Nonwoven Fabrics. Prediction Of Needle Punched Nonwoven Fabric Behavior. Designing of Nonwoven For Engineering Applications. Developments In Nonwoven Machineries.

Recommended Books

1. R. Marks and A.T.C. Robinson, "Principles of Weaving", Textile Institute, UK, **1986.**

2. A. Ormerod, “Modern Preparation and Weaving Machinery”, Buttersworth & Co., UK, **1983**.
3. O. Talavasek and V. Svaty, “Shuttleless Weaving Machine”, Elsevier Scientific Publishing Co. Amsterdam, **1981**.
4. J. Lunenschloss and W. Albrecht, “Nonwoven Bonded Fabrics”, Ellis and Harwood Ltd. UK, **1985.**
5. W. Albrecht, H. Fuchs and Kittelmann, “Nonwoven Fabrics”, Wiley – VCH Weinheim. **2003.**
6. V. Mrstina and F. Fejgal, “Needle Punching Textile Technology”, Elsevier Scientific Publishing Co. Amsterdam, **1990**.
7. M.L. Gulrajani, “Book of Papers of International Conference on Nonwoven”, The Textile Institute, UK, **1992.**
8. D.J. Spencer, “Knitting Technology”, 2nd Edn.,, Pergamon Press, **1989.**

GARMENT MANUFACTURING TECHNOLOGY

Subject Code - MTEX1-104 **L T P C** **4 0 0 4** **Duration – 40 Hrs**

UNIT-I (6 Hrs)

Introduction to Garment Manufacturing and Indian Apparel Industry

UNIT-II (10 Hrs)

Pattern Alteration Techniques, Principles of Fittings. Selection of Fabrics, Trims and Accessories, Methods of Fabric Inspection, Interlining, Trade Pattern Design and Grading, Types of Seam and Stitches.

UNIT-III (14 Hrs)

Sewing Machinery and Its Special Attachment, Apparel Production System and Practices, Production Planning and Control. Bundling Techniques, Batch, Piece and Sectional Assembling, Special Finishes on Garments Such as Stone Wash, Labeling System, Checking, Pressing, Folding and Packing Standards for Domestic and Export Market, Checking and Quality Control. Ready to Wear Garment

UNIT-IV (10 Hrs)

Garment Comfort, Kawabata and FAST Evaluation System, Plant Layout for a Garment Unit, Application of CAD and CAD Min Garment Manufacturing, Phasing of MFA and Its Implications and Export Documentations

Recommended Books

1. Cooklin Gerry, “Garment Technology for fashion Designers”, Om Book Service Delhi, **1997**.
2. Carr Harold and Barbara, “The Technology of clothing Manufacture”, Om Book Service, Delhi, **1998**
3. P.V. Mehta and S.K. Bhardwaj, “ Managing Quality in Apparel Industry”, New Age International (P) Ltd., Delhi.

4. A. Bhattacharye, “Garment TechnologyNCUTE Series”, Ed. NCUTE-IIT, Delhi, **2003**.
5. W. Aldrich, “Metric pattern cutting”, Om Book Service, Delhi, **1998.**
6. J. Wilson, “Hand book of Textile Design”, Woodhead Publishing Ltd., UK, **2002.**

PROCESS CONTROL IN SPINNING & WEAVING

Subject Code -MTEX1-156 | **L T P C 4 0 0 4** | **Duration – 40 Hrs**

UNIT - I (12 Hrs)

Process Control in Spinning: Optimum Fibre-Mix for Various End Use Requirements, Yarn Realization, Waste Control in Blow room and Card for All Types of Fibres Spun on Cotton System, Minimizing Lea Count Variation, Controlling Yarn Irregularity, Imperfections and Faults, Yarn Tenacity and Elongation, Hairiness. Production of High Quality Export Yarns

UNIT - II (8 Hrs)

Machinery Audit, Work Load, Ambient Environment etc. Trouble Shooting, Some Case Studies, Life of Accessories, Work Load, Indices of Productivity, Temperature and Humidity Control & Its Effect on Performance.

UNIT - III (12 Hrs)

Process Control in Weaving: Principles for Control of Productivity in Different Sections, Contribution of Control in Yarn Winding, Warping, Sizing & Weaving to The Cost of Production in Fabric Manufacture, Splicing, Machine Allocation and Load Distribution, Control of Migration in Sizing, Size Droppings, Sizing Materials, Loom Allocation, Control of Value Loss in Fabrics Through Evaluation & Grading of Fabric Defects, Control of Loom Accessories, Control of Loss of Efficiency by Snap Study.

UNIT - IV (8 Hrs)

Process Control in Special Conditions: Controls in the Process of High Twist Yarns, Blended Yarns, Filament Yarns in Warp and Weft, Controls in The Winding for Processing Yarns for Dyeing & Knitting, Controlling Sloughing Off During Winding, Warping & Weaving, On-Line Data System and Its Use In Controls

Recommended Books

1. ATIRA, “Process Control in Spinning”.
2. ATIRA, “Process Control in Weaving”.
3. R. Chattopadhyay, “Process Control in Spinning”, IIT, NCUTE, Delhi.
4. SITRA, “Quality Control in Spinning”.

PRODUCTION MANAGEMENT IN TEXTILE

Subject Code - MTEX1-157 | **L T P C 4 0 0 4** | **Duration – 40 Hrs**

UNIT – I (10 Hrs)

Operation Management: Operations Management in Corporate Profitability and Competitiveness, Types and Characteristics of Manufacturing and Service Systems, Operations Planning Control: Planning Production in Aggregate Terms, Quality Assurance

UNIT – II (10 Hrs)

Plant Location and Layout: Plant Layout: Features, Basic Principles, Types of Layout, Merits And Demerits, Optimization Of A Product/Line Layout And Process Layout. Location of Facilities: Nature of Location Decision, Situations That Influence Location Decision, Backward Areas And Industrial Policy, Behavioral Aspects In Location Planning

UNIT – III (10 Hrs)

Material Management: Purchasing, Objectives, Value Engineering, Vendor Relations, Selection of Vendors, Material Requirement Planning, MRP Calculations, Material Handling

UNIT - IV (10 Hrs)

Job Evaluation and Waste Management: Job Evaluation, Incentive Schemes, Job Redesign, Work Measurement Techniques, Different Types of Pollution: Water, Air, Solid Waste, Soil, Noise, Odours etc. Pollution Caused by Textile Industries, Waste Definition, Characteristics and Perspectives, Different Types of Waste

Recommended Books

1. M.R. Raymond, "Production and operations management", Mcgraw-Hill international Edition, New York, **1993.**
2. S.E. Buffa and R. Sarin, "Modern Production/Operations Management**",** John Willey and Sons, Delhi**, 1995.**
3. R. Collard, "Total quality", Jaico Publishing House, Mumbai, **1988**.
4. S.K., Sharma, Sand Sharma T, "Industrial Engineering and Operations Management", S.K. Kataria and Sons, Delhi, **1996**.
5. S. Asolekar, "Environmental Problems in Chemical Processing of Textiles" 1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, **2000.**

TEXTILE PRODUCT DESIGN

Subject Code - MTEX1-158	**L T P C** **4 0 0 4**	**Duration - 40 Hrs**

UNIT-I (10 Hrs)

Concepts of Engineering, Product Development and Design, Characteristics of Successful Product Design, Product Development Process Tools, Product Architecture. Evolution of Engineering, Engineering Attributes and Concepts

UNIT-II (10 Hrs)

Basic Concepts and Critical Factors for Product Development, Simplified View of Product Development, The Product Development Cycle, Business and Marketing Aspects Related To Product Development Product-Focus Versus User-Focus Product, Development Role Of Research in Product Development, The Core Task in Product Development

UNIT-III (10 Hrs)

The Product Design Cycle, Design Conceptualization Design Analysis, Basic Differences between Design Conceptualization and Design Analysis, General Guidelines for Design Conceptualization Basic Tools of Design Conceptualization

UNIT-IV (10 Hrs)

Purpose of Design Analysis, Optimization Analysis: Linear programming, Product Design Economics.

Recommended Books

1. Kevin Otto, & Kristin Wood, "Product Design Techniques in Reverse Engineering and New Product Development", Pearson Education Publication, 1st Edn., **2006.**
2. K.T. Ulrich, "Product Design and Development", Tata McGraw Hill, 3rd Edn., **2004.**

PHYSICAL PROPERTIES OF FIBRES

Subject Code - MTEX1-159 **L T P C** **4 0 0 4** **Duration – 40 Hrs**

UNIT – I (10 Hrs)

Moisture Absorption and Desorption of Fibres, Sorption Isotherms, Heat of Sorption and Theory of Sorption, Swelling of Fibres.

UNIT - II (10 Hrs)

Mechanism of Deformation of Fibres, Principles of Elasticity and Visco-Elasticity, Stress-Strain Behaviour of Textile Fibres, Creep and Stress Relaxation. Dynamic Mechanical Properties of Fiber, Model Theory, Time Temperature Superposition Principle, Thermodynamic Analysis of Deformation.

UNIT - III (10 Hrs)

Fiber Friction, Its Nature, Theory, Application and Measurement, Unibirefringence and Its Measurement, Thermal Transition and Its Importance

UNIT – IV (10 Hrs)

Dielectric Properties of Fiber, Static Electricity and Measurement of Static Charge in Fibres, Fiber Micro Structure, X-Ray Analysis, IR Spectroscopy and SEM

Recommended Books

1. R. Meredith, 'The Mechanical Properties of Textile Fibres', North Holland Publishing Co; Amsterdam, **1959.**
2. W.E. Morton and J.W.S. Hearle,"Physical Properties of Textile Fibres", 1st reprint, The Textile Institute, Manchester, **1986.**
3. V.B. Gupta and V.K. Kothari, "Manufactured Fibre Technology"1st Edn., Chapman and Hall, London, **1997.**
4. J.W.1.S. Hearle, Polymers and their Properties, Vol. I, John Wiley and Sons, NY, **1982.**

M.Tech.
Textile Technology

SECOND SEMESTER
SYLLABUS

STRUCTURAL MECHANICS OF YARNS

Subject Code - MTEX1-205 **L T P C** **Duration – 40 Hrs**

4 0 0 4

UNIT-I (07 Hrs)

Elements of Yarn Geometry, Geometry of Helix and Its Application to Yarn Structure, Geometry of Folded Yarn, Yarn Diameter and Density

UNIT-II (12 Hrs)

Theoretical Analysis of Effect of Fiber Properties and Their Geometrical Configuration on the Tensile and Bending Properties of Yarn, Theories and Analysis of Yarn Strength and Irregularity

UNIT-III (12 Hrs)

Fiber Migration Characteristics of Continuous Filament and Spun Yarns, Breakage of Continuous Filament and Spun Yarns, Effect of Properties of Constituent Fibres and Blend Composition on Behavior of Composite Yarn.

UNIT-IV (9 Hrs)

Effect of Yarn Structure on Different Properties of Yarns, Structure and Property Relationship of Ring, Rotor, Air-Jet and Friction Spun Yarns

Recommended Books

1. J.W.S. Hearle, P. Grosberg and S. Backer, "Structural Mechanics of Fibres Yarns and Fabrics",
Wiley Interscience, New York, **1969.**
2. B.C. Goswami, J.G. Martindale and F. Scardino, "structure and applications", Wiley Interscience Publisher, New York, **1995.**
3. J.W.S. Hearle, J.J. Thwaites and J. Amirbayat, "Mechanics of Flexible Fibre Assemblies", Sijthff and Noordhoff International Publishers BV, Alphen aan den Rijn, Netherlands, **1980.**

STRUCTURAL MECHANICS OF FABRICS

Subject Code - MTEX1-206 **L T P C** **Duration – 40 Hrs**

4 0 0 4

UNIT-1 (10 Hrs)

Fabric Cover Factor and Its Significance, Engineering Approach for Fabric Formation, Pierce's Cloth Geometry, Practical Aspect of Cloth Geometry, Graphical Relationship in Cloth Geometry for Plain, Twill and Sateen Weaves

UNIT-II (10 Hrs)

Concept of Jammed Structure, Analysis of Racetrack Section of Yarn in Cloth Geometry, Theoretical Investigation of Weavability Limit of Yarns, Elastic Thread Model for Fabric

UNIT-III (10 Hrs)

Concept of Fabric Relaxation for Knitted Fabrics, Geometry and Properties of Weft Knitted Fabrics – Importance of Doyle's and Munden's Research, K-Values and Pierce's Geometry of Knitted Fabrics

UNIT-IV (10 Hrs)

Tensile and tearing Behaviour of Fabric, Bending Deformation of Fabric, Bending Hysteresis of Woven Fabric, Buckling, Shear And Drape Behaviour of Woven Fabric, Mechanical Properties of Nonwoven Needle Punch and Stitch Bonded Fabric, Brief Study of Formability, Tailorability and Hand of Apparel Fabric.

Recommended Books

1. J.W.S. Hearle, P. Grosberg and S. Backer, "Structural Mechanics of Fibres Yarns and Fabrics", Wiley Interscience, New York, **1969.**
2. F.T. Peirce and J.R. Womersley, "Cloth Geometry", The Textile Institute, Manchester, **1978.**
3. J.W.S. Hearle, J.J. Thwaites and J. Amirbayat, "Mechanics of Flexible Fibre Assemblies", Sijthff and Noordhoff International Publishers BV, Alphen aan den Rijn, Netherlands, **1980.**
4. **J. Hu, "Structural Mechanics of Fabrics", Woodhead Publishing Co., Cambridge, UK, 2006.**

RESEARCH METHODOLOGY

Subject Code - MTEX1-260 | **L T P C** **4 0 0 4** | **Duration – 40 Hrs**

UNIT-I (10 Hrs)

Overview of Research: Research and Its Type, Identifying and Defining Research Problem and Introduction to Different Research Designs, Essential Constituents of Literature Review, Basic Principles of Experimental Design, Completely Randomized, Randomized Block, Latin Square, Factorial, Response Surfaces

UNIT-II (10 Hrs)

Methods of Data Collection: Primary and Secondary Data, Methods of Primary Data Collection, Classification Secondary Data, Designing Questionnaires and Schedules

Sampling Methods: Probability Sampling -Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling,
Non –Probability Sampling: Convenience Sampling, Judgement Sampling, Quota Sampling, Sampling Distributions

UNIT-III (10 Hrs)

Processing and Analysis of Data: Statistical Measure and Their Significance: Central Tendencies, Variation, Skewness, Kurtosis, Time Series Analysis. Correlation and Regression, Testing Of Hypothesis: Parameters (T, Z and F) Chi Square, ANOVA and Non Parametric Tests

Multivariate Analysis: Multiple Regression, Factor Analysis, Discriminant Analysis, Cluster Analysis, Multidimensional Scaling.

UNIT-IV (10 Hrs)

Reliability and Validity: Test - Retest Reliability, Alternative Form Reliability, Internal-Comparison Reliability and Scorer Reliability, Content Validity, Criterion Related Validity and Construct Validity

Essentials of Report Writing

Note: Application and Uses of Various Software for Case Studies Should Be Essential.

Recommended Books

1. R.I. Levin and D.S. Rubin, Statistics for management, 7th Edn., Pearson Education, New Delhi
2. N.K. Malhotra, 'Marketing Research - An Applied Orientation', 4th Edn., Pearson Education, New Delhi.
3. W.G. Zikmund, "Business Research Method" 7th Edn., Thomson South Western.
4. K.N. Krishnaswami, A.I. Sivakumar and M. Mathirajan, "Management Research Methodology", Pearson Education, New Delhi.
5. C.R. Kothari, "Research Methodology Methods and Techniques" New Age International Publishers, 2nd Edn.

COMPUTER PROGRAMMING AND ITS APPLICATIONS

Subject Code – MCAP0-195	**L T P C** **4 0 0 4**	**Duration – 40 Hrs**

UNIT - I (6 Hrs)

Fundamentals of Computer Programming, Programming Methodology: Structured Programming and Concepts of Object-Oriented Programming

UNIT - II (12 Hrs)

Programming in C++ Statements and Expressions, Control Statements, Structure, Functions: Function Overloading etc.

UNIT – III (10 Hrs)

C++ as Object-Oriented Programming Language: Classes and Objects, Data Abstraction

UNIT – IV (12 Hrs)

Inheritance - Multilevel and Multiple Inheritance etc., Polymorphism - Operator Overloading and

Virtual Functions, File Handling. Application Development using C++.

Recommended Books

1. Sumita Arora, "Fundamentals of Computer Programming & Information Technology", Dhanpat Roy & Sons.

2. E. Balagurusamy, "Object Oriented Programming using C++".
3. Robert Lafore, "Object Oriented Programming with C++" Galgotia Publications.

ADVANCE KNITTING TECHNOLOGY

Subject Code - MTEX1-261 **L T P C** **4 0 0 4** **Duration – 40 Hrs**

UNIT-I (10 Hrs)

Concepts of Loop Formation in Weft Knitting, Different Forces Acting on The Needle Butt and Mechanics of Loop Formation. Study of Dynamics of Knitting Process, Study of Different Machines, Process and Yarn Parameters Affecting The Yarn Tension in Knitting Zone and Loop Length, Concept of 'Robbing Back' of Yarn in Loop

UNIT-II (10 Hrs)

Study of Design and Performance of Knitting Cam and Increase in Knitting Production, Yarn Feeding Devices on Circular Knitting Machines

UNIT-III (10 Hrs)

Geometry and Properties of Weft Knitted Fabrics, Importance of Doyle's and Munden's Research, K-Values, Pierce's Geometry of Knitted Fabric

UNIT-IV (10 Hrs)

Outlines of Process Control in Knitting, Use of Electronics and Computers and other Developments in Knitting, Features of Warp Knitted Fabrics and Their Uses.

Recommended Books

1. D.J. Spencer, "Knitting Technology", 3rd Edn., Woodhead Publishing Limited, England, **2001.**
2. S.C. Ray, "Fundamentals and Advances in Knitting Technology", Woodhead Publishing India Limited, New Delhi, **2013.**
3. C. Mazza and P. Zonda, "Knitting: Reference Book of Textile Technologies", 2nd Edn., ACIMIT, Italy, **2001.**

POST SPINNING OPERATIONS

Subject Code - MTEX1-262 **L T P C** **4 0 0 4** **Duration – 40 Hrs**

UNIT-I (8 Hrs)

Drawing: Drawing Process, Neck Drawing, Initiation and Propagation of Neck, Neck Stabilization. Natural Draw Ratio, Effect of Temperature and Strain Rate on Neck Drawing, Prediction of Neck Formation, Influence of Drawing on Structure and Properties of Filament, Spin - Draw process.

UNIT-II (16 Hrs)

Texturing: Texturing and Warping Process, Material and Process Variables in Texturing and Their Influence on Yarn Quality, Recent Advances in Texturing, Testing and Evaluation of

Textured Yarn Properties of Fabrics Made from Textured Yarn.

UNIT-III (8 Hrs)

Heat Setting: Heat Setting Process, Parameters for Heat Setting, Equipment for Heat Setting and Evaluation of Degree of Set.

UNIT-IV (8 Hrs)

Multifilament Sewing Threads: Post Spinning Operation on Multifilament Sewing Threads

Recommended Books

1. V.B. Gupta and V.K. Kothari, “Manufactured Fibre Technology”, 1st Edn., Chapman and Hall, London, **1997.**
2. H.F. Mark, S.M. Atlas, E. Cernia, “Man Made fibre Science and Technology”, 1st Edn.,Vol. I, II, III, Willey Interscience Publishers, NewYork, **1967.**
3. Macintyre J E, “Synthetic Fibres”, Woodhead Fibre Science Series, UK, **2003**
4. F. Fourne, “Synthetic Fibres: Machines and Equipment, Manufacture, Properties”, Hanser Publisher, Munich, **1999.**

M. Tech.
Textile Technology

THIRD SEMESTER
SYLLABUS

PROFESSIONAL SKILLS

Subject Code -MTEX1-307 **L T P C** **Duration – 40 Hrs**

4 0 0 4

UNIT I (8 Hrs)

Communication, Its types & Significance: Communication; process of communication; its kinds, channels and role in the society.

Reading Skills: Process of reading; reading purposes, models, strategies, methodologies; reading activities, structure of meaning techniques.

UNIT II (8 Hrs)

Writing Skills: Elements of effective writing; writing styles; scientific and technical writing.

Grammar: Transformation of sentences; words used as different parts of speech; one word substitution; abbreviations, technical terms etc.

UNIT III (12 Hrs)

Business Correspondence : Business letters; elements of business writing; kinds of business letters – office order memorandum, report, purchase order, quotations and tenders, job application letters, personal resume and curriculum vitae etc.

Listening Skills: The process of listening; the barriers to listening; the effective listening skills; feedback skills.

UNIT IV (12 Hrs)

Speaking Skills: Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription; the skills of effective speaking, the components of an effective talk; oral presentation and the role of audio visual aids in it.

Discussion, Meeting and Telephone Skills: Group discussion; conducting a meeting; attending telephonic calls.

TEXT BOOKS

a. Bhattacharya, Indrajit, An Approach to Communication Skills, Dhanpat Rai Co.,(Pvt.) Ltd., New Delhi.
b. Wright, Chrissie, Handbook of Practical Communication Skills, Jaico Publishing House, Mumbai.
c. Gartside, L, Modern Business Correspondence, Pitman Publishing, London.
d. Day, Robert A., How to Write and Publish a Scientific Paper, Cambridge University Press, Cambridge.
e. Gimson, A.C., An Introduction to the Pronunciation of English, ELBS

f. Bansal, R.K. and Harrison, J.B. Spoken English Orient Longman, Hyderabad.

REFERENCE BOOKS

1. Roach, Peter, English Phonetics & Phonology, Cambridge University Press, Cambridge.
2. Rutherford, Andrea J. Basic Communication Skills for Technology, Addison Wesley Longman, New Delhi.
3. Scott, Bill, The Skills of communicating, Jaico Publishing House, Mumbai.
4. Janis, J. Harold, Writing and communicating in Business, The Macmillan Company, New Delhi.
5. Berry, Thomas Elliott, The Most Common Mistakes in English Usage, Tata McGraw Hill Publishing Company Limited, New Delhi.

HIGH PERFORMANCE FIBRES AND THEIR COMPOSITES

Subject Code - MTEX1-363	**L T P C** **4 0 0 4**	**Duration - 40 Hrs**

UNIT – I (10 Hrs)

Polyamide Fibres: Aliphatic Polyamide (N6 and 66) and Their Application in Rubber Tyre. Fully Aromatic Polyamides or Aramid Fibres (Nomex And Kevlar), Their Manufacture, Structure, Properties and Applications

UNIT – II (10 Hrs)

Carbon Fibres: Different Precursors, Preoxidation, Carbonization, Graphitization, Structure and Properties. Application in Composite. Flexible Chain High Performance Fibres, Manufacture and Application in Composite. Glass fiber, Manufacture, Properties and Applications in Composite.

UNIT-III (10 Hrs)

Nanocomposite: Introduction, Advantages and Different Nano-materials Commonly Used as Fillers Carbon Nanotubes, Carbon Nano-fibres and Nano Clay.

UNIT-IV (10 Hrs)

Definition of Composite, General Introduction to Fibres and Resins for Composites, Composite Fabrication Techniques, Matrices and Inter phase.

Recommended Books

1. N.G. Mc Crum, C.P. Buckley and C.B. Bucknall, "Principle of Polymer Engineering", Oxford University Press, New York, **1990.**
2. Ed. J.W. Stteare, "High Performance Fibres", Woodhead Publishing Co., England, **2001.**
3. D. Hull, "An Introduction to Composite Materials",Cambridge University Press, UK, **1981**.
4. H. Broody, "Synthetic Fiber Materials", Longman Scientific and Technical, UK, **1994.**

ENVIRONMENTAL PRACTICES IN TEXTILES

Subject Code - MTEX1-364 **L T P C** **Duration – 40 Hrs**
4 0 0 4

UNIT – I (10 Hrs)

Introduction to Environment, The Impact of Human upon the Environment, Improvement of Environment Quality, Role of Environmental Engineer.

UNIT - II (10 Hrs)

Different Types of Pollution: Water, Air, Solid Waste, Soil, Noise, Odours etc. Pollution Caused by Textile Industries.

UNIT – III (10 Hrs)

Waste: Definition, Characteristics and Perspectives, Different Types of Waste. Waste Water Collection, Treatment and Disposal, Solid Waste Generation, Collection and Disposal.

UNIT-IV (10 Hrs)

The Textile Effluents, Textile Waste Characteristics, Textile Waste Water Problems, Chemicals Used in Textile Industry, Treatment of Textile Effluents and its Testing.

Recommended Books

1. S. Asolekar, "Environmental Problems in Chemical Processing of Textiles",1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, **2000.**
2. V. Padma, "Textile Effluents" 1st Edn.,. NCUTE, Department of Textile Technology, IIT-Delhi, **2002.**
3. B. Edmund, "The Treatment of Industrial Wastes" 2nd Edn., Tata McGraw-Hill, New Delhi, **1976.**
4. M.N. Rao, "Environmental Engineering" 2nd Edn., Tata McGraw-Hill, New Delhi, **1993.**

TECHNICAL TEXTILES

Subject Code - MTEE1-365 **L T P C** **Duration - 40 Hrs**
4 0 0 4

UNIT - I (10 Hrs)

Definition and Scope for Technical Textiles, Brief Idea about Technical Fibres, Role of Yarn and Fabric Construction. Filtration Textiles: Definition of Filtration Parameters, Filtration Requirements

UNIT - II (10 Hrs)

Geotextiles: Brief Idea about Geosynthtics and Their Uses, Essential Properties of Geotextiles, Geotextiles Testing and Evaluation, Application Examples of Geotextiles

UNIT – III (12 Hrs)

Medical Textiles: Classification of Medical Textiles, Description of Different Medical Textiles. Protective Clothing: Brief Idea about Different Type of Protective Clothing, Functional Requirement of Textiles in Defence including Ballistic Protection Materials and Parachute Cloth, Flame Retardant Clothing, Chemical Protective Clothing.

UNIT - IV (8 Hrs)

General Technical Textile: Textiles in Agriculture, Electronics, Power Transmission Belting, Hoses, Canvas Covers and Tarpaulins.

Recommended Books

1. Ed. A.R. Horrocks and S.C. Anand "Handbook of Technical Textiles", Woodhead Publication Ltd., Cambridge, **2000.**
2. Ed. M. Raheel, Modern Textile Characterization Methods", Marcel Dekker, Inc., **1996.**
3. Ed. G.V. Rao and G.V.S. Raju, "Engineering with Geosynthetics", Tata McGraw Hill Publishing Co. Ltd., New Delhi, **1990.**
4. S.K. Mukhopadhyay and J.F. Partridge, "Automotive Textiles", The Textile Institute, Vol. 29, **1999.**

Study Scheme

Additive Manufacturing (1year skill development course)

Semester I

Subject Code	Subject name	Contact Hours		Credits	Internal Marks	External marks	Total Marks
		Theory	Practical				
CMEE3-101	Communication Skills	8		1	25	25	50
CMEE3-101P	Communication Skills Lab		24	1	25	50	75
	Basics of Engineering Drawing	30		3	50	100	150
	Basic Engineering Drawing Lab		96	3	50	100	150
	Additive Manufacturing- I	30		3	50	100	150
CMEE3-106P	Student Centred Activities		48	2	25	---	25
CMEE3-105	Basic Workshop Practice	32		2	25	50	75
CMEE3-105P	Basic Workshop Practice Lab		144	5	100	100	200
CMEE3-107P	4 weeks Industrial training (during Vacations)			4	---	100	100
	Total	100	312	24	350	625	900

Semester II

Subject Code	Units	Contact Hours		Credits	Internal Marks	External marks	Total Marks
		Theory	Practical				
CMEE3-208	Basic Science	48		3	25	75	100
	Auto CAD Lab		144	5	100	100	200
	Additive Manufacturing-II	30		3	100	100	200
	Additive manufacturing Lab		144	5	100	100	200
	Inspection & Quality Control	32		3	50	100	150
	Inspection & Quality Control Lab		80	3	50	75	125
CMEE3-106P	# Student Centred Activities (SCA)		48	2	25	---	25
CMEE3-107P	4 weeks Industrial training (during Vacations)			4	---	100	100
Total		110	416	28	500	650	1100

SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobbyclub, suchas,photography,etc.,seminars,declamationcontest,educationalfieldvisits,NCC,NSS,culturalactivities,etc.

+Industrial Training Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total hours per day: 7, Total hours in a semester: 16x5x7 = 560 One credit is defined as one hour of lecture per week or two hours of practical per week in the program.

GUIDELINESFOR ASSESSMENTOFSTUDENT CENTRED ACTIVITIES (SCA)

The maximum marks for SCA should be25. The marks may be distributed as follows:

i) 5 marks for general behavior anddiscipline (by Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance asperfollowing (by the instructors/ trainers of thedepartment)

   a) Up to75% Nil
   b) 75%to80% 02marks
   c) 80%to85% 03marks
   d) Above85% 05marks

iii)15marksmaximumforsports/NCC/NSS/Cultural/Co-curricularactivitiesas perfollowing:(by In-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities)

15marks - for National level participation or inter-university competition

10 marks - participation any two of the activities

05 marks – participation at the internal sports of the institute/college/university

Note: There should be no marks for attendance in the internal sessional of different subjects.

Salient features of the course

1	Sector	Industry 4.0/ Mechanical Engineering
2	Name of the Certificate Program	Additive manufacturing
3	Entry Qualification	Matriculation or equivalent NSQF level as prescribed by MRSPTU, Bathinda
4	Duration of Program	1 year
5	Intake	30
6	Pattern of Program	Semester Pattern
7	NSQF level	Level III
8	Ratio of Theory & Practice	20:80

Unit: Subject Code: **BASICS OF ENGINEERING DRAWING**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Utilize various types of lines used in engineering drawing. • Draw free hand sketches of various kinds of objects. • Read and apply different dimensioning methods on drawing of objects. • Read technical drawings for cost estimation and manufacturing/fabrication purpose	
Introduction: Applications of various types of lines in engineering drawing, Technical lettering, Dimensioning, method of dimensioning, types of dimensioning, and rules of dimensioning.	3 hrs
Geometrical construction: Construction of regular pentagon, and hexagon, inscribe polygon (triangle, square, pentagon, hexagon) in a circle, circumscribe polygon (triangle, square, pentagon and hexagon) to a circle.	**6 hrs**
Orthographic projections: Features of first angle projection, Features of third angle projections, symbols, General preparation for multi-view drawings, conversion of pictorial view /isometric view into orthographic view	**5 hrs**
Isometric Projections: Terminology, isometric scale, isometric projection and isometric view, Methods of drawing an isometric view of right solids, truncated solids composite solids, four centre method for drawing approximate ellipse and elliptical arcs, Conversion of orthographic views into isometric views.	**5 hrs**
Projections of solids: Classification of regular solids, Polyhedron, Prism, Pyramid, solid of revolution, Frustum of pyramid and cone and orientation of solid.	**6 hrs**
Development of surfaces: development of prism, cylinders, cones and pyramids.	**5 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

Unit:

Subject Code:

BASICS OF ENGINEERING DRAWING LAB

LEARNING OUTCOMES:
After undergoing this unit, students will be able to:

- Drawing practice for various types of lines used in engineering drawing.
- Draw free hand sketches of various kinds of objects.
- Apply different dimensioning methods on drawing of objects.

Practical demonstration with the help of blue prints/computer prints.	6 hrs
Drawing board, T-square, minidrafter, set squares, protractor, drawing instrument box, pencils of different grades, erasing shield • Learn methods of folding of blue print/drawing prints as per BIS SP: 16-2003 • Size of drawing sheets and designation of sheets. • Preparation of A3/A2 sheet for preparing drawings.	**9 hrs**
Practice construction of different types of lines (horizontal and vertical)	**6 hrs**
Construction of triangle, rectangle, rhombus, parallelogram circle quadrilateral and ellipse.	**3hrs**
Practice writing alphabets and numerals in capital/lower case as per BIS: 9609 in vertical and inclined style:	**6 hrs**
Practice construction of elements dimensioning with the help of a view of an object. • Practice dimensioning of a diameter, radius, angles, holes, chamfers, undercut, functional dimensions,nonfunctional dimensions.	**6 hrs**
Practice of free hand sketch of an object in orthographic and isometric views.	**6 hrs**
Free hand sketches of orthographic views of an object in first angle and third angle projections.	**6 hrs**
Construction of different points existing in first/second/third and fourth quadrants. • Identification of the position of points w.r.t. their projection drawings.	**6 hrs**
Practice the construction of plan and elevation of lines w.r.t. their different positions such as a line parallel to both V.P. and H.P, line perpendicular to V.P. and parallel to H.P., line perpendicular to H.P. and parallel to V.P., line parallel to H.P. and inclined to V.P., line parallel to V.P. and inclined to H.P.	**9 hrs**
Practice construction of cone, cylinder, pentagonal prism and hexagonal pyramid.	**6hr**
Practice on the sheets showing all conventions as graphical symbols for materials and equipment/instruments/engineering components cast iron, aluminum audits alloys, steel, brass, bronze, copper etc. concrete, glass, plastic/rubber/insulating material/pack material (Marble, Slate, Porcelain and stone wares) Liquids, Woods	**9 hrs**
Practice on the sheets showing the different welding joints	**6 hrs**
Practice the construction of views of the riveted joints.	**6 hrs**
Practice of sign convention of D.C. A.C. Positive, Negative, Single Phase, Three Phase, AC/DC, 3- Phase, Neutral line.	**6 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Drawing

Unit: Subject Code: **ADDITIVE MANUFACTURING- I**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Understand various types of manufacturing processes and industry 4.0. • Understand the working of various types of additive manufacturing processes. • Understand various slicing parameters required for 3D printing.	
Introduction to additive manufacturing, flexible manufacturing system,	4 hrs
Manufacturing processes, Industry 4.0	6 hrs
Classification of various additive manufacturing techniques such as fused deposition modeling (FDM), laminated object manufacturing (LOM), selective laser sintering (SLS), stereolithography (SLA), direct metal printing etc.	**10 hrs**
Fused deposition modelling, working principle, process parameters, types of materials used in FDM, types of 3D printers.	**10 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

Unit: Subject Code: **AUTOCAD LAB**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Drawing practice for various types of AutoCAD toolbars. • Draw sketches of various kinds of objects. • Apply different dimensioning methods on drawing of objects.	
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids	50 hrs
Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles	50 hrs
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques	**44 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Drawing

Unit: Subject Code: **ADDITIVE MANUFACTURING- II**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Understand various types of engineering materials. • Understand various types of material testing methods. • Understand the use of various types of slicing parameters. • Understand various Post processing techniques used for 3D printed parts.	
Introduction to materials, classification of materials, material properties, selection process of materials.	4 hrs
Material testing methods such as hardness, impact strength, tensile strength, flexural strength.	6 hrs
Slicing software, slicing parameters such as material selection, nozzle size, pattern, infill density, raster angle, layer width. Layer thickness etc.	**10 hrs**
Surface roughness techniques, Post processing techniques in additive manufacturing, process parameters.	**10 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

Unit: Subject Code: **ADDITIVE MANUFACTURING LAB**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Understand and select various types of slicing parameters. • Set FDM printer. • Print 3D parts.	
Listing the computer technologies that impact on 3D printing, Transfer of CAD file into .stl file formet. Demonstrating knowledge of the theory of slicing software and slicing parameters such as: material selection, nozzle size, pattern, infill density, raster angle, layer width. Layer thickness etc.	50 hrs
FDM printer setting, bed levelling, nozzle setting, feedstock filament loading/ unloading	50 hrs
3D printing of parts, post processing of printed parts.	**44 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- 3D printing

Unit: **Subject Code:** **INSPECTION AND QUALITY CONTROL**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Understand metrology and standard of measurement. • Understand the working of various types of inspection instruments. • Understand the concept of surface roughness and its measurement.	
Define Metrology, Inspection, Accuracy and Precision, Standards of measurements.	4 hrs
Vernier calliper, micrometre, height gauge, filler gauges, sine bars, Screw Thread Measurement: Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread caliper gauges.	6 hrs
Metrology of Surface finish: Surface Metrology Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, methods for measuring surface roughness	6 hrs
Miscellaneous Metrology: Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications.	**8 hrs**
Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Optical Interference and 8. Interferometry, Optoelectronic measurements.	**8 hrs**

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

Unit: Subject Code: **INSPECTION AND QUALITY CONTROL LAB**	
LEARNING OUTCOMES: After undergoing this unit, students will be able to: • Use the inspection instruments. • Understand the selection of instrument for particular job. • Carry out the maintenance of the instruments.	
Use of various inspection instruments such as vernier calliper, micro-meter, surface roughness tester, height gauge, tool maker microscope, optical microscope, sine bars, filler gauges, thread gauges and Surface plate. Maintenance of instruments.	80 hrs

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

Curriculum
for
Certificate Programme
In
ELECTRICIAN
for
Maharaja Ranjit Singh Punjab Technical University,
Bathinda (Punjab)

Prepared By:
Curriculum Development Centre
National Institute of
Technical Teachers Training and Research,
Sector 26, Chandigarh - 160 019

January**, 2017**

FOREWORD

Rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In order to cope with the challenges of handling new materials, machines and technologies, we have to develop human resources having appropriate competencies. There is an increasing demand of skilled workforce in India in particular and the world over in general. Under the new circumstances, India faces a challenging task of meeting the technical manpower requirement, especially in the area of skilled workforce to cater to industrial needs. Efforts have to be made so that passouts from our technical institutions are acceptable at global level.

Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Technical institutions play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab to start the skill oriented integrated courses at certificate, diploma and degree level, as per the needs of the industry, are laudable.

In order to meet the future requirements of technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of technical programmes at various levels. The curricula for various programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of programme and various courses.

The success of any technical programme depends upon its effective implementation. However best the curriculum document is designed, if it is not implemented properly, the output will not be as per expectations. In addition to acquisition of appropriate physical resources, availability of motivated, competent and qualified faculty is equally essential for effective implementation of the curricula.

It is expected that MRSPTU will carry out curriculum evaluation on a continuous basis to identify the new skill requirements. At the same time, it is expected that innovative methods of course offering will be used to develop desired skills and infuse the much needed dynamism in the system.

Dr. M.P. Poonia
Director
National Institute of
Technical Teachers Training & Research
Chandigarh

PREFACE

Curriculum document is a comprehensive plan of an educational programme. It is through the curriculum that the educational objectives of a programme are achieved. It has to be ensured that the curriculum is dynamic, articulated, balanced, data based, feasible, and as per industrial needs. Curriculum Development Centre at NITTTR, Chandigarh has been extending services to technical education system of the states in northern region in developing and updating their curriculum on regular basis.

Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab assigned the project for developing the curriculum of some integrated programmes to this institute in the month of May 2016. A series of curriculum workshops were held during the months of June-July, 2016. This curriculum document is an outcome of the extensive discussions held with the representatives from various organizations, technical institutions and industry during the curriculum workshops. While developing the study and evaluation scheme and detailed contents, the following aspects have been kept in mind :

- Employment Opportunities of Certificate holders
- Job role of certificate holders
- Learning outcome of the Programme
- Mobility of students for their professional growth

We have taken cognizance of recommendation of experts both from industry and academic institutions and have adequately incorporated segments of Industrial Training in the curriculum. Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which units on Communication Skills have been introduced in both the semesters of the certificate course.

We hope that this curriculum document will prove useful in producing skilled manpower at desired level in the state of Punjab. The success of this outcome-based curriculum depends upon its effective implementation and it is expected that MRSPTU will make all efforts to create better facilities, develop linkages with the world-of-work and foster conducive and requisite learning environment as prescribed in the curriculum document.

Professor and Head
Curriculum Development Centre
NITTTR, Chandigarh

ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance and guidance received from the following persons:

i) Vice Chancellor, Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bhatinda, Punjab for entrusting this project of curriculum design to NITTTR, Chandigarh.
ii) Director, College Development Council MRSPTU for his support and active involvement in the curriculum development.
iii) Director, National Institute of Technical Teachers' Training and Research, Chandigarh for his support and academic freedom provided to Curriculum Development Centre.
iv) All the experts from industry/field organizations, universities, ITIs and other technical institutions for their professional inputs during curriculum workshops.
v) Faculty from different departments of NITTTR, Chandigarh for content updation.
vi) Shri Yogendra Kaushal, Stenographer, Curriculum Development Centre, NITTTR, Chandigarh for processing the document.
vii) Shri Mohan Lal Bindal, Assistant, Curriculum Development Centre for his support and secretarial assistance in the conduct of curriculum design workshops.

Coordinator

1. SALIENT FEATURES OF THE PROGRAMME

1.	Sector	:	Power & Energy
2.	Name of the Certificate Programme	:	Electrician
3.	Entry Qualification	:	Matriculation or equivalent NSQF Level as prescribed by MRSPTU, Bathinda
4.	Duration of the Programme	:	One Year
5.	Intake	:	30
6.	Pattern of the Programme	:	Semester Pattern
7.	NSQF Level	:	Level - III

2. JOB ROLE AND JOB OPPORTUNITIES

a) Job Role

A certificate holder in Electrician is responsible for wiring, servicing, testing, repair and maintenance of general electrical appliances and control instruments by identifying faulty parts.

b) Job Opportunities

On successful completion of this course, the students will be gainfully employed in the following areas:

i) Various electrical appliances manufacturing industry.

ii) Maintenance section of Govt. organizations/private/public sector.

iii) Work as certified electrician.

iv) Self employed.

3. LEARNING OUTCOMES OF THE PROGRAMME

After undergoing the programme, students will be able to:

1. Draw and interpret D.C. and A.C. circuits
2. Use different types of electrical tools and measuring instruments
3. Identify and rectify different types of faults in electrical equipments/appliances
4. Install and test different types of domestic and industrial wiring circuits
5. Maintain and troubleshoot electrical machines and starters
6. Perform and test winding for electrical machines
7. Apply basic principles of math and physics in solving trade problems
8. Communicate effectively in English with others
9. Describe the characteristics/properties and uses of material related to the trade

4. STUDY AND EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN ELECTRICIAN

FIRST SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CELE11-101	*Communication Skills	8	-	1	25	-	25	25	1	-	-	25	50
CELE1-101P	*Communication Skills Lab.	-	24	1	-	50	50	-	-	75	3	75	125
CELE1-102	Engineering Drawing (Electrician)	-	-	1	-	-	-	75	3	-	-	75	75
CELE1-102P	Engineering Drawing (Electrician) Lab.	-	48	1	-	50	50	-	-	-	-	-	50
CELE1-103	Basic Electricity	32	-	2	25	-	25	50	2	-	-	50	75
CELE1-103P	Basic Electricity Lab.	-	128	4	-	75	75	-	-	100	4	100	175
CELE1-104	Electrical Measuring Instruments	16	-	1	25	-	25	25	1	-	-	25	50
CELE1-104P	Electrical Measuring Instruments Lab.	-	80	3	-	50	50	-	-	100	4	100	150
CELE1-105	Electrical Machines - I	48	-	3	25	-	25	50	2	-	-	50	75
CELE1-105P	Electrical Machines – I Lab.	-	128	4	-	75	75	-	-	100	4	100	175
CELE1-106P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CELE1-107P	+4 Weeks Industrial Training (during vacation)	-	-	4	-	-	-	-	-	100	3	100	100
Total		**104**	**456**	**27**	**100**	**325**	**425**	**225**	**-**	**475**	**-**	**700**	**1125**

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

\+ **Industrial Training**

After examination of 1st Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

Total weeks per semester = 16 Total working days per week = 5 Total hours per day = 7

Total Hours in a semester = 16 x 5 x 7 = 560

One credit is defined as one hour of lecture per week or two hours of practicals per week for one semester. Fractions in credits have been rounded to nearest integer.

SECOND SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CELE1-208	*Basic Sciences	48	-	3	25	-	25	50	2	-	-	50	75
CELE1-209	Repair and Maintenance of Electrical Installations	32	-	2	25	-	25	50	2	-	-	50	75
CELE1-209P	Repair and Maintenance of Electrical Installations Lab.	-	128	4	-	75	75	-	-	100	4	100	175
CELE1-210	Electrical Machines - II	48	-	3	25	-	25	50	2	-	-	50	75
CELE1-210P	Electrical Machines – II Lab.	-	128	4	-	75	75	-	-	100	4	100	175
CELE1-211	Electrical Controls and Switchgears	32	-	2	25	-	25	50	2	-	-	50	75
CELE1-211P	Electrical Controls and Switchgears Lab.	-	96	3	-	50	50	-	-	100	4	100	150
CELE1-212P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CELE1-213P	+4 Weeks Industrial Training	-	-	4	-	-	-	-	-	100	3	100	100
Total		**160**	**400**	**27**	**100**	**225**	**325**	**200**	**-**	**400**	**-**	**600**	**925**

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

\+ **Industrial Training**

After examination of 2nd Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

5. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 5 Marks for general behavior and discipline
(by Principal in consultation with all the trainers)

ii. 5 Marks for attendance as per following:
(by the trainers of the department)

a)	75%	Nil
b)	75 - 80%	2 Marks
c)	80 - 85%	3 Marks
d)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	National Level participation or inter-University competition
b)	10	-	Participation in two of above activities
c)	5	-	Participation in internal sports of the University

Note: There should be no marks for attendance in the internal sessional of different subjects.

<table>
<tr><td colspan="2" align="center">UNIT – 1.1
SUBJECT CODE: CELE1-101
COMMUNICATION SKILLS</td></tr>
<tr><td colspan="2">LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:
• Speak confidently.
• Overcome communication barriers.
• Write legibly and effectively.
• Listen in proper prospective.
• Read various genres adopting different reading techniques.
• Respond to telephone calls effectively.</td></tr>
<tr><td>Practical (24 Hours)</td><td>Theory (08 Hours)</td></tr>
<tr><td></td><td>Basics of Communication
• Process of communication
• Types of communication - formal and informal, oral and written, verbal and non-verbal
• Objectives of communication
• Essentials of communication
• Barriers to communication
(1 hour)</td></tr>
<tr><td>• Looking up words in a dictionary (meaning and pronunciation)
(2 hours)</td><td>Functional Grammar and Vocabulary
• Parts of speech
• Tenses
• Correction of incorrect sentences
(2 hours)</td></tr>
<tr><td>• Self and peer introduction
• Greetings for different occasions
(1 hour)</td><td>Listening
• Meaning and process of listening
• Importance of listening
• Methods to improve listening skills
Speaking
• Importance
• Methods to improve speaking
• Manners and etiquettes
(2 hours)</td></tr>
<tr><td>• Newspaper reading
(1 hour)</td><td>Reading
• Meaning
• Techniques of reading: skimming, scanning, intensive and extensive reading
(1 hour)</td></tr>
<tr><td>• Vocabulary enrichment and grammar exercises
• Exercises on sentence framing accurately
(6 hours)</td><td>Functional Vocabulary
- One-word substitution
- Commonly used words which are often misspelt
- Punctuation
- Idioms and phrases (2 hours)</td></tr>
</table>

• Reading aloud articles and essays on current and social issues • Comprehension of short paragraph (5 hours)	
• Write a short technical report • Letter writing (3 hours)	
• Participate in oral discussion • Respond to telephonic calls effectively • Mock interview (6 hours)	

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

<table>
<tr><td colspan="2" align="center">UNIT - 1.2
SUBJECT CODE: CELE1-102
ENGINEERING DRAWING (ELECTRICIAN)</td></tr>
<tr><td colspan="2">LEARNING OUTCOME:
After undergoing this unit, the students will be able to:
Identify and use engineering drawing materials and instruments.
Prepare free hand sketches of electrical tools and instruments.
Identify and use symbols of various electrical devices.
Read and interpret electrical installation plans.
Read and draw wiring diagrams of electrical installations, bell circuits etc.
Read diagrams of MDB, ELCB, MCB.</td></tr>
<tr><td>Practical (48 hours)</td><td>Theory</td></tr>
<tr><td>Introduction to engineering drawing instruments, materials, drawing board and drawing sheets (3 hours)
Different types of lines in engineering drawing as per BIS (3 hours)
Free hand sketching of electrical tools and instruments (6 hours)
Scales of drawings (2 hours)
Symbols used in electrical installations as per BIS (6 hours)
Drawing of fuse, MCB, ELCB, MDB, insulators (8 hours)
Wiring diagrams of electrical installations (10 hours)
Wiring diagram of bell circuits and staircase (10 hours)</td><td></td></tr>
</table>

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce
- Sketching
- Drawing

UNIT – 1.3 SUBJECT CODE: CELE1-103 BASIC ELECTRICITY	
LEARNING OUTCOME: After undergoing this unit, the students will be able to: • Explain concepts of basic electricity terms • Implement safety and preventive measures • Identify and utilize various electrical accessories • Identify and use symbols of electricity • Draw and connect basic electrical circuits • Calculate various electrical parameters	
Practical (128 hours)	**Theory (32 hours)**
• Demonstration of safety signs, basic injury prevention, artificial respiration and use of fire extinguisher. (24 hours)	• Care and safety working habits. Types of fire extinguishers and usage. Introduction to Indian Electricity Rules (8 hours)
• Practice of using cutting pliers, screw drivers etc. Skinning cables and jointing practice of single strands/multi strand conductors. Practice of bare conductor joints like britannia, straight, T, western union joints. Practice of using micrometer, crimping tool, thimbles, lugs etc. Practice of soldering and brazing (56 hours)	• Define electricity terms (voltage, current, power) and symbols in electricity. Explanation and definition of conductors, insulators and semi-conductors. Types of wires/cables, joints and their uses. Solder, flux and brazing techniques (10 hours)
• Demonstration of electrical accessories e.g. switches, sockets, holders, plugs, MCB, ELCB, MCCB etc. (24 hours)	• Introduction to electrical accessories (6 hours)
• Verification of Ohm's Law. Calculate electrical energy. Verification of laws of series, parallel and combination circuits. (24 hours)	• Ohm's Law. Simple electrical circuit problems. Law of series, parallel and combination circuits. (8 hours)
	• Basic properties of material used for electrical conductors, insulators and electric devices like RLC, diode transistor

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

UNIT- 1.4 SUBJECT CODE: CELE1-104 ELECTRICAL MEASURING INSTRUMENTS	
LEARNING OUTCOME: After undergoing this unit, the students will be able to: • Explain working principle of different measuring instruments • Identify and use different measuring instruments • Use various safety measures • Connect the circuits as per given specifications • Differentiate between AC and DC supply	
Practical (80 hours)	**Theory (16 hours)**
• Measure voltage, current, resistance and power using ammeter and voltmeter (10 hours)	• Working principle of analog and digital ammeter and voltmeter, their connections and safety measures to be taken during use (2 hours)
• Identify different types of measuring instruments and their connectors (10 hours)	• Types of instruments (indicating, recording, integrating and effects based) (2 hours) • Deflecting torque, controlling torque, damping torque (2 hours)
• Measure insulation value of different cables using insulation tests (10 hours)	• Working of insulation tester and earth tester, safety measures to be taken during use of instruments (1 hour)
• Measure value of different resistors using multimeter and also note down their voltage and current variation in tabular form (10 hours)	• Multimeter – Principle of digital multimeter, study their different controls, frequently occurring problems in digital multimeter (2 hours)
• Measure power factor in polyphase circuit using voltmeter, ammeter and wattmeter (10 hours)	• Define power factor, working principle of power factor meter and their connections (2 hours)
• Perform the connections of 3 phase energy meter (10 hours)	• Working principle of 3 phase and single phase digital energy meter, their connection diagrams and errors during utilization (2 hours)

• Measure speed of motor using tachometer (7 hours)	• Working of tachometer, analog and digital tachometer (1 hour)
• Measure power of inductor using wattmeter (7 hours	• Working principle of wattmeter and connections (1 hour)
• Measuring intensity of various light sources using lux meter (6 hours)	• Working of lux meter (1 hour)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

<table>
<tr><td colspan="2" align="center">UNIT - 1.5
SUBJECT CODE: CELE1-105
ELECTRICAL MACHINES - I</td></tr>
<tr><td colspan="2">LEARNING OUTCOME:
After undergoing this unit, the students will be able to:
Identify various A.C. and D.C. electrical machines
Identify and use various A.C. motors, D.C. motors and transformers
Identify and utilize various instrument transformers like C.T./P.T.
Assemble and dissemble small A.C. and D.C. motors, single phase transformers
Identify and rectify general faults in electrical machines</td></tr>
<tr><td>Practical (128 hours)</td><td>Theory (48 hours)</td></tr>
<tr><td>Identification of parts of D.C. machine (12 hours)
Connection of shunt generators. Voltage build-up in D.C. generator (20 hours)
Identification of parts and terminals of D.C. motors. (12 hours)
Practical application of D.C. motors and their uses (28 hours)
Identification of types of transformers
• (20 hours)
Demonstration of current and potential transformers, testing of transformer oil (20 hours)
Care and maintenance of transformers (16 hours)</td><td>General concept of electrical machines (5 hours)
Principle of D.C. generator, parts of D.C. generator (5 hours)
Terms used in D.C. motors, types of D.C. motors (5 hours)
Starters used in D.C. motors (15 hours)
Principles and working of transformers. 1ϕ and 3ϕ transformers (8 hours)
Construction of transformers, dehydration and oil testing of transformer oil (4 hours)
Construction of instrument transformers like C.T./P.T. (6 hours)</td></tr>
</table>

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

SUBJECT CODE: CELE1-107
INDUSTRIAL TRAINING – I (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through firsthand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 1st semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity	20%
b) Industrial training report	50%
c) Presentation and viva-voce	30%

<table>
<tr><td colspan="2" align="center">UNIT – 2.1
SUBJECT CODE: CELE1-208
BASIC SCIENCES</td></tr>
<tr><td colspan="2">LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:
Apply the basic principles of maths in solving the basic problems of the trade.
Apply the basic principles of physics in solving the basic problems of the trade.</td></tr>
<tr><td align="center">Practical</td><td>Theory (48 Hours)</td></tr>
<tr><td></td><td>Mathematics
Basic Algebra – algebraic formula. Simultaneous equation – quadratic equations (4 hours)
Simultaneous linear equation in two variables (3 hours)
Arithmetic and geometric progression, sum of n-terms, simple calculations. (3 hours)
Mensuration – Find the area of regular objects like triangle, rectangle, square and circle; volumes of cube, cuboid, sphere cylinder (6 hours)
Trigonometry - Concept of angle, measurement of angle in degrees, grades and radians and their conversions, T-Ratios of Allied angles (3 hrs)
Co-ordinate Geometry - Cartesian and polar coordinates, conversion from cartesian to polar coordinates (2 hrs)
Concept of Differentiation and Integration (3 hrs)</td></tr>
</table>

	Physics • FPS, CGS, SI units, dimensions and conversions (2 hours) • Force, speed, velocity and acCELE1ration – Definition, units and simple problems (3 hours) • Stress and strain, modulus of elasticity (2 hours) • Heat and temperature, its units and specific heat of solids, liquids and gases (4 hours) • Electricity and its uses, basic electricity terms and their units, D.C. and A.C., positive and negative terminals, use of switches and fuses, conductors and insulators (5 hours) • Work, Power and Energy-Definition, units and simple problems (4 hours) • Concept of force, Inertia, Newton's First law of motion; momentum and Newton's second law of motion; Impulse; Newton's third law of motion. (2 hrs) • Friction and Lubrication (1 hour) • Law of conservation of energy (1 hour)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making

<table>
<tr><td colspan="2" align="center">UNIT - 2.2
SUBJECT CODE: CELE1-209
REPAIR AND MAINTENANCE OF ELECTRICAL INSTALLATIONS</td></tr>
<tr><td colspan="2">LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:
Identify various types of electrical installations and appliances
Carry out trouble shooting and repair common faults in the electrical installations
Install wiring of any building
Install wiring for single and three phase motor connections
Measure the earth resistance
Carry out earthing and maintain it
Install batteries and carry out maintenance of batteries
Perform general repair and maintenance of domestic appliances
Identify and use various types of luminaries</td></tr>
<tr><td>Practical (128 hours)</td><td>Theory (32 hours)</td></tr>
<tr><td>Domestic and Industrial Wiring
Lab. or live project based wiring exercise. Making students familiar with selection of various items required
Live/lab. Project on UPS/inverter wiring
Termination of wires/cables on bus bar and motors using thimbles and cable glands
Electric load calculation
(20 hours)
Earthing
Practice on measurement of earth resistance
Practice on maintenance of earthing/ earthing pit
Practice on carrying out earthing
(24 hours)
Cell/Battery
Practical exercise of battery connection
Practical exercise on battery charging and maintenance
(28 hours)
Domestic Appliances
Repair and maintenance of following:
Washing machine
Immersion rod
Hot plate
Geyser – gas/electric
Electric oven</td><td>Domestic and Industrial Wiring
Different types of domestic wiring
Types of switches/sockets/MCB/ELCB
Types of wires/cables/sizes
Types of panels/distribution boards
Testing of wiring like continuity, insulation resistance, polarity testing etc.
(8 hours)
Earthing
Types of earthing
Need of earthing
Measurement of earth resistance, study of earth tester
Maintenance of earthing
(4 hours)
Cell/Battery
Types of batteries, battery charging, series/parallel connection
Care and maintenance of lead acid battery
(4 hours)
Domestic Appliances
Introduction to concept and types of various domestic appliances:
Washing machine – types
Fan – types/working
Electric iron – types and working
Inverter - concept of wiring
Desert cooler connection
Water pump
Mixer/grinder</td></tr>
</table>

• Hair drier • Fans • Electric iron • Microwave oven • Inverter • Air cooler/water cooler/AC/Refrigerator connection • Mixer grinder • Water pump • Sandwich toaster • RO installation/repair (32 hours) **Luminaries** Practical exercises on connections of various types of luminaries like: • Single tube • Double tube • Sodium vapour • Mercury vapour • Neon lamps • Halogen lamps • Metal halides • CFL, LED etc. (24 hours)	• Immersion rod • Hot plate • Electric oven • Microwave oven • Hair drier • Electric toaster • Induction heating (8 hours) **Luminaries** • Introduction of various types of luminaries being used such as sodium, mercury, LED, CFL etc. • Connections of commonly used luminaries such as sodium vapour, mercury vapour, tube light, metal halide lamps, LED, CFL etc. • Single and double tube fluorescent lamp fitting connections (8 hours)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Viva-voce
- Software installation and operation

UNIT - 2.3 SUBJECT CODE: CELE1-210 ELECTRICAL MACHINES - II	
LEARNING OUTCOME: After undergoing this unit, students will be able to: • Identify various AC motors, alternators • Identify and utilize tools and instruments required for winding. • Use various AC motors and AC motor starters • Use alternator for practical needs • Identify various winding material • Wind and rewind small AC/DC motors and transformers	
Practical (128 hrs)	**Theory (48 hrs)**
• Identification of parts of various single phase and 3 phase AC motors (20 hrs)	• Theory of single phase and 3 phase AC motors, construction, working and details of these motors (8 hrs)
• Practice on running on various starters like DOL, star delta, (20 hrs)	• Study of various starters used in 3 phase motors like DOL, start delta (8 hrs)
• Speed control and practical application of AC motors like squirrel cage, slip ring, synchronous motor, single phase motors-capacitor motors, universal motors, split phase motors, over-hauling of AC motors etc. (30 hrs)	• Care and maintenance of single phase and 3 phase synchronous motors. Theory of working and diagram of various single phase motors like capacitor motor, universal motor and split phase motor (12 hrs)
• Identification of parts and terminals of alternator. Connection for starting, and running of alternator. (20 hrs)	• Various parts of alternator (8 hrs)
• Practice on winding of small AC motors like ceiling fan and single phase transformers. (38 hrs)	• Material used in electrical machine winding. Theory of winding material used in winding purposes. Single phase motor and transformer winding techniques. (12 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Viva-voce
- Assembly and disassembly

UNIT - 2.4
SUBJECT CODE: CELE1-211
ELECTRICAL CONTROL AND SWITCHGEARS

LEARNING OUTCOME:

After undergoing this unit, students will be able to:

- Select and use switching devices
- Identify and use various types of fuse
- Identify and draw control circuit
- Identify ELCB, MCB and their utilization and installation
- Identify and utilize various tools and control instruments

Practical (96 hrs)	**Theory (32 hrs)**
• Demonstration of switchgear (8 hrs) • Electrical connection diagram of switch, isolator and circuit breaker (10 hrs)	• Introduction to switchgear, difference between switch, isolator and circuit breaker (2 hrs) • Concept of fuse, switch unit (2 hrs)
• Demonstration and study of various type of fuses, testing of fuses (10 hrs)	• Fuse and its purpose, types of fuse and their application (4 hrs)
• Practice of making electrical connections of M.C.B.; E.L.C.B.; M.C.C.B. installations (12 hrs) • Testing of M.C.B. and E.L.C.B. and other circuit breakers (10 hrs)	• Introduction to M.C.B., E.L.C.B., M.C.C.B; relay - salient features and their uses. (6 hrs) • Study of different circuit breakers (ACB, VCB, OCB, MCCB) and lightening arresters (6 hrs)
• Demonstration and study of control circuit and power circuit of D.O.L. starter (10 hrs) • Demonstration and study of control circuit and power circuit of star delta starter (8 hrs) • Demonstration and study of reversing the direction of three phase induction motor using contactor control circuit (10 hrs) • Demonstration of remote control circuit of three phase induction motor (8 hrs) • Study and demonstration of overload relay (10 hrs)	• Introduction to magnetic contactor control circuits and power circuit (6 hrs) • Application of contactor control circuit (6 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Viva-voce
- Assembly and disassembly

SUBJECT CODE: CELE1-213
INDUSTRIAL TRAINING – II (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through firsthand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 2nd semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	20%
b)	Industrial training report	50%
c)	Presentation and viva-voce	30%

7. RESOURCE REQUIREMENT

7.1 LIST OF TOOLS/EQUIPMENT

a) TRAINEES TOOL KIT FOR 30 TRAINEES +1 INSTRUCTOR

Sr. No.	Names of the Items	Quantity
1.	Steel Tape, 15 m length	31 Nos.
2.	Plier Insulated, 150 mm	31 Nos.
3.	Plier Side Cutting, 150 mm	31 Nos.
4.	Screw Driver, 100 mm	31 Nos.
5.	Screw Driver, 150 mm	31 Nos.
6.	Electrician Connector, screw driver insulated handle thin stem, 100 mm	31 Nos.
7.	Heavy Duty Screw Driver , 200 mm	31 Nos.
8.	Electrician Screw Driver thin stem insulated handle, 250 mm	31 Nos.
9.	Punch Centre , 150 mm X 9 mm	31 Nos.
10.	Knife Double Bladed Electrician	31 Nos.
11.	Neon Tester	31 Nos.
12.	Steel Rule 300 mm	31 Nos.
13.	Hammer, cross peen with handle	31 Nos.
14.	Hammer, ball peen With handle	31 Nos.
15.	Gimlet 6 mm.	31 Nos.
16.	Bradawl	31 Nos.
17.	Scriber (Knurled centre position)	31 Nos.
18.	Pincer 150 mm	31 Nos.

b) SHOP TOOLS, INSTRUMENTS AND MACHINERY

Sr. No.	Names of the Items	Quantity
1.	C- Clamp 200 mm, 150 mm and 100 mm	2 Nos each
2.	Spanner Adjustable 150 mm,300mm	2 Nos each
3.	Blow lamp 0.5 ltr	1
4.	Melting Pot	1
5.	Ladel	1No
6.	Chisel Cold firmer 25 mm X 200 mm	2
7.	Chisel 25 mm and 6 mm	2 Nos each
8.	Hand Drill Machine	1
9.	Portable Electric Drill Machine 6 mm capacity	1
10.	Pillar Electric Drill Machine 12 mm capacity	1
11.	Allen Key	1 set
12.	Oil Can 0.12 ltr	1
13.	Grease Gun	1 No
14.	Outside Micrometer	2
15.	Motorised Bench Grinder	1

16.	Rawl plug tool and bit	2 set
17.	Pulley Puller	2
18.	Bearing Puller	2
19.	Pipe vice	4
20.	Thermometer 0 to 100 deg Centigrade	1 No.
21.	Scissors blade 150 mm	4 Nos.
22.	Crimping Tool	2 sets
23.	Wire stripper 20 cm	2 Nos.
24.	Chisel Cold flat 12 mm	2 Nos.
25.	Mallet hard wood 0.50 kg	4 Nos.
26.	Hammer Extractor type 0.40 kg	4 Nos.
27.	Hacksaw frame 200 mm 300 mm adjustable	2 Nos.each
28.	Try Square 150 mm blade	4 Nos.
29.	Outside and Inside Divider Calliper	2 Nos.each
30.	Pliers flat nose 150 mm	4 Nos.
31.	Pliers round nose 100 mm	4 Nos.
32.	Tweezers 100 mm	4 Nos.
33.	Snip Straight and Bent 150 mm	2 Nos.each
34.	D.E. metric Spanner	2 Nos.
35.	Drill hand brace	4 Nos.
36.	Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3	4 Set
37.	Plane, smoothing cutters 50 mm	2 Nos.each
38.	Gauge, wire imperial	2 Nos.
39.	File flat 200 mm 2nd cut	8 Nos.
40.	File half round 200 mm 2nd cut	4 Nos.
41.	File round 200 mm 2nd cut	4 Nos.
42.	File flat 150 mm rough	4 Nos.
43.	File flat 250 mm bastard	4 Nos.
44.	File flat 250 mm smooth	4 Nos.
45.	File Rasp, half round 200 mm bastard	4 Nos.
46.	Soldering Iron 25 watt, 65 watt, 125 watt	2 Nos.each
47.	Copper bit soldering iron 0.25 kg.	2 Nos.
48.	Desoldering Gun	4 Nos.
49.	Hand Vice 50 mm jaw	4 Nos.
50.	Table Vice 100 mm jaw	8 Nos.
51.	Pipe Cutter to cut pipes upto 5 cm. dia	4 Nos.
52.	Pipe Cutter to cut pipes above 5 cm dia	2 Nos.
53.	Stock and Die set for 20 mm to 50 mm G.I. pipe	1 set
54.	Stock and Dies conduit	1 No.
55.	Ohm Meter; Series Type & Shunt Type	2 Nos. each
56.	Multi Meter (analog) 0 to 1000 M Ohms,2.5 to 500 V	2 Nos.
57.	Digital Multi Meter	6 Nos.
58.	A.C. Voltmeter M.I. 0 –500V A.C	1 No.
59.	Milli Voltmeter centre zero 100 – 0 – 100 m volt	1 No.
60.	D.C. Milli ammeter 0 -500m A	1 No.
61.	Ammeter MC 0-5 A, 0- 25 A	1 No. each
62.	A.C. Ammeter M.I. 0-5A, 0-25 A	1 No. each
63.	Kilo Wattmeter 0-1-3 kw	1 No.

64.	A.C. Energy Meter, Single phase 5 amp. Three Phase 15 amp	1 No. each
65.	Power Factor Meter	1 No.
66.	Frequency Meter	1 No.
67.	Flux meter	1 No.
68.	Wheatstone Bridge with galvanometer and battery	1 No.
69.	Laboratory Type Induction Coil	1 No.
70.	DC Power Supply 0-30V, 2 amp	1 No.
71.	Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp	1 No. each
72.	1 Phase Variable Auto Transformer	1 No.
73.	Battery Charger	1 No.
74.	Hydrometer	1 No.
75.	Miniature Breaker 16 amp (Raw Material)	1 No.
76.	Working Bench 2.5 m x 1.20 m x 0.75 m	4 Nos.
77.	Fire Extinguisher CO2, 2 KG	2 Nos.
78.	Fire Buckets	2 Nos.
79.	Tachometer	1 No.
80.	Current Transformer 415 Volt,50 Hz, CT Ratio 150 / 5 Amp, 5VA	1 No.
81.	Potential Transformer 415 Volt,50Hz, PT Ratio 11KV/ 110V, 10VA	1 No.
82.	Growler	1 No.
83.	Tong Tester / Clamp Meter 0 – 100 amp. AC	1 No.
84.	Megger 500 volts	1 No.
85.	Contactor & auxiliary contacts 3 phase, 440volt, 16amp (Raw Material)	1 No. each
86.	Contactor & auxiliary contacts 3 phase, 440 volt, 32 amp. (Raw Material)	1 No. each
87.	Limit Switch (Raw Material)	1 No.
88.	Rotary Switch 16 A (Raw Material)	1 No.
89.	Load Bank 5 KW(Lamp / heater Type)	1 No.
90.	Brake Test arrangement with two spring balance 0 to 25 kg rating	1 No.
91.	Knife Switch DPDT fitted with fuse terminals 16 amp (Raw Material)	4 Nos.
92.	Knife Switch TPDT fitted with fuse terminals 16 amp (Raw Material)	4 Nos.
93.	Voltage Stabiliser Input: 150 – 230 volt AC Output: 220 volt AC	1 No.
94.	Motor-Generator (AC to DC) consisting of : Squirrel Cage Induction Motor with star delta starter and directly coupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling. Induction Motor rating: 7 HP, 400V, 50 cycles, 3 phase DC Shunt Generator rating: 5 KW, 440V	1 No.

95.	Used DC Generators-series, shunt and compound type for overhauling practice	1 No. each
96.	D.C. Shunt Generator with control panel,2.5 KW, 220V	1 No.
97.	D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker, 2.5 KW, 220 V	1 No.
98.	Diesel Generator Set with change over switch, over current breaker and water-cooled with armature, star-delta connections AC 3 phase, 5 KVA, 240 volt	1 No.
99.	DC Series Motor coupled with mechanical load 0.5 to 2 KW, 220 Volts	1 No.
100.	DC Shunt Motor 2 to 2.5 KW, 220 volts	1 No.
101.	DC compound Motor with starter and switch 2 to 2.5 KW, 220 volts	1 No.
102.	Single phase Transformer, core type, air cooled 1 KVA , 240/415 V, 50 Hz	1 No.
103.	Three phase transformer, shell type oil cooled with all mounting 3 KVA , 415/240 V, 50 Hz , (Delta/Star)	1 No.
104.	Oil Testing Kit	1 No.
105.	Hygrometer	1 set
106.	a. Cut out relays b. Reverse current c. Over current d. Under voltage	1 No. each
107.	Starters for 2 to 5 H.P. A.C Motors a. Resistance type starter b. Direct on line Starter c. Star Delta Starter- manual, semi-automatic and automatic d. Auto Transformer type	1 No. each
108.	Motor Generator(DC to AC) set consisting of - Shunt Motor with starting compensator and switch directly coupled to AC generator with exciter and switch board mounted with regulator, breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling. Shunt Motor rating : 5 HP, 440V AC Generator rating : 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50 cycles	1 No.
109.	AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse. 2 to 3 HP, 3-phase ,400 volts, 50 cycles	1 No.
110.	AC phase-wound slip ring Motor with starter and switch 5 HP, 400 volts, 3-phase, 50 cycles	1 No.
111.	A.C. Series type Motor with mechanical load ¼ HP, 230V, 50 Hz	1 No.
112.	Single Phase Capacitor Motor with starter switch 1 HP 230 volt 50 cycles	1 No.
113.	Universal Motor with starter/switch 230 volt, 50 cycles ¼ HP	1 No.
114.	Bath Impregnating	1 No.
115.	Oven Stove	1 No.
116.	Synchronous motor 3 Phase, 3 HP, 415V, 50Hz, 4 Pole, with accessories.	1 no.

117.	Lux meter	1 no.
118.	Inverter- 1 KVA with 12 V Battery Input- 12 volt DC, Output- 220 volt AC	1 No.
119.	Domestic Appliances – a. Electric Hot Plate 1500 watt b. Electric Kettle, 1500 watts c. Electric Iron 1500 watts d. Immersion Heater 1500 watt e. A.C. Fan f. Geyser (Storage type) 15 ltr minimum g. Mixture & Grinder	 1 No. 1 No. 1 No. 1 No. 1 No. 1 No. 1 No.
120.	Washing Machine	1 No.
121.	Motor Pump set 1 HP, 1 Phase, 240 V	1 No.
122.	Pin Type, shackle type & suspension type insulators (Raw Material)	2 Nos. each

7.2 LIST OF CONSUMABLES

1.	Different types of electrical wires and cables	As required
2.	Different types of MCBs and ELCBs	As required
3.	Different types of resistors	As required
4.	Different types of capacitors	As required
5.	Different types of inductors	As required
6.	Different types of transformers	As required
7.	Different types of connectors	As required
8.	Different types of plugs and sockets	As required
9.	Solder wire	As required
10.	Conduit pipes of various sizes	As required
11.	Junction box	As required
12.	Distribution box	As required
13.	Wooden boards/PVC boards	As required

7.3 LIST OF RECOMMENDED BOOKS

1. Electrician Trade Practical, Sem-I (2 Years), Published by NIMI, Guindy, Chennai.
2. Electrician Trade Practical, Sem-II (2 Years), Published by NIMI, Guindy, Chennai.
3. Electrician Trade Theory, Sem-I (2 Years), Published by NIMI, Guindy, Chennai.
4. Electrician Trade Theory, Sem-II (2 Years), Published by NIMI, Guindy, Chennai.
5. Electrician Trade Theory, 2nd Year, Available in Hindi, Published by NIMI, Guindy, Chennai.
6. Electrician Trade Theory, 1st Year, Available in Hindi, Published by NIMI, Guindy, Chennai.
7. Electrician Trade Practicals, 1st Year, Published by NIMI, Guindy, Chennai.
8. Electrician Trade Practicals, 2nd Year, Published by NIMI, Guindy, Chennai.
9. Basic Shop Practicals in Electrical Engineering (1st and 2nd Year) by M.L. Anwani, Published by Dhanpat Rai & Co. Pvt. Ltd., Delhi.
10. Basic Shop Practical by Mehta and Gupta, Published by Dhanpat Rai Publishing Company, Noida.
11. Basic Electrical Engineering (as per NIMI pattern) by M.L. Anwani, Published by Dhanpat Rai & Co. Pvt. Ltd., Delhi.
12. Basic Electrical Engineering by Mehta and Gupta, Published by Dhanpat Rai Publishing Company, Noida.
13. Elementary Electrical Engineering (as per NIMI pattern) by G.L. Marwaha, Published by Royal Book Depot (Regd.), Jalandhar City.

8. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION AND EVALUATION

Since this skill development course is tailor made i.e. designed to meet the requirement of selected group of students for developing desired competencies in the given trade, it is pertinent for trainers to understand the design philosophy and arrange teaching-learning process using appropriate strategies. The following points may be considered by the trainer at the time of planning the training programme and subsequently during the implementation and evaluation stages:

1. There are multiple competencies in each unit. The course curriculum also includes a core unit on developing effective communication and entrepreneurial qualities. Each unit has specific competencies which trainees are expected to acquire at the end of the each unit. In order to achieve these competencies, the curriculum describes the practice tasks/exercises and related theoretical knowledge. Time has been allocated for both of these components.

2. The curriculum is designed for contact period of 35 hours per week but can be increased/changed as per convenience of the trainees and the trainer.

3. The trainer will assess the attainment of each specific learning outcome of the individual learner and will maintain record whether the trainee has achieved desired level i.e. Yes/No. In case of 'No' the trainee will work further to learn and attain the desired skills till s/he earns 'Yes'.

4. Each learning outcome will be assessed/tested by the trainee as per acceptable norms and record will be maintained for final certification. The final assessment of skills attained through practice jobs and acquisition of relevant knowledge should preferably be carried out appropriately.

5. The examiner will set an objective type question paper for theory examinations of each unit under final assessment. Preferably the question paper should aim at testing the understanding of basic principles and concepts by students and their applications.

6. The final assessment of practical skills development should not be limited to testing a few units, but should spread over to all the acquired skills in an integrated manner. It should ultimately assess the ability of the student to accomplish the desired learning outcomes of the programme.

9. LIST OF CONTRIBUTORS/EXPERTS

a) Following experts participated in the workshop to design curriculum of certificate programme in 'Electrician' with NSQF alignment for MRSPTU, Bathinda on 29-30 August, 2016 at NITTTR, Chandigarh.

1.	Dr. Ashok Kumar Goel, Professor & Head, Electronics and Communication Engineering Department and Director, College Development Council, MRSPTU Campus, Dabwali Road, Bathinda, Punjab
2.	Kanwar H.S. Dhindsa, Vice President, Mohali Industries Association, Mohali
3.	Shri Parmod Kumar Verma, Prop. M/S Pee Kay Trading Co., Manimajra
4.	Shri Anil Rana, M/S Rana & Rana Electrical Works, Sector 28, Chandigarh
5.	Shri Sukhvir Singh, Electrician Instructor, Govt. Industrial Training Institute, Patiala, Punjab
6.	Shri Sarabjeet Singh, Electrician Instructor, Govt. Industrial Training Institute, Patiala, Punjab
7.	Shri Ravinder Kaushal, Electrician Instructor, Govt. Industrial Training Institute, Sector-28, Chandigarh
8.	Shri ML Rana, HOD, Electrical Engineering Department, CCET (Diploma Wing), Sector-26, Chandigarh
9.	Shri Mukesh Kumar, Electrical Instructor, CCET (Diploma Wing), Sector-26, Chandigarh
10.	Mrs. Poonam Syal, Associate Professor, Electrical Engineering Department, NITTTR, Chandigarh
11.	Shri Hans Raj Sharma, Electrical Engineering Department, NITTTR, Chandigarh
12.	Shri Vinod Kumar Sharma, Electrical Engineering Department, NITTTR, Chandigarh
13.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
14.	Prof. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**

b) Following experts participated in the workshop to review the curriculum of certificate programme in ‘Electrician’ for MRSPTU, Bathinda on 20 January, 2017 at NITTTR, Chandigarh:

1.	Dr. MM Malhotra, Ex-Principal, TTTI, Chandigarh
2.	Shri Arvind Dixit, Advance Technology, Sector 24, Chandigarh
3.	Dr. Ashok Kumar Goel, Director, College Development Council, MRSPTU, Bathinda, Punjab
4.	Shri Kulmohan Singh, Ex-HOD, Electrical Engg., CCET (Diploma Wing), Sector 26, Chandigarh
5.	Shri HS Kalra, Ex-Principal, Govt. Industrial Training Institute, Sector-28, Chandigarh
6.	Shri Rakesh Goel, Estate Officer, NITTTR, Chandigarh
7.	Shri Pritpal Singh Aulakh, GZSCCET, Bathinda
8.	Shri Naib Singh, Sr. Technician, GZSCCET, Bathinda
9.	Shri Jagdip Singh, , Sr. Technician, GZSCCET, Bathinda
10.	Prof. PK Singla, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh
11.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**

STUDY & EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN MSC NASTRAN/PATRAN

Code	Units	Study Scheme Total Hrs.		Credits	Marks Evaluation Scheme								Total Marks
					Internal Assessment			External Assessment					
		Th	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
CMEE5-101	Communication Skills	8	-	1	25	-	25	25	1	-	-	25	50
CMEE5-101P	Communication Skills Lab.	-	24	1	-	25	25	-	-	50	3	50	75
	Aspects of FEM	20	-	1	25	-	25	50	2	-	-	50	75
	Introduction to Patran and MSC Apex	-	60	2	-	50	50	-	-	100	4	100	150
	Preprocessing	30	-	1	25	-	25	50	2	-	-	50	75
	Preprocessing Lab in Patran and MSC Apex	-	92	3	-	50	50	-	-	100	4	100	150
	Solution development in MSC Nastran	25	-	1	25	-	25	50	2	-	-	50	75
	Nastran Lab	-	90	3	-	75	75	-	-	100	4	100	175
	Post Processing	23	-	1	25	-	25	50	2	-	-	50	75
	Post Processing Lab in Patran and MSC Apex	-	92	5	-	75	75	-	-	100	4	100	175
CMEE5-106P	#Student Centre Activity	-	48	2	-	25	25	-	-	-	-	-	25
CMEE5-107P	+4–Week Industrial Training at the end of Semester and Major Project	-	-	4	-	-	-	-	-	100	3	100	100
	TOTAL	**106**	**406**	**25**	**125**	**300**	**425**	**225**	**-**	**550**	**-**	**775**	**1200**

SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobby club, such as, photography,etc., seminars, declamation contest, educational field visits, NCC,NSS, cultural activities,etc.

+**Industrial Training**

Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total hours per day: 7, Total hours in a semester: 16x5x7 = 560

One credit is defined as one hour of lecture per week or two hours of practical per week in the program.

GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

The maximum marks for SCA should be 25. The marks may be distributed as follows:

i) 5 marks for general behavior and discipline
(by Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance as per following
(by the instructors/ trainers of the department)

a) Up to75%	Nil
b) 75%to80%	02marks
c) 80%to85%	03marks
d) Above85%	05marks

iii) 15 marks maximum for sports/NCC/NSS/Cultural/Co-curricular activities as per following:
(by in-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities) 15 marks
- for National level participation or inter-university competition 10 marks - participation any two of the activities
05 marks – participation at the internal sports of the institute/college/university
Note: There should be no marks for attendance in the internal sessional of different subjects.

SALIENT FEATURES OFTHE PROGRAMME

1	Sector	Aerospace/Mechanical Industry
2	Name of the Certificate Program	Nastran/Patran
3	Entry Qualification	Matriculation or equivalent NSQF level as prescribed by MRSPTU, Bathinda
4	Duration of Program	Six months
5	Intake	30
6	Pattern of Program	Semester Pattern
7	NSQF level	Level III
8	Ratio of Theory & Practice	20:80

UNIT – I **SUBJECT CODE:CMEE5-101** **COMMUNICATION SKILLS**	
Learning Outcomes: After undergoing this unit, the students will be able to: 1. Speak confidently. 2. Overcome communication barriers. 3. Write legibly and effectively. 4. Listen in proper prospective. 5. Read various genres adopting different reading techniques. 6. Respond to telephone calls and E-Mails effectively.	
Practical (24Hours)	**Theory (08Hours)**
	Basics of Communication • Process of communication • Types of communication-formal and informal, oral and written, verbal and non-verbal • Objectives of communication • Essentials of communication • Barriers to communication (1hour)
• Looking up words in a dictionary(meaning and pronunciation) (2hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2hours)
• Self and peer introduction • Greetings for different occasions (1 hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improve speaking • Manners and etiquettes (2hours)
• Newspaper reading (1 hour)	Reading • Meaning • Techniques of reading: skimming, scanning, intensive and extensive reading (1hour)
• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6hours)	Functional Vocabulary • One-word substitution • Commonly used words which are often misspelt • Punctuation • Idioms and phrases (2hours)

• Reading a loud article and essays on current and social issues • Comprehension of short paragraph (5hours)	
• Write a short technical report • Letter writing (3hours)	
• Participate in oral discussion • Respond to telephonic calls and emails effectively. • Mock interview (6hours)	

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Laboratory and practical work
4. Viva-voce

UNIT-II SUBJECT CODE: INTRODUCTION	
Learning Outcomes: After undergoing study of this unit the students will be able to 1. Understand the basics of FEA 2. Know the software basics 3. Learn about meshing.	
Practical's 60hrs.	**Theory 20hrs.**
• Introduction to Patran • Patran Workspace • Entering and Reviewing Data • Working with files • All about groups • Viewports • Right Mouse Button • Viewing a model • Display control • Tools • Preferences • Patran Model Browser tree • Random Analysis • Printing options • Mass properties • List Processor	• Introduction to Finite Element analysis • Past present and Future of FEA • Types of analysis • Basics of Statics and Strength of Material • Introduction to Meshing • 1D Meshing • 2D Meshing • 3D Meshing • Materials property and boundary condition

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

<table>
<tr><td colspan="2" align="center">UNIT-III
SUBJECT CODE:
Preprocessing
Preprocessing Lab in Patran and MSC Apex</td></tr>
<tr><td colspan="2">Learning Outcomes:
1. Patran
2. MSC Apex</td></tr>
<tr><td>Practical 92hrs.</td><td>Theory 30hrs.</td></tr>
<tr><td>

Features of Patran
Geometry import
Different types of import
Geometry clean up
Mid surface extraction
Geometry edit tools for mid surface
Meshing in 1D
Meshing in 2D
Meshing in 3D
Quality Parameters.
3D solid linear static analysis
Point masses, springs problems
Shells and cylindrical coordinates problems
Linear buckling analysis problem.
Modal Transient response problems with bars, springlets
Transient heat transfer problems
Steady state heat transfer
S-N analysis

<u>Design optimization:</u>

Design model definition procedure—choosing the design variables, objective, and constraints
Structural Optimization
Approximation concept NASTRAN

</td><td>

Linear static analysis: Definition, staring any Finite Element Analysis Project, checking mesh model, Design modification, Case study, Linear static solver, solution restart method, h element vs p modeling’s modelling, linear Bulking analysis.
Dynamic analysis : Static analysis vs Dynamic analysis, definition, difference between time domain and frequency domain, types of loading, simple harmonic solution, free vibration, resonance, damping, forced vibration, Single DOF frequency response analysis, single DOF transient response analysis, Mass input (lumped and coupled mass),Dynamic analysis solvers.
Thermal analysis: Introduction, conduction heat transfer, steady state, convection heat transfer, forced convection, meshing for thermal analysis.

</td></tr>
</table>

Means of Assessment
1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

UNIT-IV SUBJECT CODE: Solution Development in MSC Nastran	
Learning Outcomes: After undergoing study of this unit, the students will be able to • Find solution to different problems	
Practical **90hrs.**	**Theory** **25 hrs.**
• Sol 101- Static Analysis • Organization of MSC NASTRAN Files • Overview of Nastran Input • Overview of Nastran Output files • Nastran element: 0D,1D,2D,3D • Material Cards • Property cards • Loads and Boundary conditions • Param Cards • Case control cards	• Explanation of BDF • Organization of BDF • FILE Management section • Execute section • Case control • Bulk Data Section

Means of Assessment

5. Assignment and quiz/class tests
6. Mid-term and end-term written tests
7. Viva–voce
8. Practical work

<table>
<tr><th colspan="2">UNIT-V
SUBJECT CODE:
Postprocessing</th></tr>
<tr><td colspan="2">Learning Outcomes:
1. After undergoing study of this unit, the students will be able to
2. Analyze and interpret results.</td></tr>
<tr><td>Practical 92hrs.</td><td>Theory 23 hrs.</td></tr>
<tr><td>• Validate and check accuracy of the result,
• View results.
• Average and unaverage stresses
• Special tricks for post processing
• Interpretation of results
• Design Modifications
• Common mistakes and errors</td><td>• Theories of failure
• Maximum Principal stress theory
• Maximum shear stress theory
• Maximum Principal Strain theory
• Maximum strain energy theory
• Maximum distortion energy theory.</td></tr>
</table>

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

SUBJECT CODE: CMEE5-
107PINDUSTRIAL TRAINING– I (4 Weeks) &
Major Project

The purpose of industrial training is to:

1. Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
2. Developconfidenceamongstthestudentsthroughfirst-handexperiencetoenablethemto use and apply institute-based knowledge and skills to perform field activities.
3. Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their certificate program. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.
An external assessment of 100 marks have been provided in the study and evaluation scheme of 1st Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.
The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity	20%
b) Industrial training report	50%
c) Presentation and viva-voce	30%

Major Project: All students are required to submit a major project before the completion of the course using their knowledge and skills to solve industrial related practical problems.

STUDY & EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN SOLIDWORKS

Code	Units	Study Scheme Total Hrs.			Credits	Marks Evaluation Scheme								Total Marks
						Internal Assessment			External Assessment					
		Th	Tut	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
CMEE5-101	Communication Skills	8	-	-	1.0	25	-	25	25	1	-	-	25	**50**
CMEE5-101P	Communication Skills Lab.	-	-	24	1.0	-	25	25	-	-	50	3	50	**75**
CMEE5-102	Introduction to Design and Modeling	12	28	-	2.0	50	-	50	50	2	-	-	50	**100**
	Introduction to Design and Modeling Lab.	-	-	80	3.0	-	50	50	-	-	100	4	100	**150**
	Engineering Components and Design	25	45	-	2.0	50	-	50	50	2	-	-	50	**100**
	Engineering Components and Design Lab.	-	-	90	4.0	-	50	50	-	-	100	4	100	**150**
	Assembly of Engineering Components	25	55	-	2.0	50	-	50	50	2	-	-	50	**100**
	Assembly of Engineering Components Lab.	-	-	120	4.0	-	50	50	-	-	100	4	100	**150**
CMEE5-106P	#Student Centre Activity	-	-	48	2.0	-	25	25	-	-	-	-	-	**25**
CMEE5-107P	+4–Week Industrial Training and Major Project (At the end of Semester)	-	-	-	4.0	-	-	-	-	-	100	3	100	**100**
	TOTAL	**70**	**128**	**362**	**25**	**175**	**200**	375	**175**	**-**	**450**	**-**	625	**1000**

SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobby club, such as, photography, seminars, declamation contest, educational field visits, NCC, NSS, cultural activities.

+**Industrial Training**

Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total hours per day: 7, Total hours in a semester: 16x5x7 = 560 One

credit is defined as one hour of lecture per week or two hours of practical per week in the programme.

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(By Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance asperfollowing
(By the instructors/ trainers of thedepartment)

a) Up to75%	Nil
b) 75%to80%	02marks
c) 80%to85%	03marks
d) Above85%	05marks

iii) 15 marks maximum for sports/NCC/NSS/Cultural/Co-curricular activities as per following:
(By In-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities) 15marks
- for National level participation or inter-university competition 10 marks - participation any two of the activities
05 marks – participation at the internal sports of the institute/college/university
Note: There should be no marks for attendance in the internal sessional of different subjects.

SALIENT FEATURES OFTHE PROGRAMME

1	Sector	Mechanical Industry
2	Name of the Certificate Programme	SOLIDWORKS
3	Entry Qualification	Graduate/Postgraduate/Diploma holder or equivalent level as prescribed by MRSPTU, Bathinda
4	Duration of Programme	Six months
5	Intake	30
6	Pattern of Programme	Semester Pattern
7	NSQF level	Level III
8	Ratio of Theory & Practice	20:80

UNIT – I SUBJECT CODE:CMEE5-101 COMMUNICATION SKILLS	
Learning Outcomes: After undergoing this unit, the students will be able to: 1. Speak confidently. 2. Overcome communication barriers. 3. Write legibly andeffectively. 4. Listen in proper prospective. 5. Read various genres adopting different reading techniques. 6. Respond to telephone calls and E-mails effectively.	
Practical (24Hours)	**Theory (08Hours)**
	Basics of Communication • Process of communication • Types of communication-formal and informal, oral and written, verbal and non-verbal • Objectives of communication • Essentials of communication • Barriers to communication (1hour)
• Looking up words in a dictionary (meaning and pronunciation) (2hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2hours)
• Self and peer introduction • Greetings for different occasions (1 hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improves peaking • Manners and etiquettes (2hours)

• Newspaper reading (1 hour)	Reading • Meaning • Techniques of reading: skimming, scanning, intensive and extensive reading. (1hour)
• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6hours)	Functional Vocabulary • One-wordsubstitution • Commonly used words which are often misspelt • Punctuation • Idioms andphrases (2hours)

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Viva-voce
4. Presentation

• Reading a loud articles and essay son current and social issues • Comprehension of short paragraph (5hours)	
• Write a short technical report • Letter writing (3hours)	
• Participate in oral discussion. • Respond to telephonic calls and E-mails effectively. • Mock interview (6hours)	

Means of Assessment

5. Assignments and quiz/class tests
6. Mid-term and end-term written tests
7. Laboratory and practical work
8. Viva-voce

UNIT-II SUBJECT CODE: ---------- INTRODUCTION TO DESIGN AND MODELING	
Learning Outcomes: After undergoing study of this unit the students will be able to 1. Design and Modeling techniques used in Engineering. 2. 2D Modeling and sketching. 3. Engineering drawing techniques. 4. SOLIDWORKS 2D designing and sketching.	
Practical 80hrs.	**Theory 12hrs.** **Tutorials 28hrs.**
• Introduction to SOLIDWORKS software package • Features of SOLIDWORKS: Various products available in SOLIDWORKSfor Product Design, Simulation, Communication SOLIDWORKS Graphical User Interface - Feature manager design tree, Handles, Confirmation corner, mouse buttons, Command Manager • Introduction to 2D drawing or sketching • Sketch Entities – Centerline line, Line, Circle, Arc, Ellipse, Rectangle, Slots, Polygon,Parabola,Ellipse,PartialEllipse, Spline, Spline tools, Points, Text, Constructiongeometry • Sketch Tools - Fillet, Chamfer, Offset, Convert entities, Trim, Extend, Mirror, Move,Copy,Rotate,Scale,Stretch,Sketch pattern, Sketchpicture • Blocks – Make block, Edit block, Insert block,Add/RemoveEntities,Rebuild,Save • ExplodeRelations-AddingSketchRelation, Automaticrelations. • Adding relations and Advanced	• **Introduction to design and modeling:** Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Different types of Modeling Techniques/tools • **Introduction to Dimensioning:** Concepts of scale in drawing, Types of scales. • **Lettering and Numbering:** SingleStroke, Double Stroke, inclined, Upper case and Lowercase. • **Types of lines:** Definition,typesandapplicationsin Drawing Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight,curved)-Drawingofparallellines, perpendicular line – Methods of Division of linesegment • **Basic Definition of geometrical objects:**Points, lines and planes.Nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle,Square,Parallelogram. - Circle and its elements

dimensioning techniques and base feature options	

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

<table>
<tr><td colspan="2" align="center">UNIT-III
SUBJECT CODE:----
ENGINEERING COMPONENTS AND DESIGN</td></tr>
<tr><td colspan="2">Learning Outcomes:
After undergoing study of this unit the students will be able to learn
• 3D Designing and Modeling in SOLIDWORKS.
• Projection of Solids
• Method of Presentation of Engineering Drawing</td></tr>
<tr><td>Practical 90hrs.</td><td>Theory 25hrs.
Tutorials 45hrs.</td></tr>
<tr><td>• Dimensioning-Smart, Horizontal, Vertical, fully define sketch.3DSketching
• Creating Extrude features – Direction1, Direction2, from option, Thin feature, applying draft, Selectingcontours
• Creating Revolve features – Selecting Axis, Thin features, selecting contours Creating Swept Features-Selecting, Profile and Path, Orientation/twisttype,Thinfeature,Creating referenceplanes
• Creating Loft features – SelectingProfiles, Guide curves, Start/EndConstraints,
• Centerline parameters, Closeloft.
• Selecting geometries – SelectionManager, Multiple Bodyconcepts
• Creating Reference - points,axis, coordinates
• Creatingcurves- Splitline,Projectcurve, Composite curve, Helix andSpiral
• Creating Fillet Features- Inserting Hole types,
• Creating Chamfer, Creating Shell,</td><td>• Dimensioning: Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary) - Typesof arrowhead -Leader Line withtext
• Method of Presentation of Engineering Drawing: Pictorial View-Orthogonal View and Isometric view</td></tr>
</table>

Creating Rib • **Creating Pattern -** Linear pattern, Circular pattern, Sketch driven pattern, Curve driven pattern, Table driven pattern, Fill pattern, mirror. • Advanced Modeling Tools- Dome, Deform, indent, Flex. • ***Minor projects:*** **Design ofvarious machine elements** – Gears, springs, propeller, piston, turbine buckets, runners, pump impellers, pipe elbows, Tees, reducers, flanges, Trusses, etc. **Analysis of structures:** – Simulation of design: Motion study, animations, etc. – Optimization of design: Material optimization, shape optimization, flow stabilization, etc.	

UNIT-IV

SUBJECT CODE: ---------

ASSEMBLY OF ENGINEERING COMPONENTS

Learning Outcomes:

After undergoing study of this unit the students will be able to

- Assembly Modeling
- Understand about Assembly Approaches
- Understand about tool parts and itsuses

Practical 120hrs.	**Theory 25hrs.** **Tutorials 55hrs.**
• **Introduction to Assembly Modeling &Approaches –** Top down and Bottom up Approach Applying Standard Mates- Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle. • **Applying Advanced Mates –** Symmetric, Width, Path Mate, Linear/LinearCoupler,and Limit Mate. • **Applying Mechanical Mates –** Cam, Hinge, Gear, Rack Pinion, Screw, andUniversalJoint. Applying Smart mates Applying Mate reference. • **Manipulating Components -** Replacing Components, Rotating Components, Move Components, Collision Detection, Detecting Interference • **CreatingPattern-**AssemblyPattern,Mirror Creating Exploded Views Top Down Assembly • SmartFasteners • Creating Extrude, Revolve, Swept, loft, Boundarysurface.InsertingPlanarSurface, Offset Surface, Free form Extending a surface, Surface fill, Ruled Surface, Trim	• **Importance of Machine Drawing –** Brief revision of 1st and 3rd angle projections - Understand the concepts of Orthographic projections and Sectional views. • **Assembly Drawings and modeling – I:** – Cotter joint – Jib and cotter joint assembly – Knuckle joint assembly – Assembly of muffs coupling (solid & split) coupling – Flange couplings – Screw jack assembly • **Assembly Drawings and modeling – II:** – Bearings – Socket and spigot joint – Protective type flanged coupling – Piston of petrol engine – Cross head – Connecting rod – Sleeve and cotter joint – Lathe tool post – Big end of a connecting rod – Foot step bearing – Plummer block

Surface, Replace Face, Delete face, Untrim surface, knit surface, Thickening aSurface • Generating DrawingViews • Introduction to Angle ofProjection • **Generating Views -** Generating Model View, Projected Views, InsertingStandard 3 View, Auxiliary Views, and Detailed views. • **Crop view, Broken –**Out Section, Section View, Alternate Position View, Working assembly specific view, Drawing properties, Manipulatingviews. • **Design of various assemblies:** Cotter joint, Jib and cotter joint assembly, Knuckle joint assembly, Assembly of muffs coupling (solid & split) coupling, Flange couplings, Screw jack assembly, Bearings, Socket and spigot joint, Protective type flanged coupling, Piston of petrol engine, Cross head, Connecting rod, Sleeve and cotter joint, Lathe tool post, Big end of a connecting rod, Foot step bearing. Plummer block, Lathe tail stock. • Monocoque (Practical), spar fuselage structures basic modeling, assembly, application-oriented part. • ***Minor projects:*** Design and analysis on any of the design given by the instructor of the subject.	– Lathe tail stock. **Note: This unit will also cover the design of various couplings. The study of mass/material properties, forces, inertia, and motions will be covered in this theory part.**

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

SUBJECT CODE: CMEE5-107P

INDUSTRIAL TRAINING– I and MAJOR PROJECT(4 Weeks)

The purpose of industrial training is to:

1. Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses ofstudy.
2. Developconfidenceamongstthestudentsthroughfirst-handexperiencetoenablethemto use and apply institute based knowledge and skills to perform fieldactivities.
3. Developspecialskillsandabilitieslikeinterpersonalskills,communicationskills,attitudes andvalues.
4. To choose a mechanical component design and make a major project in SOLIDWORKS.

It is needless to emphasize further the importance of Industrial Training of students during their certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks has been provided in the study and evaluation scheme of 1st Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real lifesituations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	20%
b)	Industrial training report	50%
c)	Presentation and viva-voce	30%

NOTE: Major project should include the complete use of SOLIDWORKS including the assembly tools. Physical model of this component should be available at the Industry where the student chooses to internship.Faculty will interact to the industry as well as students during the 4 weeks Industrial training.

ANNEXURE-03

STUDY & EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN CATIA

Code	Units	Study Scheme Total Hrs.		Credits	Marks Evaluation Scheme									Total Marks
					Internal Assessment			External Assessment						
		Th	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total		
	Communication Skills	8	-	1	25	-	25	25	1	-	-	25		50
	Communication Skills Lab.	-	24	1	-	25	25	-	-	50	3	50		75
	Introduction to Design	52	-	2	25	-	25	50	2	-	-	50		75
	Introduction to Design Lab.	-	150	4	-	50	50	-	-	100	4	100		150
	Engineering components and design	16	-	1	25	-	25	50	2	-	-	50		75
	Engineering components and design lab	-	160	4	-	75	75	-	-	100	4	100		175
	Assembly and Design	22	80	6	50	50	100	-	2	100	4	100		150
	#Student Center Activity	-	48	2	-	25	25	-	-	-	-	-		25
	+4–Week Industrial Training at the end of Semester	-	-	4	-	-	-	-	-	100	3	100		100
	TOTAL	**98**	**462**	**25**	**125**	**300**	**475**	**125**	**-**	**650**	**-**	**775**		**1275**

SCA will consist of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobby club, such as photography. seminars, declamation contests, educational field visits, NCC, NSS, cultural activities.

+**Industrial Training**

Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total hours per day: 7, Total hours in a semester: 16x5x7 = 560

One credit is defined as one hour of lecture per week or two hours of practical per week in the programme.

GUIDELINES FOR ASSESSMENT OF STUDENT-CENTERED ACTIVITIES (SCA)

The maximum marks for SCA should be25. The marks may be distributed as follows:

i) 5 marks for general behavior and discipline
(By Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance as per following
(By the instructors/ trainers of the department)

a) Up to75%	Nil
b) 75%to80%	02marks
c) 80%to85%	03 marks
d) Above85%	05 marks

iii) 15 marks maximum for sports/NCC/NSS/Cultural/Co-curricular activities as per following:

(By In-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities) 15marks - for National level participation or inter-university competition 10 marks - participation any two of the activities
05 marks – participation at the internal sports of the institute/college/university Note: There should be no marks for attendance in the internal session of different subjects.

SALIENT FEATURES OF THE PROGRAMME

1	Sector	Mechanical / Aeronautical/ Aerospace Industry
2	Name of the Certificate Programme	CATIA
3	Entry Qualification	Diploma / B. Tech. or equivalent NSQF level as prescribed by MRSPTU, Bathinda
4	Duration of Programme	Six months
5	Intake	30
6	Pattern of programme	Semester Pattern
7	NSQF level	Level III
8	Ratio of Theory & Practice	20:80

UNIT – I SUBJECT CODE: COMMUNICATION SKILLS	
Learning Outcomes: After undergoing this unit, the students will be able to: 1. Speak Confidently. 2. Overcome communication barriers. 3. Write legibly and effectively. 4. Listen in proper perspective. 5. Read various genres adopting different reading techniques. 6. Respond to telephone calls and E-mails effectively.	
Practical (24Hours)	**Theory (08 Hours)**
	Basics of Communication ● Process of communication ● Types of communication-formal and informal, oral and written, verbal and non-verbal ● Objectives of communication. ● Essentials of communication. ● Barriers to communication. (1hour)
● Looking up words in a dictionary (meaning and pronunciation) (2hours)	Functional Grammar and Vocabulary ● Parts of speech ● Tenses ● Correction of incorrect sentences (2hours)
● Self and peer introduction ● Greetings for different occasions (1 hour)	Listening ● Meaning and process of listening ● Importance of listening ● Methods to improve listening skills Speaking ● Importance ● Methods to improve speaking ● Manners and etiquettes (2hours)
● Newspaper reading (1 hour)	Reading ● Meaning ● Techniques Of Reading: skimming, scanning, intensive and extensive reading (1hour)

• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6hours)	Functional Vocabulary • One-word substitution • Commonly used words which are often misspelled • Punctuation • Idioms and phrases (2hours)

• Reading a loud articles and essays on current and social issues • Comprehension of short paragraph (5hours)	
• Write a short technical report • Letter writing (3hours)	
• Participate in oral discussion • Respond to telephonic calls and E-mails effectively. • Mock Interview (6hours)	

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Laboratory and practical work
4. Viva-voce

UNIT-II SUBJECT CODE: ---------- INTRODUCTION TO DESIGN	
Learning Outcomes: After undergoing study of this unit, the students will be able to 1. Design and Modeling techniques used in Engineering. 2. 2D Modeling and sketching. 3. Engineering drawing techniques. 4. CATIA 2D designing and sketching	
Practical 150hrs.	**Theory 52hrs.**
● Introduction to CATIA software ● Features of CATIA: Various products available in CATIA for Product Design, Simulation, Communication CATIA Graphical User Interface - Feature manager design tree, Handles, Confirmation corner, mouse buttons, Command Manager ● Introduction to 2D drawing or sketching ● Sketch Entities – Centerline line, Line, Circle, Arc, Ellipse, Rectangle, Slots, Polygon, Parabola, Ellipse, Partial Ellipse, Spline, Spline tools, Points, Text, Construction geometry. ● Sketch Tools - Fillet, Chamfer, Offset, convert entities, Trim, Extend, Mirror, Move, Copy, Rotate, Scale, Stretch, Sketch pattern, Sketch picture ● Blocks – Make block, edit block, insert block, Add/Remove Entities, Rebuild, Save ● Explode Relations-Adding Sketch Relation, Automatic relations. ● Adding relations and Advanced dimensioning techniques and base	● **Introduction to design and modeling:** Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Different types of Modeling Techniques/tools ● **Introduction to Dimensioning:** Concepts of scale in drawing, Types of scales. ● **Lettering and Numbering:** Single Stroke, Double Stroke, inclined, Uppercase and Lowercase. ● **Types of lines:** Definition, types and applications in Drawing Classification of lines (Hidden, Center, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved)- Drawing of parallel lines, perpendicular line – Methods of Division of line segment ● **Basic Definition of geometrical objects:** Points, lines and planes. Nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle - different types - Rectangle, Square, Rhombus, Parallelogram. ● - Circle and its elements

feature options	

Means of Assessment

1. Assignment and quiz/class tests.
2. Mid-term and end-term written tests.
3. Viva–voce.
4. Practical Work.

UNIT-III
SUBJECT CODE: ------

ENGINEERING COMPONENTS AND DESIGN

Learning Outcomes:

After undergoing study of this unit, the students will be able to learn

- 3D Designing and Modeling in CATIA.
- Projection of parts
- Method of Presentation of Engineering Drawing

Practical	**160hrs**	**Theory**	**16hrs**

• **Introduction to part design:** Part modeling tool classification. • Sketch based features, Dress up features, Surface based features, Transformation features. • **Part design workbench document**: part design menu bar, specification tree, work area, compass, toolbar, prompt area, power input area. • **Sketch based features**: pad, drafted fileted pad, multi-pad, pocket, drafted fileted pocket, multi-pocket, shaft, groove, hole, rib, slot, solid combine, stiffener, multi - sections solid, removed multi-sections solid • **Dress-up Features**: edge filet, variable radius filet, face-face filet, tri- tangent filet, chamfer, draft angle, draft reflect line, variable angle draft, shell, thickness, thread/tap, remove face, replace face. • **Transformation features:** Translation, rotation, symmetry, mirror, rectangular pattern, circular pattern, user pattern, scaling • **Conditions of part design workbench:** Do's and Don'ts of shaft, rib, stiffener, solid combine, multi section solid, thread/tip. • **PROCEDURE:** Invoke pad command, Invoke pocket command, • Invoke hole command, invoke slot command, Invoke filet command. • **PART DESIGN EXERCISE**: Machine vise, die casting, screw jack and parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Mathematical modeling of part design:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Motion Study of part design:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars.	• **Dimensioning:** Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary) – Types Of arrowheads -Leader Line with text • **Projection of PARTS-**Definition of solids, types of solids, and elements of solids. Projection of solids in the first or third quadrant. • **Section of Solids:** Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. • **Method of Presentation of Engineering Drawing:** Pictorial View-Orthogonal View - Isometric view • **Isometric Projection:** Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts. • **Orthographic Projection:** Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

• **Animation of part design:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Analysis of Structures and Design:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Case Studies:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Design optimization:** Machine vise, die casting, screw jack and their parts, landing gear and its components, piston, bulkhead, ribs and spars. • **Practical based on Industry**: Nut and bolt, engine and its components, Parts used in Automobile industry, fuselage, bulkheads and landing gear. • **"Minor in House Projects":** Component and design.	

<table>
<tr><td colspan="2" align="center">UNIT-IV
SUBJECT CODE: ---------
ASSEMBLY & DESIGN</td></tr>
<tr><td colspan="2">Learning Outcomes:
After undergoing study of this unit, the students will be able to:
● Assembly Modeling
● Understand about Assembly Approaches.
● Understand about tool parts and its uses.</td></tr>
<tr><td>Practical 80hrs</td><td>Theory 22hrs</td></tr>
<tr><td>● Introduction to Assembly Modeling Approaches
● Types of assembly design approach – Top down and Bottom-up Approach .
● Toolbars: product structure tools, constraints, move,
● Condition of assembly workbench: Do’s and Don'ts.
● Products structure toolbar: Import files, multi-instances
● Constraints Toolbar: contact constraint, fix, re-use pattern.
● Manipulating Components - Replacing Components, Rotating Components, Move Components, Collision Detection, Detecting Interference
● Creating Pattern-Assembly Pattern, Mirror Creating Exploded Views Top-Down Assembly
● Smart Fasteners.</td><td>● Importance of Machine Drawing – Brief revision of 1st and 3rd angle projections - Understand the concepts of Orthographic projections and Sectional views.</td></tr>
</table>

• Creating Extrude, Revolve, Swept, loft, Boundary surface. Inserting Planar Surface, Offset Surface, Free form Extending a surface, Surface fill, Ruled Surface, Trim Surface, Replace Face, delete face, Untrim surface, knit surface, Thickening a Surface • Generating Drawing Views • Introduction to Angle of Projection • **Generating Views -** Generating Model View, Projected Views, Inserting Standard 3 View, Auxiliary Views, and Detailed views. • **Crop view, broken** –Out Section, Section View, Alternate Position View, working assembly specific view, drawing properties, Manipulating views	

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Minor project at the end of the semester.
4. Viva–voce
5. Practical Work

INDUSTRIAL TRAINING– I (4 Weeks)

The purpose of industrial training is to:

1. Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
2. Develop Confidence Amongst the Students Through First-hand experience to enable them to use and apply institute-based knowledge and skills to perform field activities.
3. Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of the world of work. It prepares students for their future role as a skilled person in the world of work and enables them to integrate theory with practice.
An external assessment of 100 marks have been provided in the study and evaluation scheme of 1st Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situation.
The instructor along with one industrial representative from the concerned trade will conduct a performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	20%
b)	Industrial training report	50%
c)	Presentation and viva-voce	30%

ANNEXURE- 05

STUDY AND EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN ANSYS

Code	Units	Study Scheme Total Hrs.			Credits	Marks Evaluation Scheme									Total Marks
						Internal Assessment			External Assessment						
		Th	Tut	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total		
CMEE5-101	Communication Skills	8	-	-	1.0	25	-	25	25	1	-	-	25		**50**
CMEE5-101P	Communication Skills Lab.	-	-	24	1.0	-	25	25	-	-	50	3	50		**75**
CMEE5-102	Introduction to ANSYS TM workbench	12	28	-	2.0	50	-	50	50	2	-	-	50		**100**
	Sketching and part modeling	18	-	80	3.0	-	50	50	-	-	100	4	100		**150**
	Placed features and assembly	25	45	60	2.0	50	-	50	50	2	-	-	50		**100**
	Meshing	24	-	90	4.0	-	50	50	-	-	100	4	100		**150**
	Static Structural Analysis	25	55	70	2.0	50	-	50	50	2	-	-	50		**100**
	Electronic and Thermal analysis	24	-	92	4.0	-	50	50	-	-	100	4	100		**150**
CMEE5-106P	#Student Centre Activity	-	-	48	2.0	-	25	25	-	-	-	-	-		**25**
CMEE5-107P	+4–Week Industrial Training and Major Project (At the end of Semester)	-	-	-	4.0	-	-	-	-	-	100	3	100		**100**
	TOTAL	**136**	**128**	**464**	**25**	**175**	**200**	375	**175**	**-**	**450**	**-**	625		**1000**

SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobby club, such as, photography, etc., seminars, declamation contest, educational field visits, NCC, NSS, cultural activities, etc.

+**Industrial Training**

Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total hours per day: 7, Total hours in a semester: 16x5x7 = 560
One credit is defined as one hour of lecture per week or two hours of practical per week in the program.

GUIDELINESFOR ASSESSMENT OF STUDENT-CENTRED ACTIVITIES (SCA)

The maximum marks for SCA should be25. The marks may be distributed as follows:

i) 5 marks for general behavior and discipline
(By Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance as per following
(By the instructors/ trainers of the department)

a)	Up to75%	Nil
b)	75%to80%	02marks
c)	80%to85%	03marks
d)	Above85%	05marks

iii) 15marksmaximumforsports/NCC/NSS/Cultural/Co-curricularactivitiesas per following:
(By In-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities) 15marks
- for National level participation or inter-university competition 10 marks - participation any two of the activities
05 marks – participation at the internal sports of the institute/college/university
Note: There should be no marks for attendance in the internal sessional of different subjects.

SALIENT FEATURES OFTHE PROGRAMME

1	Sector	AERONAUTICAL Industry
2	Name of the Certificate Program	ANSYS TM
3	Entry Qualification	Graduate/Postgraduate/Diploma holder or equivalent level as prescribed by MRSPTU, Bathinda
4	Duration of Program	Six months
5	Intake	30
6	Pattern of Program	Semester Pattern
7	NSQF level	Level III

8	Ratio of Theory & Practice	20:80

UNIT – I

SUBJECT CODE: CMEE5-101

COMMUNICATION SKILLS

Learning Outcomes:

After undergoing this unit, the students will be able to:

1 Speak confidently.

2 Overcome communication barriers.

3 Write legibly and effectively.

4 Listen in proper prospective.

5 Read various genres adopting different reading techniques.

6 Respond to telephone calls and E-Mails effectively.

Practical (24Hours)	**Theory (08Hours)**
	Basics of Communication • Process of communication • Types of communication-formal and informal, oral and written, verbal and non- verbal • Objectives of communication • Essentials of communication • Barriers to communication • Respond to e-mail effectively (1hour)
• Looking up words in a dictionary (meaning and pronunciation) (2hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2hours)
• Self and peer introduction • Greetings for different occasions (1 hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improve speaking • Manners and etiquettes (2hours)
• Newspaper reading	Reading

(1 hour)	• Meaning Techniques of reading: skimming, scanning, intensive and extensive reading (1hour)
• Vocabulary enrichment and • Exercises on sentence framing accurately (6hours)	Functional Vocabulary • One-word substitution • Commonly used words which are often misspelt • Punctuation • Idioms and phrases (2hours)

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Viva-voce
4. Presentation

UNIT-II

SUBJECT CODE……

INTRODUCTION TO ANSYS WORKBENCH

Learning Outcome 1. Basic understanding of ANSYS Workbench	
Practical	**Theory** **(12hrs)**
• Introduction to ANSYS software • Features of ANSYS software • Working with FEM, Elements and shape functions, FEA software	• Engineering analysis, Procedure to conduct FEM • About ANSYS workbench • Database and file format in ANSYS • Changing the unit system • Component of system

Means of Assessment

1Assignments and quiz/class tests

2 Mid-term and end-term written tests

3 Viva-voce

4 Presentation

UNIT-III

SUBJECT CODE…….

SKETCHING AND PART MODELLING IN DESIGN MODELER

Learning outcomes • How to use Design Modeler	
Practical (80hrs)	Theory (18 hrs)
• I-section • Spring plate • Clamp • Extrusion • Revolution • Sweep • Sketching • CAD System • Surface and line models	• Introduction to modeling • Introduction to design modeler

Means of Assessment

1. Assignments and quiz/class tests

2. Mid-term and end-term written tests

3. Viva-voce

4. Presentation

UNIT-VI

SUBJECT CODE…..

Placed Features and Assembly

Learning Outcomes Learn about assembly	
Practical (30hrs)	Theory (25hrs)
• Adding a hole • Adding a round • Adding a chamfer	• Introduction • Adding Features

• Patterns • Assembly • Extrusion , Union, Intersection,	

Means of Assessment

1 Assignments and quiz/class tests

2 Mid-term and end-term written tests

3 Viva-voce

4 Presentation

UNIT-V **Meshing**

Learning outcome Understanding basic concept of Meshing	
Practical (24hrs)	Tutorial (90hrs)
• Meshing of Plate with holes (2D & 3D) • Optimizing the model • Generating the local mesh • Assembly meshing	• Meshing • Generating the mesh

Means of Assessment

1 Assignments and quiz/class tests

2 Mid-term and end-term written tests

3 Viva-voce

4 Presentation

UNIT-VI

Static Structural Analysis

Learning Outcome • Various Solution • Pre-processing • Holes and slots	
Practical (70 hrs)	Theory (25 hrs)
• Plate with central circular holes • Square Slot • Bracket	• Introduction to static structural analysis • Structural analysis of cantilever beam

• Clevis assembly • Algorithm used to stabilize and improve accuracy of the solution • Numerical discretization • Boundary conditions	• Governing equations

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Viva-voce
4. Presentation

UNIT-VII

Electronic and Thermal Analysis

Learning outcome • Thermal analysis and thermal stresses	
Practical (92 hrs)	Theory (24 hrs)
• Electronic Analysis • Steady state thermal analysis of brake • Heat Sink • Transient thermal analysis of piston • Thermal stress in cylinder	• Important term used in thermal analysis • Types of thermal analysis • Thermal stresses

Means of Assessment

1. Assignment and quiz/class tests
2. Mid-term and end-term written tests
3. Viva–voce
4. Practical work

SUBJECT CODE: CMEE5-107P

INDUSTRIAL TRAINING– I and MAJOR PROJECT (4 Weeks)

The purpose of industrial training is to:

1. Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
2. Develop confidence among the students through first-hand experience to enable them to use and apply institute based knowledge and skills to perform field activities.
3. Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.
4. To choose a meshing and structural analysis make a major project in ANSYS.

It is needless to emphasize further the importance of Industrial Training of students during their certificate program. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks has been provided in the study and evaluation scheme of 1st Semester. Evaluation of professional industrial training report through viva- voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	20%
b)	Industrial training report	50%
c)	Presentation and viva-voce	30%

NOTE: Major project should include the complete use of SOLIDWORKS including the assembly tools. Physical model of this component should be available at the industry where the student chooses to internship.

Certificate Course In Air Ticketing

Session: 2022-23

Code	Units	Study Scheme Total Hrs.		Credits	Marks Evaluation Scheme								Total Marks
					Internal Assessment			External Assessment					
		Th	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
CMEE5-101	Communication Skills	8	-	1	25	-	25	25	1	-	-	25	50
CMEE5-101P	Communication Skills Lab.	-	24	1	-	25	25	-	-	50	2	50	75
	Introduction to Aviation Industry	20	-	1	25	-	25	50	2	-	-	50	75
	Introduction to Aviation Industry Lab	-	50	2	-	50	50	-	-	100	4	100	150
	Computer Applications in Aviation Industry	30	-	1	25	-	25	50	2	-	-	50	75
	Computer Applications in Aviation Industry Lab.	-	60	2	-	50	50	-	-	100	4	100	150
	Air Ticketing	40	-	2	25	-	25	50	2	-	-	50	75
	Air Ticketing Lab	-	90	4	-	75	75	-	-	100	4	100	175
	Consumer behavior	40	-	2	25	-	25	50	2	-	-	50	75
	Consumer behavior Lab	-	92	2	-	50	50	-	-	75	3	75	100
	Passport and Visa	30		1	25	-	25	50	2	-	-	50	75
CMEE5-106P	#Student Centre Activity	-	48	2	-	25	25	-	-	-	-	-	25
CMEE5-107P	+4–Week Industrial Training at the end of Semester and Major Project	-	-	4	-	-	-	-	-	100	4	100	100
	TOTAL	**168**	**364**	**25**	**150**	**275**	**425**	**225**	**-**	**525**	**-**	**800**	**1200**

SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, Industrial tour, environment, sports, hobby club, such as, photography, etc., seminars, declamation contest, educational field visits, NCC, NSS, cultural activities, etc.

+**Industrial Training**

Before completion of the semester, the students will go for training in a relevant industry/field organization for a minimum period of 4 weeks and prepare a diary. The student will prepare a report at the end of training. This report will be evaluated by the concerned instructor in the presence of one industry representative from the relevant trade/field.

Total weeks per semester: 16, Total working days per week: 5, Total Hours per day: 7, Total Hours in a semester: 16x5x7 = 560 One credit is defined as one hour of lecture per week or two Hours of practical per week in the programme.

GUIDELINESFOR ASSESSMENTOFSTUDENT CENTRED ACTIVITIES (SCA)

The maximum marks for SCA should be25. The marks may be distributed as follows:

i) 5 marks for general behavior and discipline
(By Principal or HOD in consultation with the instructor(s)/trainers)

ii) 5 marks for attendance as per following
(By the instructors/ trainers of the department)

a) Up to 75%	Nil
b) 75%to 80%	02 marks
c) 80%to 85%	03 marks
d) Above85%	05 marks

iii) 15 marks maximum for sports/ NCC/ NSS/Cultural/ Co-curricular activities as per following:
(By In-charge of Sports/ Cultural/NCC/NSS/Co-curricular activities) 15marks - for National level participation or inter-university competition 10 marks - participation any two of the activities
05 marks – participation at the internal sports of the institute/college/university Note: There should be no marks for attendance in the internal sessional of different subjects.

SALIENT FEATURES OF THE PROGRAMME

1	Sector	Airlines
2	Name of the Certificate Programme	Air Ticketing
3	Entry Qualification	Minimum 12th Standard pass in any Stream
4	Duration of Programme	Six months
5	Intake	30
6	Pattern of Programme	Semester Pattern
7	NSQF level	Level III
8	Ratio of Theory & Practice	30:70

Name of the Course	Certificate course in Air Ticketing
Duration of the Course	06 months
Eligibility for Admission	Minimum 12th Standard pass in any Stream
Industrial Training (Practical Training in Travel related organization using Air Ticketing Software Galileo, Amadeus. Training project report + Viva and presentation)	02 Months

***Required Faculty with knowledge of LINUX and the above software's**
****Required Airline Reservation Software: Galileo Airline Reservation System & Amadeus**

UNIT – I SUBJECT CODE: CMEE5-101 COMMUNICATION SKILLS	
Learning Outcomes: After undergoing this unit, the students will be able to: 1. Speak confidently. 2. Overcome communication barriers. 3. Write legibly and effectively. 4. Listen in proper prospective. 5. Read various genres adopting different reading techniques. Respond to telephone calls and e – mails effectively.	
Practical (24 Hours)	**Theory (08 Hours)**
	Basics of Communication • Process of communication • Types of communication-formal and informal, oral and written, verbal and non- verbal • Objectives of communication • Essentials of communication • Barriers to communication (1 hour)
• Looking up words in a dictionary (meaning and pronunciation) (2 Hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2 Hours)
• Self and peer introduction • Greetings for different occasions (1 Hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improve speaking • Manners and etiquettes (2 Hours)
• Newspaper reading (1 Hour)	Reading • Meaning • Techniques of reading: skimming, scanning, in tensive and extensive reading (1 Hour)
• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6 Hours)	Functional Vocabulary • One-word substitution • Commonly used words which are often misspelt • Punctuation • Idioms and phrases (2 Hours)
• Reading a loud articles and essays on current and social issues • Comprehension of short paragraph (5 Hours)	
• Write a short technical report • Letter writing (3 Hours)	
• Participate in oral discussion • Respond to telephonic calls and e - mails effectively • Mock interview (6 Hours)	

Means of Assessment

1. Assignments and quiz/class tests
2. Mid-term and end-term written tests
3. Laboratory and practical work

4. Viva-voce

<table>
<tr><td colspan="2">UNIT – II
SUBJECT CODE
INTRODUCTION TO AVIATION INDUSTRY</td></tr>
<tr><td colspan="2">Learning Outcomes:
After undergoing this unit, the students will be able to:
• Know basics of aviation industry.
• Understand about the techniques and methodologies used in Aviation Industry.
• Learn about the Safety and Security in Air Transportation.
• Understand the role of travel agents and approved travel agencies in managing tourist‘s experiences.</td></tr>
<tr><td>Practical (50 Hours)</td><td>Theory (20 Hours)</td></tr>
<tr><td></td><td>Introduction
• Evolution of Aviation
• Growth Drivers
• Issues and Challenges
• Commercial Aviation
• Airport Handling</td></tr>
<tr><td>• Introduction to aviation industry
• Issues and Challenges</td><td>Introduction to Airline Industry
• History of Airlines
• Regulatory bodies
• Navigation systems: Route Planning
• Safety and Security
• Training and Awareness</td></tr>
<tr><td>• Navigation Systems: route planning
• Regulatory bodies</td><td>Airline Terminal Management
• Domestic and International Formalities
• Check – in of hand baggages
• Personal Screening and frisking
• Ground announcements
• Ramp handling and safety procedure</td></tr>
<tr><td>• Safety and Security at airport
• Airport Terminals</td><td>Public Relations in Aviation Sector
• PR with Airport operators
• Good Qualities of PR
• Challenges
• Types and role of media handling
• Power of electronic media</td></tr>
<tr><td>• Domestic and International Departures
• Ground Announcements</td><td></td></tr>
<tr><td>• Baggage handling
• Delayed flights</td><td></td></tr>
<tr><td>• Ramp handling and safety
• Public Relation</td><td></td></tr>
<tr><td>• Good Qualities of PR
• Role of PR in Media handling
• Do’s and Don’ts in media handling</td><td></td></tr>
</table>

UNIT – III
SUBJECT CODE
COMPUTER APPLICTIONS IN AVIATION INDUSTRY

Learning Outcomes:
After undergoing this unit, the students will be able to:

- Have knowledge of Computer Application in Aviation industry.
- Prepare students to use app software to solve business problem & increase efficiency at airports.
- Understand of why computers are essential components of Aviation Industry.

Practical (60 Hours)	**Theory (30 Hours)**
	Introduction • Concepts on word processing • Templates • Formatting • Inserting • Printing
• Practical Knowledge of concepts of word processing • Templates • Formatting • Inserting • Printing	**Preparing presentations** • Basic Presentations • Design • Animation • Slideshow
• Basic Presentations • Design • Animation • Slideshow	**Spreadsheet and its Applications in Aviation Industry** • Spreadsheet concepts • Organizing Charts and graphs • Database, and Text functions
• Spreadsheet concepts • Organizing Charts and graphs • Database, and Text functions	**Creating Aviation Spreadsheet** • Payroll statements • Graphical representation of data • Frequency distribution and its statistical parameters
• Payroll statements • Graphical representation of data • Frequency distribution and its statistical parameters	

UNIT – IV SUBJECT CODE AIR TICKETING	
Learning Outcomes: After undergoing this unit, the students will be able to: • Construct fares to various traffic conferences • Demonstrate the ability to issue tickets • Apply the practical knowledge in the travel agency	
Practical (90 Hours)	**Theory (40 Hours)**
	Introduction • Various aviation terminologies • Fare calculations • Type of journey
• Knowledge of Air – fare calculation software Amadeus and Galileo • Types of Passengers • Coding and Decoding of Airport/Airline and Aircraft codes	**Reservation system in aviation sector** • Role of GDS and CRS • Type of CRS • Amadeus • Galileo • Encoding and decoding • Aircraft Real time tracking applications.
• Phonetic alphabets in Aviation Industry • Various types of journey • Various discounts available	**Airline Terminology** • Abbreviations used in airline • Different types of Tickets • Airline timetable
• Special fares calculated for different organizations of aviation sector • Aircraft Real time tracking applications.	**Air – fare Construction** • Special fares/ discounted fares • Types of passengers • Specified routing

UNIT – V SUBJECT CODE CONSUMER BEHAVIOR IN AVIATION INDUSTRY	
Learning Outcomes: After undergoing this unit, the students will be able to: • Have knowledge of Consumer behaviour in Aviation Industry. • Prepare students to deal with customers from different cultural and sub – cultural backgrounds. • Understand why consumers are essential components of Aviation Industry.	
Practical (92 Hours)	**Theory (40 Hours)**
	Consumer Behaviour • Types of consumers • Consumer decision making process • Factors affecting buying of air tickets
• Practical Knowledge of concepts of consumer, customer, buyer and seller • Factors affecting decision making of the consumer	**Consumer as an Individual** • Positive and Negative motivation • Needs Hierarchy • Personality theories
• How family and culture affect in decision making	**Consumer in Social and Cultural Settings** • Factors affecting reference groups, family groups • Decision making • Culture and Sub – Culture influence
• Opinion leadership process • Different levels of decision-making process	**Consumer Decision Making** • Opinion leadership process • Models of customer Decision making

UNIT – VI SUBJECT CODE PASSPORT AND VISA	
Learning Outcomes: After undergoing this unit, the students will be able to: • Have knowledge of the documents required in Aviation industry. • Prepare students to have knowledge about the various modes of payment in the Aviation Sector. • Understand the role of transportation in the Aviation Industry.	
Practical	**Theory** **(30 Hours)**
	Introduction • Types of Documents for domestic and international travel • Travel Insurance
	• Travel vouchers • Credit cards • Cash back offers • Mobile applications
	• Airport formalities • Local tourism services • Transportation and its Reservation
	• Accommodation and its types • Different types of reservations
	• Air Ticket rules: Cancellation, Deportation and Asylum • Liability of Airlines regarding above rules • Asylum and Deportation

SUBJECT CODE: CMEE5-107P

INDUSTRIAL TRAINING– I (4 Weeks)

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1. Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
2. Develop confidence amongst the students through first-hand experience to enable them to use and apply institute-based knowledge and skills to perform field activities.
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