Course Structure: As per the UGC guidelines, UG degree with honours in Mathematics includes core courses (CC), Ability Enhancement Compulsory Courses (AECC), Discipline Specific Elective (DSE), Generic Elective (GE), Skill Enhancement Courses (SEC) and Non Credit Courses (NCC). On the basis of these guidelines the course structure for B. Sc. (Hons.) Mathematics has been designed as detailed below:

Sem.	Course Type						Marks	Credits
	CC	DSE	GE	SEC	AECC	NCC		
I	2	--	1	--	1		500	20
II	2	--	1	--	1	1	600	21
III	3	1	1	--	--		600	30
IV	3	1	--	1	--		600	28
V	2	1	--	1	--		500	22
VI	2	1	1	--	--		400	24
Total	14	4	4	2	2		3200	145

1st Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-121	Calculus-I	CC-I	5	1	0	40	60	100	6
BMATS1-122	Algebra-I	CC-II	5	1	0	40	60	100	6
BHSMC0-042	English	AECC-I	2	0	0	40	60	100	2
BMATS1-123	Fundamentals of Computer and its Applications	GE-I	4	0	0	40	60	100	4
BMATS1-124	Software Lab (Fundamentals of Computer and its Applications)	GE-I Lab	0	0	4	60	40	100	2
	Total		**16**	**2**	**4**	**220**	**280**	**500**	**20**

2nd Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-221	Calculus-II	CC-III	5	1	0	40	60	100	6
BMATS1-222	Algebra-II	CC-IV	5	1	0	40	60	100	6
BHSMC0-041	Environmental Science	AECC-II	3	0	0	40	60	100	3
BMNCC0-041	Drug abuse: problem, management and prevention	NCC-I	2	0	0	100	---	100	0
BMATS1-223	C Programming	GE-II	4	0	0	40	60	100	4
BMATS1-224	C Programming Lab.	GE-II Lab	0	0	4	60	40	100	2
	Total		**19**	**2**	**4**	**320**	**280**	**600**	**21**

3rd Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-321	Differential Equations-I	CC-V	5	1	0	40	60	100	6
BMATS1-322	Analysis-I	CC-VI	5	1	0	40	60	100	6
BMATS1-323	Number Theory	CC-VII	5	1	0	40	60	100	6
BMATS1-324	Analytical Geometry	DSE-I	5	1	0	40	60	100	6
BMATS1-325	Object Oriented Programming Language using C++	GE-III	4	0	0	40	60	100	4
BMATS1-326	Object Oriented Programming Lab.	GE-III Lab	0	0	4	60	40	100	2
	Total		**24**	**4**	**4**	**260**	**340**	**600**	**30**

4th Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-421	Differential Equations-II	CC-VIII	5	1	0	40	60	100	6
BMATS1-422	Analysis-II	CC-IX	5	1	0	40	60	100	6
BMATS1-423	Numerical Methods	CC-X	5	1	0	40	60	100	6
BMATS1-424	Theory of Probability	DSE-II	5	1	0	40	60	100	6
BMATS1-425	Programming with Python	SEC-I	3	0	0	40	60	100	3
BMATS1-426	Software Lab (Programming with Python)	SEC-I Lab	0	0	2	60	40	100	1
	Total		**23**	**4**	**2**	**260**	**340**	**600**	**28**

5th Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-521	Linear Algebra	CC-XI	5	1	0	40	60	100	6
BMATS1-522	Differential Geometry	CC-XII	5	1	0	40	60	100	6
BMATS1-523	Mechanics	DSE-III	5	1	0	40	60	100	6
BMATS1-524	MATLAB	SEC-II	3	0	0	40	60	100	3
BMATS1-525	MATLAB Lab.	SEC-II Lab	0	0	2	60	40	100	1
	Total		**18**	**3**	**2**	**220**	**280**	**500**	**22**

6th Semester			Contact Hrs.			Marks			Credits
Subject Code	Subject	Course Type	L	T	P	Internal	External	Total	
BMATS1-621	Complex Analysis	CC-XIII	5	1	0	40	60	100	6
BMATS1-622	Discrete Mathematics	CC-XIV	5	1	0	40	60	100	6
BMATS1-623	Linear Programming and Optimization	DSE-IV	5	1	0	40	60	100	6
BMATS1-624	Mathematical Methods	GE-IV	5	1	0	40	60	100	6
	Total		**20**	**4**	**0**	**160**	**240**	**400**	**24**

Calculus-I

Subject Code- BMATS1-121	L	T	P	C	Total Hours: 90
	5	1	0	6	

Course Objectives

To make students familiar with basic concepts of limit and continuity, Differentiability and differentials, Successive differentiation, Derivatives of higher order, Partial derivatives of higher order, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative.

Course Outcomes

Students will be able to:

1. Apply the knowledge of basic concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
2. Develop the skills to sketch the curves in a plane using its mathematical properties in the different coordinate systems of reference.
3. Apply derivatives for the computation of directional derivative and Optimization.
4. Extend the knowledge of Partial derivatives of higher order for further exploration of the subject for going into higher education.

UNIT-I (23 Hours)

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

UNIT-II (22 Hours)

Concavity, Convexity, Points of inflexion, Increasing and decreasing function, Asymptotes, Polar curves, Multiple points, Tracing of Cartesian curves, Idea of some well-known parametric and polar curves, Curvature of a curve at a point, Radius of curvature for Cartesian, Parametric, Polar forms, Centre of curvature.

UNIT-III (22 Hours)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

UNIT-IV (23 Hours)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function z= f (x, y), Lagrange's method of undetermined multipliers, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative.

Recommended Books:

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint **2007**, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, Prentice Hall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, **2000**.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, **2006**.

Algebra-I

Subject Code- BMATS1-122 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives

Define and interpret the concepts of basic algebra, Introduction of Group, Normal subgroups, Quotient subgroups, homomorphism, isomorphism permutation group and its properties.

Course Outcomes

Students will be able to:

1. Understand the concept of groups and its properties.
2. Analyze& demonstrate different types of algebraic structures such as subgroups Normal subgroups and Quotient groups to understand and use the fundamental results in Algebra.
3. Apply the concepts of isomorphism and homomorphism for groups to solve different types of problems.
4. Access the idea of counting subgroups and analyse all groups to relate with one special group.

UNIT-I (25 Hours)

Definition of a group, its examples and simple properties, Abelian group, Groups of transformations, Subgroups, Generation of groups and cyclic groups, Order of group.

UNIT-II (22 Hours)

Coset decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems. Normal subgroup, Quotient group.

UNIT-III (22 Hours)

Homomorphism, theorems on homomorphisms, Isomorphism, Automorphism, theorems on isomorphisms, Freshmen's theorem.

UNIT-IV (21 Hours)

Direct products, Permutation of group, Even and Odd permutation, alternative group, Cayley theorem, Sylow's theorems (including proofs) and its applications.

Recommended books:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, **2002**.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, **2011**.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, **1999**.
4. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004**.
5. Surjeet Singh and Qazi Zameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993**.
6. Herstein, I.N., 'Topics in Algebra.'2 nd Ed, Vikas Publishing House, **1976**.

ENGLISH

Subject Code: BHSMC0-042 **L T P C** **Total Hours: 30**
2 0 0 2

UNIT-I (8 Hours)

Communication Skills: Introduction, Definition, the Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

UNIT-II (7 Hours)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

UNIT-III (7 Hours)

Communication Styles: Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

UNIT-IV (8 Hours)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview

Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Recommended Books:

1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education,**2011**.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press,**2011**.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson,**2013**.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life,**2011**.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquettefor Success', 5th Edition, Pearson,**2013**.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,**2010**.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI,**2011**.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press,**2011**.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., **2011**.
10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw HillEducation, **2011**.
11. John A., 'Effective Communication', 4th Edition, Pan MacMillan, **2009**.
12. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,**1999**

Fundamentals of Computer and its Applications

Subject Code- BMATS1-123 **L T P C** **Total Hours: 60**

4 0 0 4

Course Outcomes

Students will be able to

1. Learning the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
2. Understanding the concept of input and output devices of Computer
3. Learning concepts of Operating system and its types.
4. Gaining knowledge about various MS Office services like Word, Excel and PowerPoint.

UNIT-I (15 hours)

Functional Units of Computer System: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.
Number System: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.

UNIT II (15 hours)

Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, barcode reader, web camera, monitor, printer, plotter.
Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks, concept of compiler and interpreter.

UNIT – III (15 hours)

Operating System: Batch, multiprogramming, time sharing, network operating system, on-line and real time operating system, Distributed operating system, multi-processor, Multi-tasking.

Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

UNIT IV (14 hours)

Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.
Presentation Graphics Software: Templates, views, formatting slides, slides with graphs, animation, using special features, presenting slide shows.

Recommended Books:

1. V. Rajaraman, 'Fundamentals of Computers', 5 th Edn., PHI, 2010.
2. Satish Jain, 'Information Technology Concepts', 4 th Edn., BPB Publications, 2006.
3. Turban, Mclean and Wetherbe, 'Information Technology for Management', 4 th Edn John Wiley & Sons, 2006.
4. Courter G, 'Mastering MS Office 2000 Professional', 3 rd Edn., BPB Publication, 2006.

Software Lab (Fundamentals of Computer and its Applications)

Subject Code- BMATS1-124 **L T P C** **Total Hours : 60**

0 0 4 2

Course Outcomes

Students will be able to

1. Learning the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
2. Understanding the concept of input and output devices of Computer
3. Learning concepts of Operating system and its types.
4. Gaining knowledge about various MS Office services like Word, Excel and PowerPoint.

List of following programs are as follows:

1. Familiarizing with PC and WINDOWS commands,
2. Learning file creation commands.
3. To learn to set up an email account and send and receive emails.
4. Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint.
5. Using MS-WORD Tools to create Resume.
6. Implementation of various powerpoint presentations tools.
7. Performing various excel operations.
8. Create envelopes inserting your merge fields for the recipient's name and address. Save the merged envelopes as Mail Merge Envelopes.

Recommended Books

1. V. Rajaraman, 'Fundamentals of Computers', 5 th Edn., PHI, 2010.
2. Satish Jain, 'Information Technology Concepts', 4 th Edn., BPB Publications, 2006.
3. Turban, Mclean and Wetherbe, 'Information Technology for Management', 4 th EdnJohn Wiley & Sons, 2006.
4. Courter G, 'Mastering MS Office 2000 Professional', 3 rd Edn., BPB Publication, 2006.

Calculus-II

Subject Code- BMATS1-221 **L T P C** **Total Hours: 90**

5 1 0 6

Course Objectives

To Introduce the Concepts of Areas under curves, Volume and surfaces of revolution of curves, Definite integrals, double integrals and Green, Gauss and Stokes Theorems.

Course Outcomes

Students will be able to:

1. Apply the knowledge of advanced concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
2. Use the idea of reduction formulae enables to solve an integral problem by reducing it to a problem of solving an easier integral problem.
3. Develop the knowledge of computing the area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.
4. Extend the knowledge of scalar surface integrals, vector surface integrals, theorems of Green, Gauss and Stokes for exploring its use in physical sciences.

UNIT-I (22 hours)

Arc formula for the Cartesian equation y=f(x), Other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves, Area of the surface obtained by revolving the curve about axes.

UNIT-II (23 hours)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations, Reduction formulae for integral of the form $\int_0^{\frac{\pi}{2}} \sin^n\theta d\theta$, $\int_0^{\frac{\pi}{2}} \cos^n\theta d\theta$, $\int_0^{\frac{\pi}{2}} \sin^m\theta\cos^n\theta d\theta$.

UNIT-III (22 hours)

Improper Integral and special function- Beta and Gamma functions and their properties.

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity.

UNIT-IV (23 hours)

Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds, Scalar line integrals, Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stokes.

Recommended Books:

1. G.B. Thomas and R.L. Finney: Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, **2002.**
2. T. Veerarajan: Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, **2008**.
3. B. V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, **2010.**
4. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 35th Edition, **2000**.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, **2006**.

Algebra-II

Subject Code- BMATS1-222

L	T	P	C
5	1	0	6

Total Hours: 90

Course Objectives

To Introduce the Concepts of Ring, Ideals, Ring Homomorphism, Integral domain, Division rings , Fields , Inner Product spaces and their properties .

Course Outcomes

Students will be able to:

1. Understand the concept of Rings, Fields and their properties.
2. Analyze & demonstrate different types of algebraic structures such as sub rings, Ideals and Quotient rings to understand and use the fundamental results in Algebra.
3. Apply the concepts of isomorphism and homomorphism for rings to solve different types of problems.
4. Access the idea of inner product space and determine it's orthogonally on vector space, including gram – schmidth orthogonalisation to obtain orthonormal basis.

UNIT-I (21 hours)

Definition and examples of a ring, Its properties, Integral domains, Characteristics of ring, Division rings and Fields.

UNIT-II (21 hours)

Sub-rings, Ideals and Quotient rings, Ring homomorphism, isomorphism and related theorems.

UNIT-III (24 hours)

Field of quotients, polynomial rings, Euclidean ideal domain, Euclidean domain, definition of fields and its properties, subfield.

UNIT-IV(24 hours)

Inner product, Length, Inner product spaces, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram Schmidt orthogonalisation process.

Recommended books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004.**
2. Surjeet Singh and Qazi Zameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi, **1993.**
3. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, **1976.**
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, **2002**.
5. M. Artin, Abstract Algebra, 2nd Ed., Pearson, **2011.**
6. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, **1999**.
7. George E Andrews, Number Theory, Hindustan Publishing Corporation, **1984**.
8. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, **2005**.

ENVIRONMENTAL SCIENCES

Subject Code: BHSMC0-041 **L T P C** **Total Hours: 45**
3 0 0 3

Unit-I (08 Hours)

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

Unit-II (15 Hours)

Natural resources and associated problems
a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-III (12 Hours)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) (d) Desert ecosystem (e) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- IV (10 Hours)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. **2001** Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Map in Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., **1989**, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution , Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani , E & Hepworth, M.T. **2001**, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BMNCC0-041 **L T P C** **Time Allowed: 30 Hrs.**
2 0 0 0

Unit-I (06 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

Unit-II (08 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

Unit-III (08 Hours)

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 (10 Hours)

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 (Latest edition):

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills,1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi,1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books,1982.
6. IshwarModi and ShaliniModi, 'Addiction and Prevention', RawatPublications,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. 1
14. 'World Drug Report', United Nations Office of Drug and Crime,2016.
15. 'World Drug Report', United Nations Office of Drug and Crime,2017.

C Programming

Subject Code- BMATS1-223

L	T	P	C	Total Hours:60
4	0	0	4	

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C language (structured programming).

Course Outcomes

1. Understand the fundamentals of C programming.
2. Students should be able to write algorithms for solving various real life problems.
3. Ability to implement fundamental data structures in C.
4. Implement different operations on functions & files.

UNIT-I (16 hours)

C programming: Introduction to C language, Evolution and characteristics of C language, Character set, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions, Type conversion and type casting, Overview of pre-processors, Structure of a C program, Input and output statements

UNIT-II (16 hours)

Control Statements: Basic programming constructs, 'if', 'if-else', 'nested-if' statements, Conditional operator, 'for', 'while', 'do - while', Switch, Break, Continue.

UNIT-III (15 hours)

Arrays and strings need for an array, Declaration and initialization, Basic operation on arrays, Multidimensional array, Structures, Union, Introduction to strings, String handling, Pointers Introduction, Declaration and initialization, Pointers and arrays: Similarities and advantages/disadvantages of using pointers.

UNIT-IV (14 hours)

Functions and Storage classes need for functions, Prototype, Function definition, Function call, Return type and Return statement, Passing arguments, Functions and arrays, Functions and pointers, Recursive functions, Difference between recursion and iteration storage classes, Files Introduction, File Operations, Character I/O, String I/O, Numeric I/O, Formatted I/O, Block I/O.

Recommended Books

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.UNIT-II (8 Hrs.) C programming:
4. P.K Sinha, 'Computer Fundamental', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language', 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', Edn', Khanna Book Publishing.

C Programming Lab

Subject Code- BMATS1-224

L	T	P	C	Total Hours:60
0	0	4	2	

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C language (structured programming).

Course Outcomes

1. Understand the fundamentals of C programming.
2. Students should be able to write algorithms for solving various real life problems.

3. Ability to implement fundamental data structures in C.
4. Implement different operations on functions & files.

List of following programs are as follows:

1. Operators: Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, go to
3. Loops: while, do-while, for
4. Functions: Definition, Declaration, Call by value, Call by reference, Recursive Function
5. Arrays: Arrays declarations, Single and multi-dimensional, Strings and string functions
6. Pointers: Pointer declarations, Pointer to function, Pointer to array.

Recommended Books

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3 rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn.', BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, NewDelhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

Differential Equations– I

Subject Code- BMATS1-321 | **L** 5 | **T** 1 | **P** 0 | **C** 6 | **Total Hours: 90**

Course Objectives

To introduce the theoretical concepts of ordinary and partial differential equations.

Course Outcomes

Students will be able to:

1. Understand the concept of ordinary differential equation, formation and order and degree of differential equation etc.
2. Apply various methods to Solve first order non-linear differential equation and linear differential equations of higher order .
3. Apply various power series methods to find series solution of differential equations.
4. Apply differential equations to significant applied and theoretical problems.

UNIT-I (25 hours)

Elementary Methods in Ordinary Differential Equation : Degree and order of a differential equation, Formation of a differential equation, General, particular, and singular solutions , Equations of first order and first degree, Equations in which the variable are separable, Homogeneous equations, Linear equations and equations reducible to linear form, First order exact equations and integrating factors.

UNIT-II (23 hours)

First order higher degree equations solvable for x, y, p, Clairaut's form and singular solutions, Linear differential equations with constant coefficients, method of variation of parameters, method of undetermined coefficients.

UNIT-III (21 hours)

Homogeneous Linear differential equation with variable coefficients: Cauchy Linear equation and Legendre linear equation. Differential Operator method: Linear dependent, Independent, Wronskian, Operator method for linear system with constant coefficients.

UNIT-IV (21 hours)

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Series solutions of Bessel equation and Legendre equation, Bessel function and their Integral expression & recurrence relations, Legendre Polynomials , Rodrigues's formula, Recurrence relations, Generating

functions and Orthogonal properties.

Recommended books:

1. W.E.Boyce and P.C.Diprima : Elementary Differential Equations and Boundary value problems, John Wiley, **1986.**
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,**1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, **2011**.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, **1989**.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, **2002**.

Analysis-I

Subject Code- BMATS1-322 | **L** | **T** | **P** | **C** | **Total Hours : 90**

5	**1**	**0**	**6**	

Course Objectives

To Introduce the Concepts and to Develop Working Knowledge of Sets and Functions, Binary and decimal representation of real numbers, Infinite series, Continuous functions, uniform continuity, Differentiability and Derivatives of real functions.

Course Outcomes

Students will be able to

1. Understand many properties of the real line $\mathbb{R}$, including completeness and Archimedean properties
2. Apply the ratio, root, and alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
3. Understand the concept of continuous functions, uniform continuity and discontinuity
4. Apply mean value theorem, Taylor's theorem

UNIT-I (23 hours)

Real Numbers

Preliminaries: Sets and Functions, Mathematical induction, Finite and infinite sets. Algebraic and order properties of R, Absolute value and the real line, Completeness property of R, Applications of supremum property, Archimedean property, Density of rational numbers in R, Intervals- Characterization theorem, Nested intervals, Nested interval property, The uncountability of R, Binary and decimal representation of real numbers.

UNIT-II (21 hours)

Sequences of Real Numbers

A sequence in R, The limit of a sequence, Convergence of a sequence, Uniqueness of limits, Limit theorems, Monotone sequence, Euler's number, Subsequence, Divergent criteria, Monotone subsequence theorem, Bolzano-Weierstrass theorem, Cauchy sequence, Cauchy convergence criterion, Properties of divergent sequences.

UNIT-III (22 hours)

Infinite Series

Infinite Series, Convergence of infinite series, The nth term test, Cauchy criterion for series, The harmonic series, P- series, Comparison test.

Absolute convergence, Tests for absolute convergence- The root test, The ratio test, The integral test, The Rabbe's test, Logarithmic test, Gauss test, Alternating series, Leibnitz test, Dirichlet test, Abel's test.

UNIT-IV (24 hours)

Limits and Continuity of Functions

Limits and Continuity of functions, Cluster point of a subset of R, Limit of a function at a cluster point of a set, Sequential criterion for the limits, Divergence criterion, Limit theorems, Squeeze theorem, Infinite limits.

Continuous functions, Sequential criterion of continuity, Discontinuity criterion, Combinations of continuous functions- sum, Difference, Product and quotient and compositions. Continuous functions on intervals,

Boundedness theorem, Maximum-Minimum theorem, Bolzano's Intermediate value theorem, Preservation of intervals theorem.

Uniform continuity, Non-uniform continuity criteria, Uniform continuity theorem, Lipschitz functions, Continuous Extension theorem, Approximations of continuous functions by step functions and by piecewise linear functions, Weierstrass Approximation theorem.

Recommended Books:

1. ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc.**2000**.
2. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, **1976**.
3. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint **2008**.
4. T.M. Apostol, Mathematical Analysis, 2/e, Narosa Publishing House, Reprint **2002**.

Number Theory

Subject Code- BMATS1-323 | **L T P C** | **Total Hours: 90**

5 1 0 6

Course Objectives

To introduce the concept of Division algorithm, Euclid's algorithm, Modular arithmetic, Arithmetic modulo p, Greatest integer function.

Course Outcomes

Students will be able to:

1. Find quotients and remainders from integer division, Division algorithm, Apply Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers
2. Learn about congruence, residue classes and least residues add and subtract integers, modulo n, multiply integers and calculate powers, modulo n, Simultaneous linear congruence's
3. Familiarise with Arithmetic modulo p and related theorems, Solving congruences modulo prime powers.
4. Learn about Euler's Phi function, Euler's theorem and properties of the Phi Function

UNIT-I (25 hours)

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

UNIT-II (23 hours)

Modular arithmetic, Basic properties of congruence's, linear congruence's, Simultaneous linear congruence's, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

UNIT-III (23 hours)

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

UNIT-IV (19 hours)

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

Recommended Books:

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, 'Introduction to Analytic Number Theory', Springer.
4. Paul T. Bateman, 'Analytic Number Theory', World scientific.
5. H. Rosen Kenneth, 'Elementary Number Theory', 6th Edn.
6. G.H. Hardy, 'An Introduction to the Theory of Numbers', 6th Edn.

Analytical Geometry

Subject Code- BMATS1-324 | **L** 5 | **T** 1 | **P** 0 | **C** 6 | **Total Hours: 90**

Course Objectives

Define and interpret the concepts of Transformation of axes, cone, sphere and cylinder.

Course Outcomes

Students will be able to:

1. Understand the relationship between different coordinate systems, transformation of axes and intersection of three planes.
2. Apply the knowledge to obtain the equation of cone, enveloping cone, tangent plane, reciprocal cone of given cone and prove their results.
3. Develop the equation of cylinder, right circular cylinder, enveloping cylinder.
4. Introduce the family of spheres passing through a circle, tangent planes and normal lines to a sphere and radical planes.

UNIT-I (21 hours)

Transformation of axes, Shifting of origin, Rotation of axes, Reduction of the second degree equation into standard forms by transformation of co-ordinates, Intersection of three planes, Condition for three planes to intersect in a point or along a line or to form a prism.

UNIT-II (23 hours)

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z, Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, Right circular and elliptic cones.

UNIT-III (24 hours)

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms.

UNIT-IV (22 hours)

Sphere, Section of a sphere by a plane, Spheres of a given circle, Intersection of a line and a sphere, Tangent line, Tangent plane, Power of a point w.r.t. a sphere, Radical planes.

Recommended Books

1. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
2. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry

Object Oriented Programming Language Using C++

Subject Code- BMATS1-325 | **L** 4 | **T** 0 | **P** 0 | **C** 4 | **Total Hours: 60**

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C++ language (structured programming).

Course Outcomes

1. Ability to implement programs using C++.
2. Identify classes, objects, member of class , and the relationships among them needed to solve a specific problem.
3. Understand the concept of inheritance.
4. Demonstrate the concept of polymorphism and operator overloading and file operations.

UNIT- I (13 Hrs.)

Characteristics of Object Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types. Introduction to C++: Identifier, Keywords, Constants, And Operators: Arithmetic, relational, logical, And conditional and assignment. size of operator, Operator precedence and associativity.

UNIT- II (15 Hrs.)

Classes and Objects: Class Declaration and Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. this pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member functions.

Constructors and Destructor: properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes, Virtual destructors. Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes.

UNIT- III (16 Hrs.)

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class. Types of Inheritance: Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability.

UNIT- IV (16 Hrs.)

Polymorphism and Operator Overloading: Methods of achieving polymorphic behavior. Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class. Introduction to File Handling.

Recommended Books:

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill.
2. Deitel and Deitel, 'C++ How to Program', Pearson Education.
3. Herbert Schildt, 'The Complete Reference C++', Tata McGraw Hill.
4. Robert Lafore, 'Object Oriented Programming in C++', Galgotia Publications.
5. Bjarne Strautrup, 'The C++ Programming Language', Addition-Wesley Publication Co.
6. Stanley B. Lippman, JoseeLajoie, 'C++ Primer', Pearson Education, **2002.**

Object Oriented Programming Lab

Subject Code- BMATS1-326	L	T	P	C	Total Hours: 60
	0	0	4	2	

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C++ language (structured programming).

Course Outcomes

1. Ability to implement programs using C++.
2. Identify classes, objects, member of class , and the relationships among them needed to solve a specific problem.
3. Understand the concept of inheritance.
4. Demonstrate the concept of polymorphism and operator overloading and file operations.

List of Programmes:

1. Introduction to C++: Identifier, Keywords, Constants.
2. Operators: Arithmetic, relational, logical, And conditional and assignment. size of operator

3. Classes and objects: Class Declaration and Definition, Defining member functions
4. Constructors and Destructor**:** types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes, Virtual destructors.
5. Inheritance: Access Specifiers, Types of inheritance
6. Operator Overloading: overloading binary operator, overloading unary operators
7. Polymorphism: virtual functions, late binding, pure virtual functions and abstract base class
8. File Handling: Implement various file HANDLING operations.

Operational Knowledge and Implementation of numerical methods & statistical Techniques using C++ Language.

Differential Equations– II

Subject Code- BMATS1-421 **L T P C** **Total Hours: 90**
5 1 0 6

Course Objectives

To introduce the theoretical concepts of partial differential equations, Classification of linear partial differential equations of second order, Boundary-value problems.

Course Outcomes

Students will be able to :

1. Understand the concept of partial differential equation of first order (linear and nonlinear).
2. Solve partial differential equations (linear and nonlinear) using various methods and apply these methods in solving some physical problems.
3. Understand the formation and solution of some significant PDEs like wave equation, heat equation and diffusion equation
4. Undertake any advanced course on ordinary as well as partial differential equations

UNIT-I (22 hours)

Formation of partial differential equations, PDEs of the first order, Lagrange's method, determination of integral surfaces of linear first order partial differential equations passing through a given curve, surfaces orthogonal to given system of surfaces, non-linear PDE of first order, Cauchy's method of characteristic.

UNIT-II (21 hours)

Compatible system of first order PDE, Charpit's and Jacobi's general method of solution, Classification of linear partial differential equations of second order.

UNIT-III (24 hours)

Homogeneous and non- homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Characteristic curves of the second order PDE, Monge's method of solution of non-linear PDE of second order.

UNIT-IV (23 hours)

Method of Solution: Separation of variables in a PDE, Laplace, wave and diffusion equations, Elementary solutions of Laplace equations.

Recommended books:

1. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
2. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, **2011**
3. Elements of Partial Differential Equation (3rd edition) – I. N. Sneddon, McGraw Hill Book Company, **1998**.
4. Partial Differential Equations (2nd edition) – E. T. Copson, Cambridge University Press, **1995**.
5. J.N. Sharma and K. Singh, Partial differential equations for engineers and scientists, 2nd Edition, Narosa Publication House, New Delhi, **2009**

Analysis-II

Subject Code- BMATS1-422 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives

To work comfortably with Differentiation, Reimann Integral , Sequences of Functions , Series of functions

Course Outcomes:

Students will be able to:

1. Apply Mean Value theorem, Rolle's Theorem in real life problems
2. Understand Properties of Riemann Integral and various theorems of Riemann integral.
3. know the sequences of functions and their Convergence.
4. Series of functions.

UNIT-I (24 hours)

Differentiation

Differentiability and Derivatives of real functions, Differentiability and Continuity, Basic properties of the derivatives, Caratheodory theorem, Chain rule, Inverse functions and their derivatives, Rolle's theorem, Mean Value theorem, Applications of mean value theorem, Intermediate value property of derivatives, Darboux's theorem, Indeterminate forms, L'hospital rules, Taylor's theorem, Applications of Taylor's theorem.

UNIT-II (23 hours)

Riemann Integral

Riemann Integral Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem, Lebesgue's integrability criterion, Composition theorem, Product theorem, Approximate integration, The trapezoidal rule, Simpson's rule.

UNIT-III (21 hours)

Sequences of Functions

Sequences of Functions Point wise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic functions, trigonometric functions.

UNIT-IV (22 hours)

Series of Functions

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weierstrass M-test, Power series, Radius of convergence, Cauchy hadamard theorem, Term by term differentiation, Taylor's series.

Recommended Books:

1. ROBERT G. Bartle and Donald R. Sherbert , Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
2. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, **1976**.
3. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint **2008**.
4. S. Shirali & H.L. Vasudeva, Metric Spaces, Springer, **2006**.
5. T.M. Apostol, Mathematical Analysis, 2/e, Narosa Publishing House, Reprint **2002**.

Numerical Methods

Subject Code- BMATS1-423 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives

Construction and use of numerical systems, Influence of data representation and computer architectures on algorithms choice and development, use numerical methods for solving a problem, locate and use good mathematical software, get the accuracy you need from the computer, assess the reliability of the numerical results, and determine the effect of round off error or loss of significance.

Course Outcomes

Students will be able to

1. Learn various types of numerical methods to find the roots of nonlinear equations and solution of a system of

linear equations.

2. Find values for a tabulated function using Interpolation techniques.
3. Apply these numerical methods to solve ordinary differential equation.
4. Introduce the basic concepts of Numerical Mathematics to solve the problems arising in science and engineering etc.

UNIT-I (24 hours)

Solution of Non Linear equations: Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton raphson method, Secant method.

Solution of simultaneous equations: Gauss Elimination, Gauss Jordan , LU decomposition, Gauss Jacobi, Gauss-Siedel and Rayleigh's power method.

UNIT-II (23 hours)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae, Newton divided difference formula, Central differences, Hermite interpolation.

UNIT-III (21 hours)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's $1/3^{rd}$ and $3/8^{th}$ formula, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration.

UNIT-IV (22 hours)

Solution of Ordinary differential equation: Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India**, 2007**.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, **2007**.
3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, **1980.**
4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., **2001.**

Theory of Probability

Subject Code- BMATS1-424 | **L T P C** = **5 1 0 6** | **Total Hours: 90**

Course Objectives

To introduce the concept of random variables, distribution functions, various probability distributions, and concepts in testing of statistical hypotheses.

Course Outcomes

Students will be able to

1. Understand and use the concept of probability theory and statistics to solve industrial problems
2. Define and examine the random sampling and graphical methods with technology
3. Recognize and compute the sampling distributions, sampling distributions of means and variances (S2) and the t and F-distributions
4. Recognize the relationship between the confidence interval estimation and tests of hypothesis.

UNIT-I (22 hours)

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Independent events, mutually and pair wise independent events, Baye's theorem, problems Bayes theorem,

UNIT-II (23 hours)

Concept of real random variable one dimensional (discrete and continuous), function of random variable and their distributions, probability mass function, probability density function, cumulative distribution function, Expectation and moments, moment generating function and its properties.

UNIT-III (23 hours)

Study of various discrete and continuous distributions: Binomial Distribution, Poisson Distribution, Poisson approximation to the binomial distribution, Normal Distribution.

UNIT-IV (22 hours)

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

Recommended Books:

1. R.V. Hogg & Craige , 'Introduction to Mathematical Statistics', 7th Edn.,**2005**
2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, **1990**.
3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, **1975**.
4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', **2009**.
5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, **1975**.

Programming with Python

Subject Code- BMATS1-425 **L T P C** **Total Hours: 45**

3 0 0 3

Course Outcomes

Students will be able to:

1. To learn and understand Python programming basics and paradigm.
2. Understand python loops, Control statements and string manipulations.
3. Design user defined functions, modules, and packages.
4. Learn Object Oriented Programming Concepts.

UNIT-I (10 hours)

Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python Structure of a Python Program, Python Statement, Indentation, Documentation

Elements of Python: Keywords, Identifiers, Operators, Precedence and associativity of operators, Variables, Expressions and assignment statements, Data Types, Python Input and Output Functions, Import command.

UNIT-II (12 hours)

Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Strings.

Control Structures: Decision making statements, Python loops, Python control statements.

UNIT-III (13 hours)

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Standard Modules.

UNIT-IV (10 hours)

Objects and Their Use: Introduction to Object Oriented Programming, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes.

Recommended books:

1. Martin C. Brown ,Python The complete Reference, Mc Graw Hill Education,2018.
2. Hamilton, Naomi. "The A-Z of Programming Languages: Python",2008.
3. Downey, Allen B. Think Python: How to Think Like a Computer Scientist (Version 1.6.6 Ed.),2012.
4. Pilgrim, Mark Dive into Python 3. Apress, 2009.

Software Lab (Programming with Python)

Subject Code- BMATS1-426 | **L T P C** | **Total Hours: 30**
0 0 2 1

Course Outcomes
Students will be able to:

1. To learn and understand Python programming basics and paradigm.
2. Understand python looping, control statements and string manipulations.
3. Design user defined functions, modules, and packages.
4. Learn Object Oriented Programming Concepts.

List of following programs are as follows:

1. Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2. Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3. Write a program to determine whether a triangle is isosceles or not?
4. Print multiplication table of a number input by the user.
5. Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13.....n
6. Compute the factorial of a given number.
7. Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete the entire list.
8. Design a Python class named Rectangle, constructed by a length & width, also design a method which will compute the area of a rectangle.

Recommended books:

1. Martin C. Brown ,Python The complete Reference, Mc Graw Hill Education,2018.
2. Hamilton, Naomi. "The A-Z of Programming Languages: Python",2008.
3. Downey, Allen B. Think Python: How to Think Like a Computer Scientist (Version 1.6.6 Ed.),2012.
4. Pilgrim, Mark Dive into Python 3. Apress,2009.

Linear Algebra

Subject Code- BMATS1- 521 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives

To introduce the theoretical concepts linear transformations, Range, Null space, Eigen values and Eigen vectors, Invertibility and Isomorphisms.

Course Outcomes

Students will be able to :

1. Understand the basic concepts of linear transformations, the Rank-Nullity Theorem, matrix of a linear transformation, algebra of transformations and the change of basis.
2. Analyze & solve problems related to Matrices, Quotient space, Homomorphism & Isomorphism of vector space and Null space etc.
3. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
4. Find eigenvalues and corresponding eigenvectors for a square matrix.

UNIT-I (23 hours)

Binary space, Definition of group, Ring and field, Vector space, Subspace, Linear combination, Linear span, Dimension of vector space, Direct sum of spaces, Quotient space.

UNIT-II (23 hours)

Linear Transformation, Null space, Range space, Rank nullity theorem, Product of linear transformation,,

Representation of linear transformations by matrices, Change of basis, Singular and non singular transformation ,Isomorphism of vector space, Canonical forms, Jordan forms, Triangular forms ,Dual space.

UNIT-III (23 hours)

Matrices, Row and Column Space of Matrix, Row reduction and echelon forms, Rank, Systems of linear equations, Determinants and their properties, Cramer's rule, Vector equations, The matrix equation AX = B, Solution sets of linear systems (Homogeneous & Non homogeneous), Applications of linear systems.

UNIT-IV (21 hours)

Eigen value & Eigen vectors of linear transformation ,Characteristic polynomial, Characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Minimal polynomial, Diagonalization, Linear transformations.

Recommended Books:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, **2004**.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, **2007.**
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, **2005**.
4. Gilbert Strang, Linear Algebra and its Applications, Thomson, **2007**.
5. Marc Lipson and Seymour Lipschutz , SCHAUM'S outlines Linear Algebra Fourth Edition Schaum's Outline Series, **1968** by The McGraw-Hill Companies

DIFFERENTIAL GEOMETRY

Sub. Code: BMATS1-522 | **L T P C** | **Total Hours: 90**

5 1 0 6

Course Objectives: The course aims to introduce space curves and their intrinsic properties of a surface and geodesics. Further the non-intrinsic properties of surfaces are explored.

Course Outcomes:

1. Students will be at ease to understand the various curves in space
2. Students will be able to understand the behavior of the curves in various Situations.
3. Students will be able to understand the Concept of surface
4. Students will be able to understand geodesics.

UNIT-I (21 Hrs.)

Curves in Space: Space curves, Path, Arc length, Tangent line, Contact of nth order of a curve and surface, Plane of curvature, Tangent plane at any point of the surface f(x ,y , z)=0.The Principal normal and bi-normal, Definitions of curvature, Torsion and screw- curvature, Serret -Fernet Formulae, To find curvature and torsion of curve, Helices.

UNIT-II (22 Hrs.)

Intrinsic equations, Fundamental theorems for space curves, the circle of curvature, Osculating sphere, Behaviour of curve in the neighborhood of a point, Involute and Evolute.

UNIT-III (23 Hrs.)

Concept of a Surface and Fundamental Forms: Concept and Definition of a surface, Curvilinear equations of the curve on the surface, Parametric curves, Tangent plane and normal, First and Second Fundamental Form, Derivatives of N, Weingarton equations, Angle between parametric curves, Direction coefficients, Angle between any two intersecting curves on the surface.

UNIT-IV (24 Hrs.)

Geodesics: Geodesics, Differential equation of geodesics, Normal property of geodesics, Geodesics curvature, Gauss bonnet theorem, Torsion of geodesics, Geodesics on Geodesics parallel.

Recommended Textbooks/ Reference Books:

1. T. J. Willnore, An Introduction to Differential Geometry, Dover Publications, **2012**

2. D. Somasundaram, Differential Geometry: A First Course, Alpha Science Publishers, **2008.**

3. S. Kobayashi and K. Nomizu, ‚Foundations of Differential Geometry, Inter science Publishers, **1963.**

4. D.T. Struik, ‚Lectures on Classical Differential Geometry, Addison - Wesley, Mass, **1950.**

5. Martin M. Lipschutz, „Differential Geometry‟ Schaum‟s Outlines, McGraw Hill Education, **2012.**

6. Taha Sochi, „Introduction of Differential Geometry of space Curves‟ Createsapce Independent Pub, McGraw-Hill Education, **2017.**

7. C E Weatherburn, "Differential Geometry of Three Dimensions "Cambridge University Press, **2016.**

MECHANICS

Sub. Code: BMATS1-523 | **L T P C** | **Total Hours: 90**

5 1 0 6

Course Objectives: The course will give introduction to Mechanics. This theory and its applications are an excellent example of how physics and mathematics work hand in hand to give a complete picture of the real problems.

Course Outcomes:

Students will be able to :

1. Thorough understanding of dynamics is essential to understanding any modern development of Physical sciences.
2. Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.
3. Reduction of two-body central force problem to an equivalent one-body problem, Central force motion in a plane.
4. Mechanics and its applications are an excellent example of how physics and mathematics work hand in hand to give a complete picture of the real problems.

UNIT-I (23 Hrs.)

Langrangian Dynamics: Basic concepts, Constraints, Generalized coordinates, Holonomic and non-holonomic systems, scleronomic and rheonomic systems, Generalized potential, Lagrange's equation of first kind and second kind. Guage invariance of the Lagrangian.

UNIT-II (22 Hrs.)

Hamiltonian Dynamics: Hamilton canonical equation, cyclic coordinates, Routh's equation Hamiltonian function and Conservation of energy, Hamilton's equations in different coordinate systems, Principle of least action.

UNIT-III (23 Hrs.)

Two-Body Central Force Problem: Reduction of two-body central force problem to an equivalent one-body problem, Central force motion in a plane, Equations of motion under central force and First integrals, Differential equation of an orbit, Inverse square law of force, Kepler's laws of planetary motion and their deduction, Stability of orbit under central force, Virial theorem.

UNIT-IV (22 Hrs.)

Poisson brackets and Lagrange brackets:- Poisson brackets, Poisson's identity , Jacobi – Poisson theorem, Lagrange bracket, condition of canonical character of transformation in terms of Lagrange bracket and Poisson bracket, Poincare – carton integral invariant, invariance of Lagrange bracket and Poisson brackets under canonical transformation.

Recommended Textbooks/ Reference Books:

1. John L. Synge and Byron A. Griffith: Principles of Mechanics 3rd Edition McGraw-Hill international, **2000**.

2. J C Upadhyay, 3rd Edition „Classical-Mechanics‟ Himalaya Publication House,**2014**.

3. J. G. Chakraborty, and P R Ghosh, Advanced Analytical Dynamics, U.N. Dhur & Sons,**1982.**

4. F. Chorltan, Textbook of Dynamics, Published by Van Nostrand NJ, **1967.**

5. Lev. D. Elsgolc: Calculus of Variations, Dover Publication, **2007.**

MATLAB

Sub. Code: BMATS1-524 | **L T P C** | **Total Hours: 45**
3 0 0 3

Course Objectives: Students will be able to integrates computation, visualization, and programming in an easy-to-use environment, being able to develop algorithms, Data analysis, exploration and visualization.

Course Outcomes:

1. Use MATLAB for Basic mathematics computations
2. Creating M-files , working with script tools and also writing script file
3. Program scripts and functions using the MATLAB development environment, Able to use basic flow controls (if else, for, while).
4. Use MATLAB for calculus , numerical integration and other mathematical operations

UNIT-I (12 hrs.)

Introduction to MATLAB , MATLAB software: Introduction, MATLAB window, command window , workspace ,command history ,basic commands ,operation with variables . Data Files and data types, Basic Mathematics: BODMAS RULES, Arithmetic operations, Mathematical and logical operators, solving arithmetic equations. Basic matrix operations.

UNIT-II (18 hrs.)

Other Operations: trigonometric functions, complex numbers, fractions, real numbers Functions: Writing user defined functions, Built in Function, Function Calling, Return value, Types of functions, Global variables. M files: Working with script tools, Writing Script File, Executing script file, The MATLAB editor, Saving M file.

UNIT-III (12 hrs.)

MATLAB Programming: Automating commands with Scripts, Writing programmes with logic and flow control, Writing functions, Control and conditional Statement programming. Loops and Conditional Statement: Control flow Conditional control: if , else , switch; Loop control- for, while, continue , break , programming termination – return.

UNIT-IV (18 hrs.)

Symbolic Math in MATLAB: calculus: numerical integration, linear algebra, roots of polynomials, algebraic equations, differential equations, transforms (Laplace and Fourier).

Recommended Text Books/ Reference Books:

1. Andrew knight, "Basics of MATLAB and beyond", Chapman and Hall/Crc,1st Edition **1999.**
2. Stephen .J. Chapman , MATLAB Programming for engineers`, 4th Edition, **2007**.
3. Brian.R.Hunt `A Guide To MATLAB`, 3rd Edition, **2014**.
4. Rudra Pratap Singh, Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, **2010**.

MATLAB LAB

Sub. Code: BMATS1-525 | **L T P C** | **Total Hours: 30**
0 0 2 1

Course Objectives:

1. Understanding the MATLAB environment.
2. Being able to do simple calculations using MATLAB.
3. Being able to carry out simple numerical computations and analyses using MATLAB.

Course Outcomes: Upon successful completion of this course, the student should be able to:

1. Understand the main features of the MATLAB development environment
2. Design simple algorithms to solve problems
3. Write simple programs in MATLAB to solve scientific and mathematical problems

4. Understand the main features of the MATLAB/SCILAB program development environment

EXPERIMENTS

To develop algorithms/ programming in MATLAB language for following:

1. Study of basic matrix operations
2. Solve linear simultaneous equations
3. Determine eigen value and eigen vector of square matrix
4. Euler's method and Modified Euler's Method
5. Picard Method
6. 4^{th} order Runge – Kutta method
7. Determine roots of polynomial
8. Simpson's 1/3 and 3/8 rules for numerical integration
9. Trapezoidal Method

Note: At least eight must be performed from the list

Recommended Textbooks/ Reference Books:

1. Andrew knight, "Basics of MATLAB and beyond", Chapman and Hall/Crc,1^{st} Edition **1999**.
2. Stephen .J. Chapman ,`MATLAB Programming for engineers`4^{th} Edition **2007**.
3. Brian.R.Hunt `A Guide To MATLAB`3^{rd} Edition, **2014**.
4. Rudra Partap Singh ,Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, **2010**.

COMPLEX ANALYSIS

Sub. Code: BMATS1-621 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives: The course aims to introduce the basic ideas of analysis for complex functions in complex variables which includes differentiability and geometrical representation of complex functions. The course also discuss the expansion of complex function in form of series.

Course Outcomes:

Students will be able to

1. Understand calculus of complex functions also concept and consequences of analyticity and Cauchy-Riemann equations .
2. Understanding Geometrical interpretation of Complex functions especially bilinear and conformal transformations.
3. Formulation of analytic functions and their applications.
4. Represent complex functions as Taylor, power and Laurent series, classification of singularities .

Unit-1 (21 HOURS)

Limits, continuity and derivatives of the function of complex variable, Analytic function, Necessary and sufficient conditions for analytic functions, Cauchy-Riemann equations, C-R equations in polar form.

Unit-II (23 HOURS)

Harmonic functions, Conjugate functions, Applications of Milne Thomson Method, Application to flow problems, Stereographic projection

Unit-III (23 HOURS)

Geometrical representation of $w = (z)$, Standard Transformations, Bilinear Transformatios , Conformal transformations.

Unit –IV (23 HOURS)

Expansion of f(z), Taylor's series, Laurent's Theorem, Zeros and singularities of analytic functions.

Recommended Books:

1. Brown, James Ward, & Churchill, Ruel V. **(2014).**"*Complex Variables and Applications* (9th ed.)", McGraw-Hill Education, New York.

2. Bak, Joseph & Newman, Donald J. **(2010)**. "*Complex analysis* (3rd ed.)". Undergraduate Texts in Mathematics, Springer. New York.
3. Zills, Dennis G., & Shanahan, Patrick D. **(2003)**. "*A First Course in Complex Analysis with Applications*". Jones & Bartlett Publishers, Inc.
4. "Higher Engineering Mathematics" B.S Grewal, Khanna Publishers ,Edition 35th.

DISCRETE MATHEMATICS

Sub. Code: BMATS1-622 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives: The objective of this course is to make the students familiar with the basic concepts in Discrete Mathematics and Graph Theory.

Course Outcomes:

1. Significant concepts of partial order relations, Recurrence relations, Boolean algebra, Lattices and Graph Theory.
2. To understand logical concepts and to show logical equivalences by using truth tables and rules in logics.
3. Appreciate the definition and basics of graphs along with types and their examples.
4. Understand the definition of a tree and learn its applications to fundamental circuits. Know the applications of graph theory to network flows. Relate the graph theory to the real-world problems.

UNIT-I (21 Hrs.)

Partial order relations, Chains and anti-chains, Pigeon hole principle, Principle of inclusion and exclusion, Analysis of algorithms-Time complexity. Complexity of problems, Discrete numeric functions and Generating functions.

UNIT-II (24 Hrs.)

Recurrence relations and Recursive algorithms, Linear recurrence relations with constant coefficients. Homogeneous solutions, Particular solution, Total solution, Solution by the method of Generating functions.

UNIT-III (23 Hrs.)

Boolean Algebra-Lattices as ordered sets and as Algebraic structures. Duality. Distributive and Modular lattices. Boolean lattices and Boolean algebras. Boolean functions and expressions. Prepositional calculus. Design and implementation of digital networks. Switching circuits.

UNIT-IV (22 Hrs.)

Graph Theory: Graphs and Planar graphs-Basic concept. Biparite multigraphs. Weighted graphs. Paths and circuits, Shortest paths. Eulerian and Hamiltonian trails and cycles, Theorems related to eulerian and hamiltanion graph, Travelling salesman problem. Planar graphs. Trees.

Recommended Text Books/ Reference Books:

1. C. L. Liu, "Elements of Discrete Mathematics", 2nd Edition, McGraw Hill, International Edition, Computer Science Series, **1986**.
2. Dr. Babu Ram, "Discrete Mathematics", Pearson Education India; First edition **2010.**
3. B A. Davey and H. A. Priestley, "Introduction to Lattices and Order", Cambridge University Press, Cambridge, **1990**.
4. Edgar G. Goodaire and Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 2nd Edition , Pearson Education (Singapore) P. Ltd. , Indian Reprint 2003.
5. Dr. Satinder Pal Gupta and Dr. C.P. Gandhi , "Discrete Structures" ,Fourth edition ,University Science Press,**2009.**

LINEAR PROGRAMMING AND OPTIMIZATION

Sub. Code: BMATS1-623 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives: To introduce the basic concepts of linear programming among the students for its applications in solving optimization problems.

Course Outcomes:

Students will able to:

1. Introduce and formulate linear programming models of real life situations.
2. Understand the selection and implementation of graphical solution and variants of simplex method for the solution of LPP.
3. Develop the relationships between the primal and dual problems and their solutions.
4. Apply the knowledge to solve two-person zero-sum game problems.

UNIT-I (23 hrs.)

System of Linear Equations, Linear independence and dependence of vectors, Concept of basis, Basic feasible solution, Convex sets. Extreme points, Hyperplanes, Introduction and formulation of linear programming problem (LPP), Solution of LPP using graphical method: Unbounded solution, infeasible solutions.

UNIT-II (23 hrs.)

Standard form of LPP, Slack, surplus and artificial variables, Optimal solution of LPP using Simplex, Big-M and two phase computational procedure, Exceptional cases in LPP i.e., Infeasible, unbounded, alternate and degenerate solutions.

UNIT-III (22 hrs.)

Duality in Linear Programming: General Primal- Dual pair, Formulating a dual problem from primal problem, Duality theorems, Complementary slackness theorem, Duality and simplex method, Dual simplex method.

UNIT-IV (22 hrs.)

Game Theory: Two person zero sum games, pure strategies (minimax and maximin principles), Game with saddle point, Mixed strategies: Game without saddle point, Rule of Dominance, Solution methods for games without saddle point: Graphical method, Linear programming method.

Recommended Text Books/ Reference Books:

1. G. Hadley: "Linear Programming", Narosa, Reprint, **2002**.
2. Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research", 9th Edn., Sultan Chand & Sons, **2002.**
3. Hamdy A. Taha, "Operations Research-An Introduction", Prentice Hall, 9th Edition, **2010**.
4. Martin Osborne, "An Introduction to Game Theory", Oxford University Press, **2003**.
5. F.S. Hillier. G.J. Lieberman: "Introduction to Operations Research- Concepts and Cases", 9th Edition, Tata Mc-Graw Hill, **2010**.
6. S. D. Sharma ,Himanshu Sharma, Operations Research: Theory, Methods and Applications Kedar Nath Ram Nath, **2010**.

MATHEMATICAL METHODS

Sub. Code: BMATS1-624 | **L T P C** | **Total Hours: 90**
5 1 0 6

Course Objectives: The course aims to provide students with adequate knowledge of methods to find exact or approximate solutions of their problems through various methods.

Course Outcomes:

Students will be at able to learn:

1. Fourier series and its applications.
2. Fourier transform and its applications to P.D.E

3. Laplace transform and its applications to solutions of integrals and Differential Equations.
4. Z-transforms and inverse Z-transforms and its importance in context of Difference equations

Unit I (25 hrs.)

Fourier Series: Dirichlet's conditions, Expansion of functions in the form of Fourier Series, Even and Odd functions, half range series, Complex Fourier Series, practical harmonic analysis.

Unit II (23 hrs.)

Fourier transforms: Fourier integrals, Fourier transforms (finite and infinite), Inverse Fourier transforms, Parseval's identities, Convolution theorem.

Unit III (24 hrs.)

Laplace transforms: Definition, Laplace transform of standard functions, Laplace transform of derivatives and integrals, Inverse Laplace transform, Convolution theorem, Unit step function, Application of Laplace transforms to boundary value problems.

Unit IV (18 hrs.)

Z - transforms: Difference equations, Basic definition of Z transform, Z- transform of standard functions, Shifting rules, Initial and final value theorems, Inverse Z- transforms, Application of Z- transform to solve difference equations.

Recommended Textbooks/ Reference Books:

1. R. K. Jain & S.R.K. Iyengar: Advanced Engineering Mathematics (Narosa Publishing House), 2nd Edition, **2003**.
2. Sokolnikoff and Redheffer: Mathematics for Physics and Engineering, Mc Graw Hill, 2nd Edition, **1966**.
3. Erwin Kreyszig: Advanced Engineering Mathematics (Wiley Eastern Limited), 8th Edition, **2006**.
4. George B. Thomas, Jr, Ross L. Finney: Calculus &Analytic Geometry, Pearson Publication, **2016.**