

**DEPARTMENT OF MATHEMATICS****PREAMBLE****M Phil Mathematics**

1. The syllabus has been modified for the Core Papers Research Methodology and Analysis.
2. The Core paper General Skills in Geometry has been introduced instead of Professional Competency in Mathematics.
3. The Elective paper Functional Analysis has been introduced.
4. The Elective paper Domination in Graphs has been introduced instead of Optimization Techniques.

**M Sc Mathematics**

1. The syllabus has been modified for the Core Papers Differential Geometry and Numerical Analysis.
2. The Core paper Measure and Integration has been introduced.
3. The Core paper Functional Analysis-I has been modified and renamed as Functional Analysis.
4. The Core paper Functional Analysis-II has been removed.
5. The Core Paper Mathematical Statistics has been modified and renamed as Probability and Statistics.
6. The Core paper Graph Theory has been modified and introduced instead of the Elective Paper Mathematical Methods.
7. The Elective paper Operations Research has been introduced instead of Coding Theory.
8. The Elective paper Distribution Theory, Mathematical Methods and Coding Theory has been removed.

**B Sc Mathematics**

1. The Core papers Calculus and Differential Equations has been modified.
2. The Core paper Theory of Equations and Numbers has been modified and renamed as Theory of Equations.
3. The Allied Papers Mathematical foundation for computer science and Operations Research has been included.
4. The skill based Elective paper Applied Statistics has been modified.

**Certificate Course**

1. Career Oriented Programme in LATEX has been transferred into Certificate Course in LATEX.
2. The Core Papers Elementary in Latex and Pictures and Colors in Latex has been modified and renamed as Documentation Techniques in LATEX.

**Programme Outcomes (All Programmes)**

**PO 1: Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid and looking at our ideas and decision (intellectual, organizational, and personal) from different perspectives.

**PO 2: Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language and make meaning of the world by connecting people, ideas, books, media and technology.

**PO 3: Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

**PO 4: Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

**PO 5: Ethics:** Recognize different value systems including your own understand the moral dimensions of your decisions and accept responsibility for them.

**M Phil MATHEMATICS**  
**[1- year Regular Programme]**  
**(For those who joined since 2018-19)**

**PSO 1:** They can go for higher degree programmer in respective subjects.

**PSO 2:** This degree course enables the students to go for various mathematical audits, and teaching related jobs such as investment and insurance government and public administration.

**PSO 3:** Understand formulate and use mathematical models arising in science, technology and other areas.

**PROGRAMME STRUCTURE**

Sem	Subject Code	Course	Subject Title	Hrs /Wk	Credits	CIA Marks	ESE Marks	Total Marks
I	GPMXC11	Core I	Research Methodology	6	6	25	75	100
	GPMXC12	Core II	Analysis	6	6	25	75	100
	GPMXC13	Core III	General Skills in Geometry	6	6	100	-	100
			Dissertation	6	-	-	-	-
			Library	6	-	-	-	-
			<b>Total</b>		<b>30</b>	<b>18</b>	<b>150</b>	<b>150</b>
II	GPMXE2A\	Elective	Functional Analysis	6	6	25	75	100
	GPMXE2B\		Domination in Graphs					
	GPMXE2C		Algebraic Theory Of Semigroups					
	GPMXC21PW	Core IV	Dissertation	16	12	100	100	200

		Library	8	-	-	-	-
	<b>Total</b>		<b>30</b>	<b>18</b>	<b>125</b>	<b>175</b>	<b>300</b>
	<b>Grand Total</b>		<b>60</b>	<b>36</b>	<b>275</b>	<b>325</b>	<b>600</b>

**Core I - Research Methodology**  
(For those who joined since 2018-19)

**Semester: I**  
**Sub.Code: GPMXC11**

**Hours per week: 6**  
**Credit: 6**

**CO 1:** Understand some basic concepts of research and its methodologies.

**CO 2:** Organize and conduct research in a more appropriate manner.

**CO 3:** Understand the concept of modules.

**CO 4:** Understand the concept of localization.

**CO 5:** Understand the concept of Calculus of variations.

**CO 6:** Knowledge about the Critical Points.

**Unit I** **(18 hours)**

Types of Research - Research Process - Report Writing and Presentation: Introduction - Types of Report - Guidelines for Reviewing Draft - Report Format - **Self Study:** Typing Instructions and Oral Presentation.

**Unit II** **(18 hours)**

Modules: Free Modules - Projective Modules - Tensor products - **Self Study:** Flat Modules.

**Unit III** **(18 hours)**

Localization: Ideals - Local Rings - **Self Study:** Localization.

**Unit IV** **(18 hours)**

The Calculus of Variations: Introduction - Existence of Minimizers.

**Unit V** **(18 hours)**

The Calculus of Variations: Regularity - Constraints - Critical Points - Problems.

**Text Books:**

- R. Panneerselvam, **Research Methodology**, PHI Learning Private Limited, Delhi, Tenth Printing, Second Edition. January 2016.  
**Unit I:** Chapter 1 (Section: 1.4 and 1.5) & Chapter 16
- N.S. Gopala Krishnan, **Commutative Algebra**, Oxonian Press Pvt. Ltd., New Delhi, 1984.  
**Unit II:** Chapter I  
**Unit III:** Chapter II
- L. C. Evans, **Partial Differential Equations**, American Mathematical Society, Providence, 1998.  
**Unit IV:** Chapter 8 (Section 8.1 - 8.2)  
**Unit V:** Chapter 8 (Section 8.3 - 8.8)

**Reference Books:**

- C.R. Kothari, **Research Methodology Methods and Techniques**, New Age International (P) Limited, Publishers. Second Revised Edition. Reprint 2012.
- Pierce R. S., **Associative Algebras, Graduate Texts in Mathematics**, Springer Verlag, New York, 1982.

**Core II - Analysis**  
(For those who joined since 2018-19)

**Semester: I****Sub.Code: GPMXC12****Hours per week: 6****Credit: 6****CO 1:** Gain knowledge of measurability.**CO 2:** Understand the Riesz representation theorem.**CO 3:** Understand convex functions and inequalities.**CO 4:** Know about Orthonormal sets.**CO 5:** Understand ideals and homomorphisms.**CO 6:** Know about the invertible elements.**Unit I****(18 hours)**

Abstract Integration: Set - Theoretic Notations and Terminology - The Concept of Measurability - Simple Functions - Elementary Properties of Measures - Arithmetic in  $[0, \infty]$  - Integration of Positive Functions - **Self Study:** Integration of complex Functions - The Role played by Sets of Measure Zero.

**Unit II****(18 hours)**

Positive Borel Measures: Vector Spaces - Topological Preliminaries - The Riesz Representation Theorem - Regularity Properties of Borel Measures - **Self Study:** Lebesgue Measure - Continuity properties of Measurable Functions.

**Unit III****(18 hours)**

$L^p$  spaces: Convex Functions and Inequalities - The  $L^p$  spaces - **Self Study:** Approximation by Continuous Functions.

**Unit IV****(18 hours)**

Elementary Hilbert space theory: Inner products and Linear Functions - Orthonormal Sets - **Self Study:** Trigonometry Series.

**Unit V****(18 hours)**

Elementary Theory of Banach Algebras: Introduction - The Invertible Elements - **Self Study:** Ideals and homomorphisms - Applications.

**Text Book:**

1. Walter Rudin, **Real and Complex Analysis**, McGraw Hill Education (India) Private Limited, New Delhi, Third Edition. 2006.

**Unit I:** Chapter 1**Unit II:** Chapter 2**Unit III:** Chapter 3**Unit IV:** Chapter 4**Unit V:** Chapter 18**Reference Books:**

2. H.L.Royden and P.M.Fitpatrick, **Real Analysis**, PHI Learning Private Limited, Fourth Edition. 2013.
3. G.F.Simmons, **Topology and Modern Analysis**, Robert E. Krieger Publishing Company INC, Reprint Edition 1983.
4. Kenneth R.Davidson and Allan. P. Donsig, **Real Analysis with Real Applications**, Prentice Hall of India, Edition 2002.

**Core III – General Skills in Geometry**  
(For those who joined since 2018-19)

**Semester: I****Sub.Code: GPMXC13****Hours per week: 6****Credit: 6****CO 1:** Understanding in the use of formal logic in geometric and algebraic proofs.**CO 2:** Know the concept of points, lines and planes.**CO 3:** Determine all distinguishing features of a conic section.**CO 4:** Develop and solve Polar equations.**CO 5:** Solve general equations.**CO 6:** Solve system of equations describing real-life problem.**Unit I****(18 hours)**

Algebraic Results - Areas of triangles - Polar coordinates Equation to a locus - Straight line in Rectangular Coordinates - Polar Coordinates and in Oblique Coordinates.

**Unit II****(18 hours)**

Two or more straight lines - Transformation of Coordinates - Systems of circles.

**Unit III****(18 hours)**

Conic sections - The Parabola - The ellipse - The Hyperbola.

**Unit IV****(18 hours)**

Polar equation to a Conic - Tracing of Curves.

**Unit V****(18 hours)**

More general equations - the director circle etc.

**Text Book:**

1. S.L. Loney, **The elements of Coordinate Geometry**, MacMillan and Co., New York, 1895.

**Unit I:** Chapter 1 - 5**Unit II:** Chapter 6 - 9**Unit III:** Chapter 10 - 13**Unit IV:** Chapter 14 - 15**Unit V:** Chapter 16**Reference Book:**

2. Henry Burchard Fine, Henry Dallas Thompson, **Coordinate Geometry**, the MacMillan Company, 1911.

**Elective - Functional Analysis**  
(For those who joined since 2018-19)

**Semester: II****Sub.Code: GPMXE2A****Hours per week: 6****Credit: 6****CO 1:** Learns the topological vector spaces and apply.**CO 2:** Understand the concepts of bounded linear operator and apply.**CO 3:** Understand the completeness and learn how to apply theorems.**CO 4:** Understand the importance of Hahn- Banach theorems and applied problems.**CO 5:** Understand the concept of convexity.

**CO 6:** Knowledge about Duality in Banach spaces.

**Unit I** (18 hours)

Topological Vector Spaces: Introduction - Separation Properties - Linear Mappings - Finite dimensional spaces - **Self Study:** Metrization.

**Unit II** (18 hours)

Boundedness and Continuity - Seminorms and Local Convexity - **Self Study:** Quotient Spaces - Examples.

**Unit III** (18 hours)

Completeness: Baire Category - The Banach-Steinhaus Theorem - The Open Mapping Theorem - The Closed Graph Theorem - **Self Study:** Bilinear Mappings.

**Unit IV** (18 hours)

Convexity: The Hahn-Banach Theorems - Weak Topologies - **Self Study:** Compact Convex Sets.

**Unit V** (18 hours)

Duality in Banach spaces: The normed dual of a normed space - Adjoints - **Self Study:** Compact Operator.

**Text Book:**

1. Walter Rudin, **Functional Analysis**, McGraw Hill Education (India), Second Edition. 2006.

**Unit I:** Chapter 1 (Page No: 3 - 22)

**Unit II:** Chapter 1 (Page No: 23 - 41)

**Unit III:** Chapter 2

**Unit IV:** Chapter 3 (Page No: 56 – 77)

**Unit V:** Chapter 4

**Reference Books:**

2. Balmohan V Limaye, **Functional Analysis**, New Age International Pvt. Ltd., Publishers, Second Edition.

3. George F. Simmons, **Introduction to Topology and Modern Analysis**, Tata McGraw- Hill, Edition 2009.

4. P. K. Jain. O. P. Ahuja, Khalil Ahmad, **Functional Analysis**, New Age International Pvt Ltd., Edition 1995.

**Elective - Domination in Graphs**  
(For those who joined since 2018-19)

**Semester: II**

**Sub.Code: GPMXE2B**

**Hours per week: 6**

**Credit: 6**

**CO 1:** Understand the concept of bounds on the domination numbers.

**CO 2:** Understand the concepts of independence.

**CO 3:** Understand the role played by Irredundancy and efficiency.

**CO 4:** Understand the concept of conditions on the dominating set.

**CO 5:** Understand the concept of Paired- Domination.

**CO 6:** Used to guarantee the existence of certain graph of specified type.

**Unit I**

(18 hours)

Bounds on the Domination Number.

<b>Unit II</b>	<b>(18 hours)</b>
Dominations - Independence.	
<b>Unit III</b>	<b>(18 hours)</b>
Irredundancy - Efficiency.	
<b>Unit IV</b>	<b>(18 hours)</b>
Conditions on the Dominating Set.	
<b>Unit V</b>	<b>(18 hours)</b>
Conditions on the Dominating Set (Paired – Domination).	

**Text Book:**

1. Teresa W. Haynes, Stephen T. H., Hedetniemi and Peter J Slater, **Fundamentals of domination in graph**, Marcel Dekker New York, 1998.  
**Unit I:** Chapter 2  
**Unit II:** Chapter 2, 3  
**Unit III:** Chapter 3, 4  
**Unit IV:** Chapter 6  
**Unit V:** Chapter 6

**Reference Books:**

2. Teresa W. Haynes, Stephen T. H., Hedetniemi and Peter J Slater, **Advanced topics of domination in graphs**, Marcel Dekker, New York, 1998.
3. Gary Chartrand Ping Zhang, **Introduction to graph Theory**, Tata McGraw Hill, Edition 2006.

**Elective - Algebraic Theory Of Semigroups**  
**(For those who joined since 2018-19)**

<b>Semester: II</b>	<b>Hours/week: 6</b>
<b>Sub.Code: GPMXE2C</b>	<b>Credit: 6</b>

CO 1: Know the treatment on the theory of Semi groups.

CO 2: Understand the basic structure theory of Semi groups.

CO 3: Know the concepts of algebraic lattices and investigate the relations between the algebraic structures and the lattice structures.

CO 4: Understand the (0)-simple semigroups .

CO 5: Know the fundamental methods and notions which enable research work in the field of semigroup theory.

CO 6: Know the Fundamental inverse semigroups.

**UNIT I** **(18 Hours)**

**Introductory Ideals:** Monogenic semigroups – Ordered sets, semilattices and lattices – Binary relations, equivalences – Congruences – Free semigroups – Ideals and Rees congruences. **Green's Equivalences:** The equivalences L, R,, H, J and D – The structure of D classes – Regular D-classes – Regular semigroups.

**UNIT II** **(18 Hours)**

**0-Simple Semigroups:** Simple and 0-simple semigroups; principal factors – Rees Theorem – Primitive Idempotents – Congruences on completely 0 – simple semi groups.

**UNIT III** **(18 Hours)**

**Unions of Groups:** Introduction – Union of groups – Semilattices of groups – Bands – Free bands – Varieties of bands.

**UNIT IV** (18 Hours)

**Inverse Semigroups:** The natural order relation on inverse semigroup – Congruences on inverse semigroups – Bisimple inverse semigroups – Simple inverse semigroups.

**UNIT V** (18 Hours)

Fundamental inverse semigroups – Anti - uniform semilattices.

**Text Book:**

1. Howie, J.M. **An Introduction to Semigroup Theory**. Academic Press, 1976.

**Unit I:** Chapter I

**Unit II:** Chapter II

**Unit III:** Chapter III

**Unit IV:** Chapter IV

**Unit V:** Chapter V

**Reference Books:**

2. John. M. Howie, **London Mathematical Society Monographs New Series, Fundamentals of Semigroup Theory**, Oxford Science Publications, 1996.
3. Gerhard O. Michler, **Theory of Finite Simple Groups**, Cambridge University Press, Cambridge, 2006.

**Core IV- Dissertation**  
(For those who joined since 2018-19)

**Semester: II**

**Sub.Code: GPMXC21PW**

**Hours per week: 16**

**Credit: 12**

**CO 1:** Acquired a comprehensive understanding of techniques, and a thorough knowledge of the literature applicable to their own research.

**CO 2:** Show abilities in the critical evaluation of current research and research methodologies.

**CO 3:** Apply knowledge of mathematical in all the fields of learning including higher research and its extension.

**M Sc MATHEMATICS**  
**[2 -Year Regular Programme]**  
(For those who joined since 2018-19)

**PSO 1:** Formulate and develop mathematical arguments in a logical manner.

**PSO 2:** Acquire the knowledge and understanding in advanced areas of mathematics chosen by the student from the courses.

**PSO 3:** Understand and formulate and use quantitative models arising in social science, business and other contexts.



## PROGRAMME STRUCTURE

Sem	Subject Code	Course	Subject Title	Hrs/ Wk	Credits	CIA Marks	ESE Marks	Total Marks
I	GMMXC11	Core I	Algebra-I	6	5	40	60	100
	GMMXC12	Core II	Analysis-I	6	5	40	60	100
	GMMXC13	Core III	Ordinary and Partial Differential Equations	6	5	40	60	100
	GMMXC14	Core IV	Measure and Integration	6	5	40	60	100
	GMMXE1A	Elective I	Numerical Analysis	6	5	40	60	100
	GMMXE1B		Stochastic Process					
	GMMXX1	Extra credit	Fuzzy Analysis		2		100	100
		<b>Total</b>			<b>30</b>	<b>25+2</b>	<b>200</b>	<b>300+100</b>
II	GMMXC21	Core V	Algebra-II	6	5	40	60	100
	GMMXC22	Core VI	Analysis-II	6	5	40	60	100
	GMMXC23	Core VII	Topology-I	6	5	40	60	100
	GMMXC24	Core VIII	Differential Geometry	6	5	40	60	100
	GMMXE2A	Elective II	Graph Theory	6	5	40	60	100
	GMMXE2BP		Web Designing Lab					
	GMMXX2P	Extra credit	Village Placement Programme		2		100	100
		<b>Total</b>			<b>30</b>	<b>25+2</b>	<b>200</b>	<b>300+100</b>
III	GMMXC31	Core IX	Functional Analysis	6	5	40	60	100
	GMMXC32	Core X	Topology-II	6	5	40	60	100
	GMMXC33	Core XI	Classical Mechanics	6	5	40	60	100
	GMMXC34	Core XII	Probability and Statistics	6	5	40	60	100
	GMMXE3AP	Elective III	Statistics through R Tool Lab	6	5	40	60	100
	GMMXE3B		Operations Research					
	GMMXX3	Extra credit	Communication Skills		2		100	100
		<b>Total</b>			<b>30</b>	<b>25+2</b>	<b>200</b>	<b>300+100</b>
IV	GMMXC41	Core XIII	Complex Analysis	6	5	40	60	100
	GMMXC42	Core XIV	Advanced Statistics	6	5	40	60	100
	GMMXC43PW	Core XV	Project	18	5	100	100	200

GMSED4	Extra credit	Skills for Employability Development		2	100		100
<b>Total</b>			<b>30</b>	<b>15+2</b>	<b>180+100</b>	<b>220</b>	<b>400+100</b>
<b>Grand total</b>			<b>120</b>	<b>90+8</b>	<b>780+100</b>	<b>1120+300</b>	<b>1900+400</b>

**ELECTIVE COURSE FOR OTHER PG PROGRAMME**

Sem	Subject Code	Course	Subject Title	Hrs/ Wk	Credits	CIA	ESE	Total
II	GMITE2A	Elective II	Probability and Statistics	6	5	40	60	100

**Core I – Algebra-I**

(For those who joined since 2018-19)

**Semester : I**

**Hour per week : 6**

**Sub.Code : FMMXC11/GMMXC11**

**Credit : 5**

**CO 1:** Abstract the concepts of Groups and Rings theory and field.

**CO 2:** Understand the concepts of Groups Homomorphisms and Isomomorphisms.

**CO 3:** Use the concepts of Sylow's Theorem.

**CO 4:** Analyze and demonstrate examples of ideals and quotient rings.

**CO 5:** Use various canonical types of rings including Euclidean Rings and Polynomial Rings.

**CO 6:** Explain the notions of an extension of a Field.

**Unit I**

**(18 hours)**

Group Theory: A Counting Principle - Normal Subgroups and Quotient Groups - Homomorphisms - Automorphisms - Cayley's theorem - **Self-Study:** Permutation Groups.

**Unit II**

**(18 hours)**

Another Counting Principle - Sylow's Theorem - Direct Products - **Self-Study:** Finite Abelian Groups.

**Unit III**

**(18 hours)**

Ring Theory: Definition and Examples of Rings - Some Special Classes of Rings - Homomorphisms - Ideals and Quotient Rings - More Ideals and Quotient Rings - **Self-Study:** The Field of Quotients of an Integral Domain.

**Unit IV**

**(18 hours)**

Euclidean Rings - A Particular Euclidean Ring - Polynomial Rings - Polynomials over the Rational Field - **Self-Study:** Polynomial Rings over Commutative Rings.

**Unit V**

**(18 hours)**

Fields: Extension Fields - The Transcendence of e - Roots of Polynomials - Construction with Straightedge and Compass - **Self-Study:** More About Roots.

**Text Book:**

1. I.N. Herstein, **Topics in Algebra**, Wiley India Pvt. Ltd., Second edition, 2006.

**Unit I:** Chapter 2 (2.5 – 2.10)

**Unit II:** Chapter 2 (2.11 – 2.14)

- Unit III:** Chapter 3 (3.1 – 3.6)  
**Unit IV:** Chapter 3 (3.7 – 3.11)  
**Unit V:** Chapter 5 (5.1 – 5.5)

**Reference Books:**

2. Surjeet Singh and Zameerudin, **Modern Algebra**, Wiley India New Delhi, First Edition, 2008.
3. William J. Gilbert, **Modern Algebra with applications**, Wiley India Pvt. Ltd., 2008.
4. Vivek Sahai and Vivek Bist, **Algebra**, Nulrosa Publishing House, 1999.

**Core II – Analysis-I**  
**(For those who joined since 2018-19)**

**Semester : I****Hours per week : 6****Sub.Code : FMMXC12/GMMXC12****Credit : 5****CO1:** Understand the basic features of real and complex number system.**CO2:** Recognize the basic topological properties (able to identify the objects that are topological equivalent).**CO3:** Recognize the series of real numbers and convergence.**CO4:** Recognize the continuity of real functions.**CO5:** Recognize the differentiability of real functions and its related theorems.**CO6:** Apply analysis concepts to model and solve real-life situations.**Unit I****(18 hours)**

The Real and Complex Number Systems: Introduction - Ordered Sets - Fields - The Real Field - The Extended Real Number System - The Complex Field – **Self-Study:** Euclidean Spaces.

**Unit II****(18 hours)**

Basic Topology: Finite, Countable and Uncountable Sets - Metric Spaces - Compact Sets - Perfect Sets - **Self-Study:** Connected Sets.

**Unit III****(18 hours)**

Numerical Sequences And Series: Convergent Sequences - Sub Sequences - Cauchy Sequences - Upper and Lower Limits - Some Special Sequences - Series - Series of Nonnegative Terms - The Number  $e$  - The Root and Ratio Tests - Power Series - Summation by Parts - Absolute Convergence - Addition and Multiplication of Series - **Self-Study:** Rearrangements.

**Unit IV****(18 hours)**

Continuity: Limits of Functions - Continuous Functions - Continuity and Compactness - Continuity and Connectedness - Discontinuities - Monotonic Functions - **Self-Study:** Infinite Limits and limits at Infinity.

**Unit V****(18 hours)**

Differentiation: The Derivative of a Real Function - Mean Value Theorems - The Continuity of Derivatives - L' Hospital Rule - Derivatives of Higher Order - Taylor's Theorem - **Self-Study:** Differentiation of Vector-valued Functions.

**Text Book:**

1. Walter Rudin, **Principles of Mathematical Analysis**, McGraw-Hill Book Company, Third Edition, 1976.

<b>Unit I:</b>	Chapter 1
<b>Unit II:</b>	Chapter 2
<b>Unit III:</b>	Chapter 3
<b>Unit IV:</b>	Chapter 4
<b>Unit V:</b>	Chapter 5

**Reference Books:**

2. S.C. Malik, **Principles of Real Analysis**, New Age International Pvt. Ltd., Second Edition.
3. Apostol, **Mathematical Analysis**, Narosa Publishing House, Second Edition, 2002.
4. V.Ganapathy Iyer, **Mathematical Analysis**, Tata McGraw Hill 1985.

**Core III - Ordinary and Partial Differential Equations**  
(For those who joined since 2018-19)

**Semester : I****Hour per week : 6****Sub.Code : FMMXC13/GMMXC13****Credit : 5****CO 1:** Solve higher order and system of differential equations of different types**CO 2:** Finding the solutions of differential equation with initial and boundary conditions**CO 3:** Solving higher order partial differential equations using various methods**CO 4:** Choose the appropriate techniques from Calculus to explain exact solutions of differential equations.**CO 5:** Students will translate descriptions of real world phenomena and data into mathematical models**CO 6:** It is one of the basic fundamental courses for research scholars in Discipline of Mathematics.**Unit I****(18 hours)**

Linear Equations with Variable Coefficients: Introduction - Initial value Problems for the homogeneous equation - Solutions of the homogeneous equation - The Wronskian and linear independence - Reduction of the order of a homogeneous equation - The non-homogeneous equation - Homogeneous equations with analytic coefficients – **Self-Study:** The Legendre equation - Justification of the power series method.

**Unit II****(18 hours)**

Linear Equations with Regular Singular Points: The Euler equation - Second order equations with regular singular points-an example - Second order equations with regular singular points-the general case - A convergence proof - The exceptional cases - **Self-Study:** The Bessel equation - Regular Singular points at infinity.

**Unit III****(18 hours)**

Existence and Uniqueness of Solutions to First Order Equations: Equations with variables separated - Exact equations - The method of successive approximations - The Lipschitz condition - Convergence of the successive approximations - Non-local existence of solutions - **Self-Study:** Approximation to and uniqueness of solutions – Equations with complex-valued functions.

**Unit IV****(18 hours)**

Partial Differential Equations of the First Order: Origins of First-Order Partial Differential Equations - Cauchy's Problem for First-order Equations - Linear Equations of the First Order - **Self-Study:** Integral surfaces Passing through a Given Curve - Surfaces

Orthogonal to a Given System of Surfaces - Nonlinear Partial Differential Equations of the First Order.

**Unit V** **(18 hours)**

Cauchy's Method of Characteristics - Compatible Systems of First Order Equations - Charpit's Method - **Self-Study:** Special Types of First order Equations - Solutions Satisfying Given Conditions - Jacobi's Method.

**Text Books:**

1. Earl A. Coddington, **An introduction to Ordinary Differential Equations**, Prentice Hall of India Pvt. Ltd., 2001.

**Unit I:** Chapter 3

**Unit II:** Chapter 4

**Unit III:** Chapter 5

2. Ian Sneddon, **Elements of Partial Differential Equations**, McGraw Hill International Edition, 1957.

**Unit IV:** Chapter 2 (Pg. No: 44 - 61)

**Unit V:** Chapter 2 (Pg. No: 61 - 80)

**Reference Books:**

3. Phoolan Prasad and Renuka Ravindran, **Partial Differential Equations**, New Age International (P) Ltd, First Edition, 1996.
4. Nita H. Shah, **Ordinary and Partial Differential Equations Theory and Applications**, PHI Learning Pvt. Ltd., New Delhi, 2010.
5. B Rai D P Choudhury, **Ordinary Differential Equations An Introduction**, Naroso Publishing House Pvt. Ltd., New Delhi, First Edition, 2006.

**Core IV – Measure and Integration**  
(For those who joined since 2018-19)

**Semester : I**

**Sub.Code : GMMXC14**

**Hours per week : 6**

**Credit : 5**

**CO 1:** Understand how Lebesgue measure is defined on  $\mathbb{R}$ .

**CO 2:** Know the basic convergence theorem for Lebesgue Integrals.

**CO 3:** Understand how measure may be used to construct integrals

**CO 4:** Understand the shortcomings of the Classical Integration Theory due to Riemann.

**CO 5:** Understand the relation between Riemann and Lebesgue integrals.

**CO6:** The material covered in this course lays foundations for courses in Functional Analysis, Harmonic Analysis and Probability Theory.

**Unit I** **(18 hours)**

Lebesgue Measure: Introduction - Outer measure - Measurable sets and Lebesgue measure - **Self-Study:** Measurable functions - Littlewood's three principles.

**Unit II** **(18 hours)**

The Lebesgue Integral: The Riemann integral - The Lebesgue integral of a bounded function over a set of finite measure - **Self-Study:** The integral of a nonnegative function - The general Lebesgue integral.

**Unit III (18 hours)**

Differentiation and Integration: Differentiation of monotone functions - Functions of bounded variation - **Self-Study:** Differentiation of an integral - Absolute continuity.

**Unit IV (18 hours)**

Measure and Integration: Measure spaces - Measurable functions - Integration - **Self-Study:** Signed measures - The Radon-Nikodym Theorem.

**Unit V (18 hours)**

Measure and Outer Measure: Outer measure and measurability - The Extension Theorem  
**Self-Study:** Product measures.

**Text Book:**

1. H.L.Royden, **Real Analysis**, Pearson Education Pvt. Ltd., Third Edition, 1988.

<b>Unit I:</b>	Chapter 3(Pg. No: 54 - 64, 66 - 74)
<b>Unit II:</b>	Chapter 4(Pg. No: 75 - 95)
<b>Unit III:</b>	Chapter 5(Pg. No: 97 - 113)
<b>Unit IV:</b>	Chapter 11(Pg. No: 253 - 268, 270 - 282)
<b>Unit V:</b>	Chapter 12(Pg. No: 288 - 299, 303 - 313)

**Reference Books:**

2. G.De Barra, **Measure Theory and Integration**, New age international(p) Ltd., First Edition, 1981.
3. Inter K Rana, **An Introduction to Measure and Integration**, Narosa Publishing house Pvt. Ltd., Second Edition, 2005.
4. M.E.Munroe, **Measure and Integration**, Addison – Wesley publishing Company, Second Edition, 1971.

**Elective I - Numerical Analysis**  
**(For those who joined since 2018-19)**

**Semester : I****Sub.Code : GMMXE1A****Hours per week : 6****Credit : 5**

**CO 1:** Solve an algebraic or transcendental equation using an appropriate numerical method.

**CO 2:** Understand the difference operator and the use of interpolation.

**CO 3:** Solving a differential equation using an Appropriate numerical methods.

**CO 4:** Finite difference operators are also introduced to understand a different approach in Interpolation.

**CO 5:** Understand numerical technique to find the roots of non- linear equation.

**CO 6:** Understand the concepts of Picard's methods

**Unit I (18 hours)**

Solution of Algebraic and Transcendental Equations - Bisection Method - Regula Falsi Method - Newton-Raphson Method - Rate of Convergence-Secant Method - **Self-study:** Ramanujan's Method - Graeffe's Root-Squaring Method - Lin-Bairstow's Method.

**Unit II (18 hours)**

Interpolation - Errors in Polynomial Interpolation - Newton's Forward and Backward Interpolation - Gauss Central Difference Formula - Stirling's Formula - Bessel's Formula - Everett's Formula - Lagrange's Interpolation Formula - Error in Lagrange's Formula - Hermite's Interpolation Formula - **Self-study:** Finite Differences - Forward, Backward and Central Difference - Symbolic Relations and Separation of Symbols - Relation between Bessel's and Everett's Formulae.

**Unit III (18 hours)**

Numerical Differentiation and Integration - Numerical Differentiation - Errors in Numerical Differentiation - Maximum and Minimum Values of a Tabulated Function - Numerical Integration - Trapezoidal Rule - Simpson's 1/3-Rule - Simpson's 3/8-Rule - Gauss Legendre Formula - **Self-study:** Cubic Spline Method for differentiation - Romberg Integration - Euler-Maclaurian Formula.

**Unit IV (18 hours)**

System of linear Equations - Direct Methods - Gauss Elimination Method - Gauss-Jordan method - LU Decomposition - Iterative Methods - Jacobi's Method - Gauss-Seidel Method. Eigen Value Problem - Power Method - **Self-study:** Matrix Inverse using Jordan Method - Solution of Tridiagonal Systems - Singular Value Decomposition.

**Unit V (18 hours)**

Numerical Solution of Ordinary Differential Equations - Initial Value Problems - Taylor's Series Method - Picard's Method - Euler's Method - Modified Euler's Method - Runge-Kutta Methods - Boundary Value Problems - Finite-difference Method - The Shooting Method - **Self-study:** Error Estimates for the Euler Method - Milne's Method - Cubic Spline Method.

**Text Book:**

1. Sastry, S.S. **Introductory Methods of Numerical Analysis**, Fourth Edition, PHI Learning Pvt. Ltd., New Delhi, 2005.

<b>Unit I:</b>	Chapter 2 (Pg. No: 20 – 26, 33 – 44 & 46 - 50)
<b>Unit II:</b>	Chapter 3 (Pg. No: 63 – 70, 73 – 86 & 90 - 100)
<b>Unit III:</b>	Chapter 5 (Pg. No: 187 – 204, 211 – 213 & 216 - 220)
<b>Unit IV:</b>	Chapter 6 (Pg. No: 255 – 261, 265 – 271 & 275 - 290)
<b>Unit V:</b>	Chapter 7 (Pg. No: 295 – 308, 311 – 314 & 318 - 325)

**Reference Books:**

2. David Kincaid & Ward Cheney, **Numerical Analysis and Mathematics of Scientific Computing**, Brooks/Cole, 1999.
3. Jain, M.K. Iyengar, S.R.K., Jain R.K, **Numerical Methods for scientific and Engineering Computations**, Wiley Easter, 2003.
4. Shankara Rao K, **Numerical Methods for Scientists and Engineers**, Prentice Hall of India, 2001.

**Elective I - Stochastic Process**  
(For those who joined since 2018-19)

**Semester : I****Sub.Code : FMMXE1B/GMMXE1B****Hours per week : 6****Credit : 5**

**CO 1:** Apply the concepts of the Laplace transform of the Probability Distribution.

**CO 2:** Adaption capability of Stochastic Process and Markov Chains.

**CO 3:** Understand the concepts of the Stability of Markov System.

**CO 4:** Understand the concepts of Poisson Process.

**CO 5:** Understand the concepts of Queueing System and Model.

**CO 6:** Gain knowledge of Poisson Process and Related Distribution.

**Unit I (18 hours)**

Generating Functions - Laplace Transform - **Self-Study:** Laplace Transform of a probability distribution or of a random variable.

**Unit II (18 hours)**

Stochastic Process: An Introduction - Specification of Stochastic Process - Markov Chains - Definition and Examples - **Self-Study:** Higher Transition probabilities.

**Unit III (18 hours)**

Classification of States and Chains - Determination of Higher Transition Probabilities - Stability of A Markov System - **Self-Study:** Markov Chain with Denumerable Number of States.

**Unit IV (18 hours)**

Poisson Process and Related Distributions - Generalisation of Poisson Process - **Self-Study:** Birth and Death Process.

**Unit V (18 hours)**

Queueing Systems and Models - Birth and Death Process in Queueing Theory - **Self-Study:** Reliability Models.

**Text Book:**

1. J. Medhi, **Stochastic Processes**, New Age International [P] Limited Publishers, Third Edition.

<b>Unit I:</b>	Chapter 1 (Pg. No: 1 - 43)
<b>Unit II:</b>	Chapter 1, 2 (Pg. No: 49 -51 & 62 - 74)
<b>Unit III:</b>	Chapter 2 (Pg. No: 78 -99 & 101 - 102)
<b>Unit IV:</b>	Chapter 3 (Pg. No: 150 -170)
<b>Unit V:</b>	Chapter 10 (Pg. No: 388 - 395 & 402 - 415)

**Reference Books:**

2. Arnold O. Allen, **Probability, Statistics, and Queueing Theory with Computer Science Applications**, Elsevier, a division of Reed Elsevier India Pvt. Ltd, 2005.
3. I. U. N. Bhat, **Elements of Applied Stochastic Process**, John Wiley and Sons Limited Second Edition, 1984.
4. D. R. Cox and H. D. Miller, **Theory of stochastic process**, Methuen, London, 1965.

**Extra Credit- Fuzzy Analysis  
(For those who joined since 2018-19)**

**Semester : I**

**Sub.Code : FMMXX1/GMMXX1**

**Credit : 2**

**CO 1:** Gain knowledge of crisp sets and fuzzy sets.

**CO 2:** Apply the rules of fuzzy logic in research and political science.

**CO 3:** Understand the concepts of fuzzy logic control.

**CO 4:** Gain knowledge of solving similarity relations.



**Unit I**

Crisp Sets And Fuzzy Sets: Introduction - Crisp Sets: An Overview - The Notion of Fuzzy Sets.

**Unit II**

Basic Concepts of Fuzzy Sets - Classical Logic: An Overview - Fuzzy Logic.

**Unit III**

Operations on Fuzzy Sets: General Discussion - Fuzzy Complement - Fuzzy Union.

**Unit IV**

Fuzzy Intersection - Combinations of Operations - General Aggregation Operations.

**Unit V**

Fuzzy Relations: Crisp and Fuzzy Relations - Binary Relations - Binary Relations on a Single Set.

**Text Book:**

- George J.Klir and Tina A. Folger, **Fuzzy Sets, Uncertainty and Information**, Published by Asoke K.Ghosh Prentice Hall of India Pvt. Ltd., 1988.  
**Unit I:** Chapter 1(1.1 - 1.3)  
**Unit II:** Chapter 1(1.4 - 1.6)  
**Unit III:** Chapter 2(2.1 - 2.3)  
**Unit IV:** Chapter 2(2.4 - 2.6)  
**Unit V:** Chapter 3(3.1 - 3.3)

**Reference Books:**

- George J. Klir and Boyuan, **Fuzzy Sets and Fuzzy Logic Theory and Applications**, Published by Prentice Hall of India Pvt. Ltd., 2005.
- Timothy J.Ross, **Fuzzy logic with Engineering Applications**, Published by Wiley India Pvt. Ltd., Second Edition, 2008.
- James J.Buckley Esfandiar Eslami, **An Introduction to Fuzzy Logic and Fuzzy Sets**, Published by Springer (India) Pvt Ltd., Second Indian Reprint 2009.

**Core V – Algebra-II**  
**(For those who joined since 2018-19)**

**Semester : II**

**Sub.Code : FMMXC21/GMMXC21**

**Hour per week : 6**

**Credit : 5**

**CO 1:** Abstract the Concepts of Vector Spaces and Modules

**CO 2:** Use the definition and properties of Linear Transformations and Matrices of Linear Transformations.

**CO 3:** Understand the significance of Canonical Forms and Nilpotent Transformations.

**CO 4:** Analyze Jordan form and Rational Canonical Forms

**CO 5:** Analyze the concept of Determinants and Hermitians.

**CO 6:** Understand the Trace and Transpose.

**Unit I**

**(18 hours)**

Vector Spaces and Modules: Elementary Basic Concepts - Linear Independence and Bases - Dual Spaces - Inner Product Spaces - **Self-Study:** Modules.

**Unit II**

**(18 hours)**

Linear Transformations: The Algebra of Linear Transformations - Characteristic Roots - **Self-Study:** Matrices.

**Unit III** (18 hours)

Canonical Forms: Triangular Form - **Self-Study:** Canonical forms: Nilpotent Transformations.

**Unit IV** (18 hours)

Canonical Forms: A Decomposition of  $V$ : Jordan Form - Canonical Forms: Rational Canonical Form - **Self-Study:** Trace and Transpose.

**Unit V** (18 hours)

Determinants - Hermitian, Unitary and Normal Transformations - **Self-Study:** Real Quadratic Forms.

**Text Book:**

1. I.N. Herstein, **Topics in Algebra**, Wiley India Pvt. Ltd., Second Edition, 2006.

<b>Unit I:</b>	Chapter 4
<b>Unit II:</b>	Chapter 6 (6.1 – 6.3)
<b>Unit III:</b>	Chapter 6 (6.4 – 6.5)
<b>Unit IV:</b>	Chapter 6 (6.6 – 6.8)
<b>Unit V:</b>	Chapter 6 (6.9 – 6.11)

**Reference Books:**

2. J.N. Sharma and A. R. Vashishtha satyendra Rastogi Mitra, **Linear Algebra**, Krishna Prakasham media (P) Ltd., 2010.
3. Kenneth Holfmam and Ray kunze, **Linear Algebra**, PHI learning Pvt. Ltd., Second Edition, 2014.
4. Jin ho kwak and Sungpyo Hong, **Linear Algebra**, Springer Pvt. Ltd., Second Edition, 2004.

**Core VI- Analysis-II**  
(For those who joined since 2018-19)

**Semester : II****Sub.Code : FMMXC22/GMMXC22****Hour per Week : 6****Credit : 5****CO1:** Introduce the motion of Reimann-stieltjes integral.**CO2:** Explore new theoretical dimensions in uniform convergence of Sequences and Series of Functions.**CO3:** Demonstrate the ability to manipulate and use power series.**CO4:** Demonstrate the ability to manipulate gamma functions, linear transformations and differentiation.**CO5:** Recognize the functions of several variables.**CO6:** Develop the ability to reflect on problems that are quite significant in the field of real analysis.**Unit I** (18 hours)

The Riemann-Stieltjes Integral: Definition and Existence of the Integral - Properties of the Integral - Integration and Differentiation - Integration of Vector-valued Functions - **Self-Study:** Rectifiable Curves.

**Unit II** (18 hours)

Sequences and Series of Functions: Discussion of Main Problem - Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration - Uniform

Convergence and Differentiation - Equicontinuous Families of Function - **Self-Study:** The Stone-Weierstrass Theorem.

**Unit III** (18 hours)

Some Special Functions: Power Series - The Exponential and Logarithmic Functions - The Trigonometric Functions - The Algebraic Completeness of the Complex Field - **Self-Study:** Fourier Series.

**Unit IV** (18 hours)

The Gamma Function - Functions of Several Variables - Linear Transformations - **Self-Study:** Differentiation.

**Unit V** (18 hours)

The Contraction Principle - The Inverse Function Theorem - The Implicit Function Theorem - The Rank Theorem - Determinants - Derivatives of Higher Order - **Self-Study:** Differentiation of Integrals.

**Text Book:**

1. Walter Rudin, **Principles of Mathematical Analysis**, McGraw-Hill International Editions, Third Edition, 1976.

<b>Unit I:</b>	Chapter 6
<b>Unit II:</b>	Chapter 7
<b>Unit III:</b>	Chapter 8 (Pg. No: 172 - 191)
<b>Unit IV:</b>	Chapter 8, 9 (Pg.No: 192 - 219)
<b>Unit V:</b>	Chapter 9 (Pg.No: 220 - 244)

**Reference Books:**

2. Apostol, **Mathematical Analysis**, Narosa Publishing House, Second Edition, 2002.
3. V.Ganapathy Iyer, **Mathematical Analysis**, Tata McGraw Hill 1985.
4. S.C. Malik, **Principles of Real Analysis**, New Age International Pvt. Ltd., Second Edition.

**Core VII – Topology-I**  
(For those who joined since 2018-19)

**Semester : II**

**Sub.Code : FMMXC23/GMMXC23**

**Hours per week : 6**

**Credit : 5**

**CO 1:** Understand the Topological Spaces.

**CO 2:** Understand Continuous Functions and Metric Topology.

**CO 3:** Illustrate the Concept of Connected and Components.

**CO 4:** Gain the knowledge of Compact spaces in Topology.

**CO 5:** Understand the Separation Axioms.

**CO 6:** Understand the standard terms in Topology.

**Unit I** (18 hours)

Topological Spaces - Basis for a Topology - The Order Topology - The Product Topology on  $X \times Y$  - The Subspace Topology - **Self-Study:** Closed Sets and Limit Points.

**Unit II** (18 hours)

Continuous Functions - The Product Topology - The Metric Topology - **Self-Study:** The Metric Topology (Continued).

**Unit III** (18 hours)

Connected Spaces - Connected Subspaces of the Real Line - **Self-Study:** Components and Local Connectedness.

**Unit IV** (18 hours)

Compact Spaces - Compact Subspaces of the Real Line - Limit Point Compactness - **Self-Study:** Local Compactness.

**Unit V** (18 hours)

The Countability Axioms - The Separation Axioms - **Self-Study:** Normal Spaces.

**Text Book:**

1. James R. Munkres, **Topology**, PHI Learning Pvt. Ltd., New Delhi, Second Edition, 2009.

<b>Unit I:</b>	Chapter 2 (12 - 17)
<b>Unit II:</b>	Chapter 2 (18 - 21)
<b>Unit III:</b>	Chapter 3 (23 - 25)
<b>Unit IV:</b>	Chapter 3 (26 – 29)
<b>Unit V:</b>	Chapter 4 (30 - 32 )

**Reference Books:**

2. G. F. Simmons, **Introduction to Topology and Modern Analysis**, Tata McGraw-Hill Education Pvt. Ltd., Edition, 2004.
3. John L. Kelley, **General Topology**, Springer International Edition, Second Indian Reprint 2008.
4. Seymour Lipschutz, **General Topology**, Schaum's Outline Series, McGraw Hill Book Company, 2004.

**Core VIII - Differential Geometry**  
(For those who joined since 2018-19)

**Semester : II****Sub.Code : GMMXC24****Hours per week : 6****Credit : 5****CO 1:** Gain knowledge of space curves.**CO 2:** Understand the concept of intrinsic equations .**CO 3:** Gain knowledge of metric.**CO 4:** Understand the basic knowledge of Geodesic curvature.**CO 5:** Understand and apply the fundamental concepts in Normal property of geodesic.**CO 6:** Compute Involutives and Evolutes .**Unit I** (18 hours)

The Theory of Space Curves: Introductory remarks about space curves - Definitions - Arc length - Tangent, normal and binormal – **Self Study:** Curvature and torsion of a curve given as the intersection of two surfaces.

**Unit II** (18 hours)

Contact between curves and surfaces - Tangent surface, involutes and evolutes - Intrinsic equations, fundamental existence theorem for space curves - **Self Study:** Helices.

**Unit III (18 hours)**

The Metric: Local Intrinsic Properties of a Surface: Definition of a surface - Curves on a Surface - Surfaces of revolution - Helicoids – Metric – Direction coefficients - Families of curves - Isometric correspondence - **Self Study:** Intrinsic properties.

**Unit IV (18 hours)**

Geodesics - Canonical geodesic equations - Normal property of geodesics - Existence Theorems - Geodesic parallels - Geodesic curvature - Gauss-Bonnet theorem - **Self Study:** Gaussian curvature.

**Unit V (18 hours)**

The second fundamental form: Local non-intrinsic properties of a surface: Principal curvatures - **Self Study:** Lines of curvature.

**Text Book:**

1. T. J. Willmore, **An Introduction to Differential Geometry**, Oxford University Press, 1959.

<b>Unit I:</b>	Chapter 1(Pg. No: 1 - 18)
<b>Unit II:</b>	Chapter 1(Pg. No: 18 - 27)
<b>Unit III:</b>	Chapter 2(Pg. No: 31 - 54)
<b>Unit IV:</b>	Chapter 2(Pg. No: 54 - 80)
<b>Unit V:</b>	Chapter 3(Pg. No: 95 - 101)

**Reference Books:**

2. D Somasundaram, **Differential Geometry A First Course**, Narosa Publishing House, Sixth Reprint, 2014.
3. Christian Bar, **Elementary Differential Geometry**, Cambridge University Press India Pvt. Ltd., First Edition, 2011.
4. D.J.Struik, **Classical Differential Geometry**, Addison Wesley Publishing Company Inc., Massachusetts 1961.

**Elective II - Graph Theory**  
(For those who joined since 2018-19)

**Semester : II****Sub.Code : GMMXE2A****Hours per week : 6****Credit : 5****CO 1:** Ability to develop Trees, Connectivity and Blocks.**CO 2:** Demonstrate the concept of Euler Tour.**CO 3:** Understand the concept of Edge Colouring.**CO 4:** Discuss the Independent Set.**CO 5:** Analyze the concept of Vertex Colouring.**CO 6:** Translate real life situations to diagrammatic representations.**Unit I (18 hours)**

Trees - Connectivity – Blocks **Self-Study:** Construction of Reliable Communication Networks .

**Unit II (18 hours)**

Euler tour - Hamilton cycle - **Self-Study:** Applications.

**Unit III (18 hours)**

Matching - Perfect Matching - Edge colouring **Self-Study:** Vizing's Theorem.

**Unit IV** (18 hours)  
Independent sets – Cliques **Self-Study:** Turan’s Theorem.

**Unit V** (18 hours)  
Vertex Colouring **Self-Study:** Girth and Chromatic Number.

**Text Book:**

1. J.A. Bondy and U.S.R. Murthy, **Graph Theory with applications**, The Macmillan Press Ltd, Fifth Printing, 1982.

**Unit I:** Chapter 2(2.1 - 2.4) & Chapter 3(3.1 - 3.3)

**Unit II:** Chapter 4(4.1 - 4.3)

**Unit III:** Chapter 5(5.1 - 5.3) & Chapter 6(6.1 - 6.2)

**Unit IV:** Chapter 7(7.1 - 7.3)

**Unit V:** Chapter 8(8.1 – 8.5)

**Reference Books:**

2. R R. Balakrishnan, K. Ranganathan, **A Textbook of Graph Theory**, Springer International Edition, First Indian Reprint 2008.
3. John Clark & Derek Allan Holtan, **A First Look at Graph theory**, Allied Publishers Ltd., 1995.
4. S.A.Choudum, **A First Course in Graph Theory**, Macmillan India Ltd., First Edition, 1987.

**Core IX - Functional Analysis**  
(For those who joined since 2018-19)

**Semester : III**

**Sub.Code : GMMXC31**

**Hours per week : 6**

**Credits : 5**

**CO 1:** Solve the approximation of continuous functions and linear maps.

**CO 2:** Understand the statements and proof of important theorems.

**CO 3:** Know the application of Open Mapping and Closed graph theorem.

**CO 4:** Understand concept of Dual and Transposes with  $l^2$  and  $l^p$  spaces as examples.

**CO 5:** Acquired the knowledge of Inner product spaces and Riesz Representation theorems.

**CO 6:** Know a basic idea of Functional Analysis underpins Modern Analysis.

**Unit I** (18 hours)  
Fundamentals of Normed Spaces: Normed Spaces – **Self Study:** Continuity of Linear

Maps.

**Unit II** (18 hours)

Hahn-Banach Theorems - Banach Limits - **Self Study:** Banach Spaces.

**Unit III** (18 hours)

Bounded Linear Maps on Banach Spaces: Uniform Boundedness Principle - Closed Graph - **Self Study:** Open Mapping Theorems.

**Unit IV** (18 hours)

Spaces of Bounded Linear Functionals: Duals and Transposes - **Self Study:** Duals of  $L^p$  ( $[a, b]$ ) and  $C$  ( $[a, b]$ ) (excluding moment sequences).

**Unit V** (18 hours)

Geometry of Hilbert Spaces: Inner Product Spaces - Orthonormal Sets - **Self Study:** Projection and Riesz Representation Theorems.

**Text Book:**

1. Balmohan V Limaye, **Functional Analysis**, New Age International Pvt. Ltd., Second Edition, 2009.

<b>Unit I:</b>	Chapter II (Pg.No: 62 - 104)
<b>Unit II:</b>	Chapter II (Pg.No: 104 - 134)
<b>Unit III:</b>	Chapter III (Pg.No: 138 – 144 & 166 - 182)
<b>Unit IV:</b>	Chapter IV (Pg.No: 216 - 248)
<b>Unit V:</b>	Chapter VI (Pg.No: 367 – 401 & 420 - 431)

**Reference Books:**

2. George F. Simmons, **Introduction to Topology and Modern Analysis**, Tata McGraw- Hill, 2009.
3. P. K. Jain. O.P.Ahuja, Khalil Ahmad, **Functional Analysis**, New Age International Pvt. Ltd., 1995.
4. S. Ponnusamy, **Foundation of Functional Analysis**, Narosa Publishing House Pvt Ltd., 2011.

**Core X – Topology-II**  
(For those who joined since 2018-19)

**Semester : III****Sub.Code : FMMXC32/GMMXC32****Hours per week : 6****Credit : 5**

**CO 1:** Know the Urysohn lemma is the existence of real valued continuous function on a Normed space.

**CO 2:** Understand the Tychonoff theorem is of great usefulness to analysis

**CO 3:** Understand the paracompactness & Metrization theorems

**CO 4:** Understand the Function spaces and compact convergence

**CO 5:** Gain the knowledge of nowhere differentiable function from analysis

**CO 6:** Understand and apply the analysis concept in topology

**Unit I** **(18 hours)**

The Urysohn Lemma - The Urysohn Metrization Theorem - The Tietze Extension Theorem – **Self-Study:** Imbeddings of Manifolds.

**Unit II** **(18 hours)**

The Tychonoff Theorem - **Self-Study:** The Stone-Čech Compactification.

**Unit III** **(18 hours)**

Metrization Theorems and Para compactness: Local Finiteness - The Nagata-Smirnov - Metrization Theorem - Para Compactness - **Self-Study:** The Smirnov Metrization Theorem.

**Unit IV** **(18 hours)**

Complete Metric Spaces and Function Spaces: Complete metric spaces - A Space-Filling Curve - Compactness in Metric spaces - **Self-Study:** Pointwise and Compact Convergence.

**Unit V** **(18 hours)**

Ascoli's Theorem - Baire Spaces - **Self-Study:** A Nowhere-Differentiable Function.

**Text Book:**

1. James R.Munkres, **Topology**, PHL Learning Pvt. Ltd., New Delhi, Second Edition, 2009.

<b>Unit I:</b>	Chapter 4 (33 - 36)
<b>Unit II:</b>	Chapter 5 (37 - 38)
<b>Unit III:</b>	Chapter 6 (39 - 42)
<b>Unit IV:</b>	Chapter 7 (43 - 46)
<b>Unit V:</b>	Chapter 7, 8 (47 & 48 - 49)

**Reference Books:**

2. G. F. Simmons, **Introduction to Topology and Modern Analysis**, Tata McGraw-Hill education, Private Ltd. Edition, 2004.
3. John L.Kelley, **General Topology**, Springer International Edition, Second Indian Reprint 2008.
4. Seymour Lipschutz, **General Topology**, Schaum's Outline Series, McGraw Hill Book Company, 2004.

**Core XI - Classical Mechanics**  
(For those who joined since 2018-19)

**Semester : III****Sub.Code : FMMXC33/GMMXC33****Hours per week : 6****Credit : 5****CO 1:** Enable the students to understand the basic concepts of Mechanics**CO 2:** Prepare the students to understand basic concepts of Lagrangian and Hamilton's Approaches**CO 3:** Learn about central force problem**CO 4:** Know the basic concepts of Kepler Problem and its applications**CO 5:** Proficient in Variational Principle, Hamilton principle and Hamilton's Equations**CO 6:** Familiar with the main mathematical methods used in physics.**Unit I****(18 hours)**

Survey of the Elementary Principles: Mechanics of a Particle - Mechanics of a System of Particles - Constraints - D'Alembert's Principle and Lagrange's Equations - Velocity - Dependent Potentials and the Dissipation Function - **Self-Study:** Simple Applications of the Lagrangian Formulation.

**Unit II****(18 hours)**

Variational Principles and Lagrange's Equations: Hamilton's Principle - Some Techniques of the Calculus of Variations - Derivation of Lagrange's Equations from Hamilton's Principle - Extension of Hamilton's Principle to Nonholonomic Systems - Advantages of a Variational Principle Formulation - Conservation Theorems and Symmetry Properties - **Self-Study:** Energy Function and the Conservation of Energy.

**Unit III****(18 hours)**

The Central Force Problem: Reduction to the Equivalent One-Body Problem - The Equations of Motion and First Integrals - The Equivalent One-Dimensional Problem and Classification of Orbits - The Virial Theorem - The Differential Equation for the Orbit and Integrable Power - Law Potentials - **Self-Study:** Conditions for Closed Orbits.



**Unit IV (18 hours)**

The Kepler Problem: Inverse-Square Law of Force - The Motion in Time in the Kepler Problem - The Laplace - Runge - Lenz Vector - Scattering in a Central Force Field - Transformation of the Scattering Problem to Laboratory Coordinates - **Self-Study:** The Three-Body Problem.

**Unit V (18 hours)**

The Hamilton Equations of Motion: Legendre Transformations and the Hamilton Equations of Motion - Cyclic Coordinates and Conservation Theorems - Routh's Procedure - The Hamiltonian Formulation of Relativistic Mechanics - Derivation of Hamilton's Equations from a Variational Principle - **Self-Study:** The Principle of Least Action.

**Text Book:**

1. Herbert Goldstein, Charles Poole, John Safko, **Classical Mechanics**, Dorling Kindersley Publishing Inc., Third Edition, 2002.

<b>Unit I:</b>	Chapter 1 (1.1 - 1.6)
<b>Unit II:</b>	Chapter 2 (2.1 – 2.7)
<b>Unit III:</b>	Chapter 3 (3.1 – 3.6)
<b>Unit IV:</b>	Chapter 3 (3.7 – 3.12)
<b>Unit V:</b>	Chapter 8 (8.1 – 8.6)

**Reference Books:**

2. J.L.Synge and B.A.Griffith, **Principle of Mechanics**, McGraw Hill, 2003.
3. Madhumangal Pal, **A Course on Classical Mechanics**, Narosa Publishing House, 2009.
4. Herbert Goldstein, **Classical Mechanics**, Narosa Publishing House, New Delhi, Second Edition, 2000.

**Core XII - Probability and Statistics**  
(For those who joined since 2018-19)

**Semester : III****Sub.Code : GMMXC34****Hours per week : 6****Credit : 5****CO 1:** Determine probabilities of events in Statistical Method.**CO 2:** Know about various type of Distribution.**CO 3:** Apply sampling theories and concepts as well as change of variable.**CO 4:** Use method of Moment and Moment Generating Function.**CO 5:** Apply the Central Limit Theorem to Problem Involving Sums.**CO 6:** Provide essential tools in Theory of Statistics and its application.**Unit I (18 hours)**

Probability and Distribution: Introduction - Set Theory – The Probability Set Function - Conditional Probability and Independence - Random Variables of the Discrete type - Random variables of the Continuous type - Properties of the distribution function - Expectation of a random variable - Some special expectations - **Self-Study:** Chebyshev's Inequality.

**Unit II (18 hours)**

Multivariate Distributions: Distributions of Two Random Variables - Conditional Distributions and Expectations - The Correlation Coefficient - Independent Random Variables - **Self-Study:** Extension to Several Random Variables.

**Unit III** (18 hours)

Some special Distributions: The Binomial and Related Distributions - The Poisson Distribution - The Gamma and Chi-Square Distributions - The Normal Distributions - **Self-Study:** The Bivariate Normal Distribution.

**Unit IV** (18 hours)

Distributions of Functions of Random Variables: Sampling Theory - Transformations of Variables of the Discrete Type - Transformations of Variables of the Continuous Type - The Beta, t and F Distributions - Extensions of the Change of Variable Technique - Distributions of the Order Statistics - The Moment Generating Function Technique - **Self-Study:** The Distributions of  $\bar{X}$  and  $nS^2/\sigma^2$  - Expectations of Functions of Random Variables.

**Unit V** (18 hours)

Limiting Distributions: Convergence in Distribution - Convergence in Probability - Limiting Moment Generating Functions - The Central Limit Theorem - **Self-Study:** Some Theorems on Limiting Distributions.

**Text Book:**

1. Robert V. Hogg and Allen T. Craig, **Introduction to Mathematical Statistics**, Pearson Education Asia, Fifth Edition, 2004.

<b>Unit I:</b>	Chapter 1 (1.1 - 1.10)
<b>Unit II:</b>	Chapter 2 (2.1 – 2.5)
<b>Unit III:</b>	Chapter 3 (3.1 – 3.5)
<b>Unit IV:</b>	Chapter 4 (4.1 – 4.9)
<b>Unit V:</b>	Chapter 5 (5.1 – 5.5)

**Reference Books:**

2. S.C Gupta & V.K Kapoor, **Fundamental of Mathematical Statistics**, Sultan Chand & Sons, Educational Publisher, New Delhi, Tenth Edition, 2002.
3. A.P Baisnab and M Jas, **Elements of Probability and Statistics**, Tata McGraw Hill Publishing Company Ltd., Thirteenth Edition, 2006.
4. Hoel. P.G, **Introduction to Mathematical Statistics**, Willey, 1971.

**Elective III - Operations Research**  
(For those who joined since 2018-19)

**Semester : III****Sub.Code : FMMXE4B/GMMXE3B****Hours per week : 6****Credit : 5****CO 1:** Understand the concept of Applications of Branch and Bound Algorithm.**CO 2:** Understand the concepts of Backward and Forward Recursion in Dynamic Problems.**CO 3:** Gain knowledge of Decision Making.**CO 4:** Understand the Elements of Queuing Model and Pure Birth and Death Model.**CO 5:** Understand the Concepts of the General Poisson Queuing Model.**CO 6:** Understand the Concepts of the Inventory Model and Dynamic EOQ Model.**Unit I** (18 hours)

Integer Linear Programming - Illustrative Applications - Integer Programming Algorithms: Branch and Bound Algorithm – **Self-Study:** Cutting-Plane Algorithm.

**Unit II (18 hours)**

Deterministic Dynamic Programming: Recursive Nature of DP Computations - Forward and Backward Recursion - Selected DP Applications - **Self-Study:** Problem of Dimensionality.

**Unit III (18 hours)**

Decision Analysis: Decision Making under Certainty - Decision Making under Risk-  
**Self-Study:** Decision under Uncertainty.

**Unit IV (18 hours)**

Elements of a Queuing Model - Role of Exponential Distribution - Pure Birth and Death Models - General Poisson Queuing Model - **Self-Study:** Specialized Poisson Queues.

**Unit V (18 hours)**

Deterministic Inventory Models: General Inventory Model - Role of Demand in the Development of Inventory Models - Static Economic-order-Quantity (EOQ) Models - **Self-Study:** Dynamic EOQ Models.

**Text Book:**

1. Hamdy A. Taha, **Operations Research: An Introduction**, Prentice Hall of India, Ninth Edition, 2016.

**Unit I:** Chapter 9 (9.1 - 9.2)

**Unit II:** Chapter 12 (12.1 - 12.4)

**Unit III:** Chapter 15 (15.1 - 15.3)

**Unit IV:** Chapter 18 (18.2 - 18.6)

**Unit V:** Chapter 13 (13.1 - 13.4)

**Reference Books:**

2. Kanti Swarup, P.K.Gupta, Man Mohan, **Operations Research**, Sultan Chand & Sons Educational Publishers, New Delhi, Thirteenth Edition, 2006.
3. Ravindran, Philips, Solberg, **Operations Research Principle and Practice**, Wiley India, Second Edition, 2012.
4. Fredrick S.Hillier, Gerald J.Lieberman, **Operations Research Concepts and Cases**, Tata Mc Graw Hill Publishing Company Ltd., Eighth Edition, 2009.

**Core XIII- Complex Analysis**  
**(For those who joined since 2018-19)**

**Semester : IV**

**Sub.Code : FMMXC41/GMMXC41**

**Hours per week : 6**

**Credit : 5**

**CO 1:** Apply theorems related to the algebra and geometry of the complex plane.

**CO 2:** Apply results of the theory of analytic and holomorphic functions of complex variable.

**CO 3:** Identify the location and nature of a singularity of a function and calculate the order and the residue.

**CO 4:** Apply basic results in Cauchy integral theory and its consequences, Residue Calculus.

**CO 5:** Write solutions to problems and extend theoretical proofs to examples.

**CO 6:** Apply techniques from Complex Analysis to deduce results in other areas of Mathematics.

**Unit I (18 hours)**

Introduction to the Concept of Analytic Function: Limits and Continuity - Analytic Functions - Polynomials - Rational Functions. Elementary theory of Power Series: Sequences - Series - Uniform Convergence - Power Series - Abel's limit Theorem. Conformality: Arcs and Closed curves - Analytic Functions in Regions Conformal Mapping - Length and Area. Linear Transformations: The Linear Group - The Cross Ratio - Symmetry - Oriented Circles - **Self-Study:** Families of Circle.

**Unit II (18 hours)**

Fundamental Theorems: Line Integrals - Rectifiable Arcs - Line integrals as Functions of Arcs - Cauchy's Theorem for a Rectangle - Cauchy's Theorem in a Disk. Cauchy's Integral Formula: The Index of a Point with respect to a Closed Curve - The Integral Formula - **Self-Study:** Higher Derivatives.

**Unit III (18 hours)**

Local Properties of Analytical Functions: Removable Singularities. Taylor's theorem Zeros and Poles - The Local Mapping - **Self-Study:** The Maximum Principle.

**Unit IV (18 hours)**

The Calculus of Residues: The Residue Theorem - The Argument Principle - **Self-Study:** Evaluation of Definite Integrals.

**Unit V (18 hours)**

Power Series Expansions: Weierstrass's Theorem - The Taylor series - The Laurent Series - Partial Fractions and Factorization: Partial Fractions - Infinite Products - **Self-Study:** Canonical Products. Entire Functions: Jensen's Formula.

**Text Book:**

1. Lars V. Ahlfors, **Complex Analysis**, McGraw Hill International, Third Edition, 1979.

<b>Unit I:</b>	Chapter 2(Sec.1.2), 3(Sec.2.3)
<b>Unit II:</b>	Chapter 4(Sec.1.2)
<b>Unit III:</b>	Chapter 4(Sec.3)
<b>Unit IV:</b>	Chapter 4(Sec.5)
<b>Unit V:</b>	Chapter 5(Sec.1.1, 1.3, 2.1 – 2.3, 3.1)

**Reference Books:**

2. V Karunakaran, **Complex Analysis**, Narosa Publishing House, Second Edition, 2005.
3. John M. Howie, **Complex Analysis**, Springer – Verlog London limited, 2003
4. Liang-shin Hahn, Bernard Epstein, **Classical Complex Analysis**, Jones and Bartlett publishers Inc, 1996.

**Core XIV - Advanced Statistics**  
(For those who joined since 2018-19)

**Semester : IV****Sub.Code : FMMXC42/GMMXC42****Hours per week : 6****Credit : 5****CO 1:** knowledge interesting the hypothesis for large and small samples.**CO 2:** Demonstrate understanding of the sufficient statistics.**CO 3:** Explain the comprehensive idea about the Bayesian Estimations.

**CO 4:** Know the knowledge about statistical tests and estimations.

**CO 5:** Students shall be able to effectively communicate results of Statistical Analysis.

**CO 6:** Identify the features that describe a data distribution.

**Unit I (18 hours)**

Introduction to Statistical Inference: Point Estimation - Confidence Intervals for Means - Confidence Intervals for Differences of Means - Test of Statistical Hypothesis - Additional Comments About Statistical Tests - **Self-Study:** Chi-Square Tests.

**Unit II (18 hours)**

Sufficient Statistics: Measures of Quality of Estimators - A Sufficient Statistic for a Parameter - Properties of a Sufficient Statistic - Completeness and Uniqueness - The Exponential class of Probability Density Functions - **Self-Study:** Functions of a Parameter.

**Unit III (18 hours)**

More About Estimation: Bayesian Estimation - Fisher Information and the Rao-Cramer Inequality- **Self-Study:** Limiting Distributions of Maximum Likelihood Estimators.

**Unit IV (18 hours)**

Theory of Statistical Tests: Certain Best Tests - Uniformly Most Powerful Tests - Likelihood Ratio Tests - **Self-Study:** The Sequential Probability Ratio Test.

**Unit V (18 hours)**

Inferences about Normal Models: The Distributions of Certain Quadratic Forms - A Test of the Equality of Several Means - Noncentral  $\chi^2$  and Noncentral F – Multiple Comparisons - The Analysis of Variance - A Regression Problem - **Self-Study:** A Test of Independence.

**Text Book:**

1. Robert V. Hogg and Allen T. Craig, **Introduction to Mathematical Statistics**, Pearson Education Asia, Fifth Edition, 2004.

**Unit I:** Chapter 6 (6.1 – 6.6)

**Unit II:** Chapter 7 (7.1 – 7.6)

**Unit III:** Chapter 8 (8.1 - 8.3)

**Unit IV:** Chapter 9 (9.1 – 9.4)

**Unit V:** Chapter 10 (10.1 - 10.7)

**Reference Books:**

2. A.P Baisnab and M .Jas, **Elements of Probability and Statistics**, Tata McGraw Hill Publishing Company Ltd., New Delhi, Thirteenth Edition, 2006.
3. S.C.Gupta, **Fundamentals of Statistics**, Himalaya publishing house, Sixth Edition, 2004.
- 4 . John E.Freund , **Mathematical statistics**, Prentice Hall of India, Fifth Edition, 1994.

**Core XV - Project**

(For those who joined since 2018-19)

**Semester : IV**

**Sub.Code : FMMXC44PW/GMMXC43PW**

**Hours per week : 18**

**Credit : 5**

**CO 1:** Develop a critical awareness of a topic of current research.

**CO 2:** Acquire a deeper and systematic understanding of selected areas of pure mathematics.

**CO 3:** Cultivate a mathematical attitude and nurture the interests.

**Elective II - Probability and Statistics**  
**(For those who joined since 2018-19)**

**Semester : II**  
**Sub.Code : FMITE21C/GMITE2A**

**Hours per week : 6**  
**Credit : 5**

**CO 1:** Apply Probability theory using random variables.

**CO2:** Acquainted knowledge in various measures of central tendency and their characteristics.

**CO 3:** Calculate the mean and variance of special probability distribution.

**CO 4:** Gain knowledge about the interval estimation.

**CO 5:** Construct exact and approximate confidence intervals.

**CO 6:** Explain chi square test to evaluate the fit of hypothesized distribution.

**Unit I** **(18 hours)**

Probability Theory: Random Experiment - Mathematical or Apriori Definition of Probability - Statistical or Aposteriori Definition of probability - Axiomatic Definition of Probability - Conditional Probability - Independent Events - Theorem of Total Probability - Baye's Theorem or Theorem of Probability of Causes - **Self-Study:** Random Variables.

**Unit II** **(18 hours)**

Statistical Averages: Statistical Measures - Measure of Central Tendency - Mathematical Expectation and Moments - Relation Between Central and Non central Moments - Dispersion - Definitions - The Coefficient of variation - Properties of variation - Skewness - Kurtosis - Pearson's Shape Coefficient of skewness - Expected values of Two-Dimensional random variable - Properties of Expected Values - Conditional Expected Values - **Self-Study:** Properties.

**Unit III** **(18 hours)**

Some Special Probability Distributions: Introduction - Special Discrete Distributions - Mean and Variance of the Binomial Distribution - Recurrence Formula for the Central Moments of the Binomial Distribution - Poisson Distribution as Limiting form of Binomial Distribution - Mean and Variance of Poisson distribution - Geometrical Distribution - Standard Normal Distribution - Normal Probability Curve - Properties of the Normal Distribution - **Self-Study:** Importance of Normal Distribution.

**Unit IV** **(18 hours)**

Tests of Hypothesis: Parameters and Statistics - Sampling Distribution - Estimation and Testing of Hypothesis - Tests of Hypothesis and Tests of Significance - Critical Region and Level of Significance - Errors in Testing of Hypotheses - One-tailed and two-tailed Tests - Critical Values or Significant Values - Procedure for Testing of Hypotheses - Interval Estimation of Population Parameters - **Self-Study:** Tests of Significance for Large Samples.

**Unit V** **(18 hours)**

Chi-Square Distribution - Properties of  $\chi^2$  Distribution - Uses of  $\chi^2$  Distribution -  $\chi^2$ -Test of Goodness of Fit - Conditions for the Validity of  $\chi^2$  Test - **Self-Study:**  $\chi^2$  test of Independence of Attributes.

**Text Book:**

1. T.Veerarajan, **Probability, Statistics and Random Processes**, Tata McGraw Hill Education Private Limited, Third Edition, 2009.

**Unit I:** Chapter 1, 2 (Pg. No: 1 – 17 & 33 - 57)

**Unit II:** Chapter 4 (Pg. No: 111 - 120)

**Unit III:** Chapter 5 (Pg. No: 208 – 215 & 246 - 255)

**Unit IV:** Chapter 8 (Pg. No: 419 - 426)

**Unit V:** Chapter 8 (Pg. No: 466 - 468)

**Reference Books:**

2. S. Arumugam and A. Thangapandi Isaac, **Statistics**, New Gamma Publishing House, July 2009.
3. S.C Gupta, **Fundamental of Statistics**, Himalaya publishing house, Seventh edition, 2012.
4. Mood. A. M. Graybill, F.A & Boes D.G, **Introduction to Theory of Statistics**, Mc Graw Hill, 1974.

**B Sc MATHEMATICS**  
**(3-Year Regular Programme)**  
**(For those who joined since 2018-19)**

**PSO 1:** Connect Mathematics to real life problems in their lives.

**PSO 2:** Investigate and apply Mathematical problems and solutions to a variety of contexts related to science.

**PSO 3:** Prepare for a career in which critical thinking is a central features.

**PROGRAMME STRUCTURE**

Sem	Part	Subject code	Course	Subject Title	Hrs/ Wk	Credits	CIA Marks	ESE Marks	Total Marks
I	I	GBLT11 / GBLA11 /GBLIA11/ GBLH11	Language I	Tamil-I/Arabic-I :Basic Arabic-I /Intermediate Arabic-I/Hindi-I	6	6	40	60	100
	II	GBLG12/ GBLF12	Language II	English-I: General/Functional	6	6	40	60	100
	III	GBMXC11	Core I	Calculus	5	4	40	60	100
		GBMXC12	Core II	Theory of Equations	5	4	40	60	100
		GBMXA13	First Allied I	Statistics-I	6	5	40	60	100
	IV	GBMXE14	Skill Based Elective I	Trigonometry	2	2		50	50
				<b>Total</b>	<b>30</b>	<b>27</b>	<b>200</b>	<b>350</b>	<b>550</b>
II	I	GBLT21 / GBLA21 /GBLIA21/ GBLH21	Language I	Tamil-II / Arabic-II : Basic Arabic- II /Intermediate Arabic-II /Hindi-II	6	6	40	60	100
	II	GBLG22 / GBLF22	Language II	English-II: General/Functional	6	6	40	60	100
	III	GBMXC21	Core III	Analytical Geometry-3D & Vector Calculus	4	3	40	60	100
		GBMXC22	Core IV	Graph Theory-I	4	3	40	60	100
		GBMXA23	First Allied II	Statistics-II	6	5	40	60	100
	IV	GBMXE24	Skill Based Elective II	Fourier series	2	2		50	50

	IV	GBES2	General Interest Course I	Environmental Studies	2	2		50	50
		GBMXX2/ GBMXX2O	Extra Credit	Arithmetic for Competitive Examinations / * Online Certification		2		100	100
				<b>Total</b>	<b>30</b>	<b>27+2</b>	<b>200</b>	<b>400+100</b>	<b>600+100</b>
III	III	GBMXC31	Core V	Differential Equations	6	4	40	60	100
		GBMXC32	Core VI	Graph Theory-II	6	4	40	60	100
		GBMXA33	Second Allied I	Programming in "C"	6	5	T-20 P-20	60	100
	IV	GBNM3MX	Non Major Elective I		4	2		50	50
		GBMXE34	Skill Based Elective III	Applied Statistics	3	2		50	50
		GBHR3	General Interest Course II	Human Rights	3	2		50	50
	V	GBXTN3	Extension	NSS/CSS	2	2	100		100
		GBMXX3 / GBMXX3O	Extra Credit	Logical Reasoning / * Online Certification		2		100	100
				<b>Total</b>	<b>30</b>	<b>21+2</b>	<b>220</b>	<b>330+100</b>	<b>550+100</b>
	IV	III	GBMXC41	Core VII	Abstract Algebra-I	5	4	40	60
GBMXC42			Core VIII	Real Analysis-I	5	4	40	60	100
GBMXC43			Core IX	Statics	5	4	40	60	100
GBMXA44			Second Allied II	Object Oriented Programming with C++	6	5	T-20 P-20	60	100
IV		GBVE4	General Interest Course III	Values and Ethics	2	2		50	50
		GBNM4MX	Non Major Elective II		4	2		50	50
		GBMXE45	Skill Based Elective IV	Verbal Reasoning	3	2		50	50
		GBMXX4 / GBMXX4O	Extra Credit	Applications of Group Theory/ * Online Certification		2		100	100
				<b>Total</b>	<b>30</b>	<b>23+2</b>	<b>160</b>	<b>390+100</b>	<b>550+100</b>



V	III	GBMXC51	Core X	Abstract Algebra-II	4	3	40	60	100
		GBMXC52	Core XI	Dynamics	5	4	40	60	100
		GBMXC53	Core XII	Astronomy	4	3	40	60	100
		GBMXE5A	Core Elective I	Fourier and Laplace Transforms	5	5	40	60	100
		GBMXE5B		Combinatorics					
		GBMXE5C	Core Elective II	Fluid Dynamics	5	5	40	60	100
	GBMXE5D	Operations Research							
	IV	GBMXE54	Skill Based Elective V	Non-Verbal Reasoning	3	2		50	50
		GBWS5	General Interest Course IV	Women Studies	3	2		50	50
				Library	1				
	GBMXX5 / GBMXX50	Extra Credit	Quantitative Techniques/ * Online Certification		2		100	100	
			<b>Total</b>	<b>30</b>	<b>24+2</b>	<b>200</b>	<b>400+100</b>	<b>600+100</b>	
VI	III	GBMXC61	Core XIII	Real Analysis-II	5	4	40	60	100
		GBMXC62	Core XIV	Number theory	5	4	40	60	100
		GBMXC63	Core XV	Numerical Analysis	5	4	40	60	100
		GBMXC64	Core XVI	Complex analysis	5	4	40	60	100
		GBMXE6A/ GBMXE6B	Core Elective III	Discrete Mathematics /Mathematical Modeling	5	5	40	60	100
	IV	GBMXE65	Skill Based Elective VI	Quantitative Aptitude	3	2		50	50
				Library	2				
		GBSED6	Extra Credit	Skills for Employability Development		2	100		100
				<b>Total</b>	<b>30</b>	<b>23+2</b>	<b>200+100</b>	<b>350</b>	<b>550+100</b>
				<b>Grand Total</b>	<b>180</b>	<b>145 + 10</b>	<b>1180 + 100</b>	<b>2220 + 400</b>	<b>3400 + 500</b>

**Core Courses for other UG Programme**

Sem	Part	Subject code	Course	Subject Title	Hrs/ Wk	Credit	CIA Marks	ESE Marks	Total Marks
III	III	GBITCA31	Core V	Mathematics for Computer Science-I	5	4	40	60	100
IV	III	GBITCA41	Core VIII	Mathematics for Computer Science-II	6	4	40	60	100

**Allied Courses for other UG Programme**

Sem	Part	Subject code	Course	Subject Title	Hrs/ Wk	Credit	CIA Marks	ESE Marks	Total Marks
III	III	GBCSA33	Second Allied I	Mathematical Foundation for Computer science	6	5	40	60	100
IV	III	GBCSA44	Second Allied II	Operations Research	6	5	40	60	100

**Allied Courses for other UG Programme**

Sem	Part	Subject code	Course	Subject Title	Hrs/ Wk	Credit	CIA Marks	ESE Marks	Total Marks
I	III	GBCHA13	Allied I	Ancillary Mathematics-I	6	5	40	60	100
II	III	GBCHA23	Allied II	Ancillary Mathematics-II	6	5	40	60	100
III	III	GBSYA33	Allied III	Psychological Statistics	6	5	40	60	100

**Non Major Elective For Students Other than B Sc Mathematics Programme**

Sem	Part	Subject code	Course	Subject Title	Hrs/ Wk	Credit	CIA Marks	ESE Marks	Total Marks
III	IV	GBNM3MX	Non Major Elective I	Quantitative Aptitude for Competitive Examinations-I	4	2	-	50	50
IV	V	GBNM4MX	Non Major Elective II	Quantitative Aptitude for Competitive Examinations-II	4	2	-	50	50

\*For Online Certification credit alone will be assigned on submission of certificate obtained through appearing for Online examination from NPTL, Spoken tutorial, courrera and open to study.

**Core I - Calculus**  
(For those who joined since 2018-19)

**Semester: I****Hours per Week: 5****Sub.Code: FBMXC11/GBMXC11****Credit: 4****CO 1:** Develop the problem solving skills.**CO 2:** Familiarize with the applications of differential calculus.**CO 3:** Understand the concept of multiple integral techniques**CO 4:** Ability to evaluate integrals by a repeated use of integration by parts**Unit I** **(15 hours)**Tangent and Normal - Subtangent and subnormal - Differential coefficient of the length of an arc of  $y = f(x)$  - Polar coordinates.**Unit II** **(15 hours)**

Envelopes - Curvature - The Co-ordinates of the center of curvature - Evolute and Involute - Chord of Curvature.

**Unit III** **(15 hours)**

Linear Asymptotes - Special Cases - Another Method for finding asymptotes - Asymptotes by inspection - Intersections of a curve with its asymptotes.

**Unit IV** **(15 hours)**

Properties of definite integrals - Integration by parts, Reduction formulae - Bernoulli's formula.

**Unit V** **(15 hours)**

Multiple integrals: Definition of double integrals - Evaluation of double integral – Double integral in polar co-ordinates - Triple integrals - Applications of Multiple integrals.

**Text Books:**

1. S. Narayanan, T. K. Manicavachagom Pillay, **Calculus - Volume I**, Divya Subramanian for Ananda Book Depot. 2017.

**Unit I:** Chapter 9**Unit II:** Chapter 10**Unit III:** Chapter 11

2. S. Narayanan, T. K. Manicavachagom Pillay, **Calculus - Volume II**, Divya Subramanian for Ananda Book Depot. 2017.

**Unit IV:** Chapter 1(sec 11 - 15.1)**Unit V:** Chapter 5(sec 1 - 5.4 )**Reference Books:**

3. Dr. S. Arumugam & A. Thangapandi Issac, **Calculus**, New Gamma Publishing House. June 2014.
4. Shanthi Narayan and P. K. Mittal **Differential Calculus**, S. Chand & Company 2008
5. George B. Thomas, Jr. & Ross L. Finney, **Calculus**, Pearson Education (Singapore) pvt. Ltd., Indian Branch, Seventh Edition. Reprint 2004.

**Core II- Theory of Equations**  
(For those who joined since 2018-19)

**Semester: I**  
**Sub.Code: GBMXC12**

**Hours per Week: 5**  
**Credit: 4**

- CO 1:** Understand the properties of equations.  
**CO 2:** Understand the transformation of equations.  
**CO 3:** Gain knowledge to find the roots for the different types of equations.  
**CO 4:** Understand the concept of Algebra

**Unit I** **(15 hours)**

Theory of Equations: Remainder Theorem - Every equation  $f(x) = 0$  of the  $n^{\text{th}}$  degree has  $n$  roots and no more - In an equation with real coefficients, imaginary roots occur in pairs - In an equation with rational coefficients irrational roots occur in pairs - Relations between the roots and coefficients of equations.

**Unit II** **(15 hours)**

Symmetric function of the roots - Sum of the powers of the roots of an equation - Newton's theorem on the sum of the powers of the roots - Transformations of equations - Reciprocal equation - To increase or decrease the roots of a given equation by a given quantity - Form of the quotient and remainder when a polynomial is divided by a binomial.

**Unit III** **(15 hours)**

Removal of terms - To form an equation whose roots are any power of the roots of a given equation - Transformation in general - Descartes' Rule of signs

**Unit IV** **(15 hours)**

Rolle's Theorem - Multiple roots - Sturm's Theorem - Solutions of numerical equations - Newton's method of divisors

**Unit V** **(15 hours)**

Horner's method - Graphical solutions of numerical equations - Cubic equation - Biquadratic equations - General solution of the Cubic equations - Solution of biquadratic equations.

**Text Book:**

1. T.K. Manicavachagom Pillay, T. Natarajan & K.S. Ganapathy, **Algebra - Volume I**, Divya Subramanian for Ananda Book Depot. 2017.

**Unit I:** Chapter 6 (Sec 1 - 11)

**Unit II:** Chapter 6 (Sec 12 - 18)

**Unit III:** Chapter 6 (Sec 19 - 24)

**Unit IV:** Chapter 6 (Sec 25 - 29)

**Unit V:** Chapter 6 (Sec 30 - 35)

**Reference Books:**

1. N.P. Bali, **Golden Maths Series Algebra**, Laxmi Publications Pvt. Ltd. First Edition 1990.
2. Dr S. Arumugam & A. Thngapndi Issac, **Algebra Theory of Equations Theory of Numbers and Trigonometry**, New Gamma Publishing House. Edition 2011.
3. K. Khurana and S.B Malik, Elementary topics in Algebra, Vikas Publishing House Pvt. Ltd., 1994.

**First Allied I – Statistics-I**  
(For those who joined since 2018-19)

**Semester: I****Sub.Code: FBMXA13 / GBMXA13****Hours per Week: 6****Credits: 5****CO 1:** Develop skills in basic statistical concepts**CO 2:** Apply the various measures of statistical parameters to real life**CO 3:** Know about correlation and regression**CO 4:** Understand and use the language of probability**CO 5:** Learn about random variables**CO 6:** Students will formulate complete and correct mathematical proofs.**Unit I** **(18 hours)**

Central Tendencies: Measures of Central Tendencies - Arithmetic mean - Partition values  
- Mode - Geometric mean and Harmonic mean - Relative advantages of different averages.

**Unit II** **(18 hours)**

Measures of dispersion: Moments – Skewness - Kurtosis

**Unit III** **(18 hours)**

Correlation and Regression: Correlation - Rank Correlation – Regression - Correlation  
co- efficient for a bivariate frequency distribution

**Unit IV** **(18 hours)**

Probability: Conditional Probability

**Unit V** **(18 hours)**

Random variables: Discrete random variable - Continuous random variable -  
Mathematical expectations - Moment generating function - Characteristic function

**Text Book:**

1. Dr. S. Arumugam and A. Thangapandi Isaac, **Statistics**, New Gamma Publishing House, June 2015.

**Unit I:** Chapter 2**Unit II:** Chapter 3,4**Unit III:** Chapter 6**Unit IV:** Chapter 11**Unit V:** Chapter 12**Reference Books:**

2. K. R. Gupta, **Mathematical Statistics**, Atlantic Publishers & distributors (p) Ltd, 2015.
3. P. N. Arora, and P. K. Malhan, **Biostatistics**, Himalaya Publishing House, First Edition, 1996.
4. S. C. Gupta, **Fundamentals of Statistics**, Himalaya Publishing House, Sixth Edition, 2004.

**Skill Based Elective I - Trigonometry**  
(For those who joined since 2018-19)

**Semester: I****Sub.Code: FBMXE14 / GBMXE14****Hours per Week: 2****Credit: 2**

**CO 1:** Recognize the reciprocal relationship between sine/cosecant, cosine/secant, and tangent.

**CO 2:** Identifying the six trigonometric functions and solve their expansions.

**CO 3:** Know the definition and details about hyperbolic functions and the inverse hyperbolic functions.

**CO 4:** To expose trigonometry as a tool in solving problem.

**Unit I** **(6 hours)**

Expansions of  $\cos n\theta$  and  $\sin n\theta$  - Expansion of  $\tan n\theta$  in power of  $\tan \theta$  - Expansion of  $\tan(A+B+C+\dots)$ .

**Unit II** **(6 hours)**

Examples on formation of equations - Powers of sines and cosines of  $\theta$  in terms of function of multiples of  $\theta$  - Expansions of  $\cos^n \theta$  when  $n$  is a positive integer.

**Unit III** **(6 hours)**

Expansion of  $\sin^n \theta$  when  $n$  is a positive integer - Expansions of  $\sin \theta$  and  $\cos \theta$  in a series of ascending powers of  $\theta$

**Unit IV** **(6 hours)**

Hyperbolic functions - Relations between hyperbolic functions - Inverse hyperbolic functions.

**Unit V** **(6 hours)**

Resolution into factors - Logarithm of complex quantities

**Text Book**

1. S. Narayanan and T. K. Manicavachagom pillay, **Trigonometry**, S. Viswanathan (printers and publishers) Pvt., Ltd, 2015.

**Unit I:** Chapter 3 (Pg. No:61-66)

**Unit II:** Chapter 3 (Pg. No:68-79)

**Unit III:** Chapter 3 (Pg. No:79-89)

**Unit IV:** Chapter 4 (Pg. No:93-108)

**Unit V:** Chapter 5 (Pg. No:109-130)

**Reference Books**

2. S. Narayanan. R. Hanumantha Rao, T.K. Manicavachagam Pillay and Dr. P. Kandasamy, **Ancillary Mathematics - volume I**. S. Viswanathan (Printers and Publishers), Pvt. Ltd, 2010.
3. K. S. Rawat, **Trigonometry**, Sarup & Sons, First edition, 2005.
4. T. Veerarajan, **Trigonometry, Algebra and Calculus**, Tata McGraw - Hill Publishing company Ltd, New Delhi, First edition, 2003.

**Core III - Analytical Geometry - 3D & Vector Calculus**  
(For those who joined since 2018-19)

**Semester: II****Hours per Week: 4****Sub.Code: FBMXC21 /GBMXC21****Credit: 3****CO 1:** Improve their analytical ability in Plane and Straight line.**CO 2:** Understand the concepts of Sphere.**CO 3:** Explain the Concepts of Vector Differentiation and Divergence.**CO 4:** Understand the concepts of Vector Integration**Unit I** **(12 hours)**

The Plane: Plane Equations - Angle between the planes - Equation to a plane passing through the line of intersection of two given planes - Length of the perpendicular.

**Unit II** **(12 hours)**

The straight line: Symmetrical form - Image of the point - the plane and the straight line - Coplanar Lines.

**Unit III** **(12 hours)**

The Sphere: Equation of a Sphere - Plane section of a sphere - Equation of a circle - The Intersection of two spheres – Tangent and Tangent plane - Orthogonal spheres.

**Unit IV** **(12 hours)**

Vector Differentiation: Differentiation of a vector - Geometric interpretation of the Derivative - Differentiation of the Dot and Cross products - Gradient, Divergence & Curl: The vector differential operator Del - Gradient of a Scalar function - The Divergence of a Vector – Physical Interpretation of the Divergence of a vector - Physical Interpretation of the Curl of a vector.

**Unit V** **(12 hours)**

Vector integration: Integration of a vector: The line integral - Green`s theorem in two dimensions – Extension of Green`s theorem.

**Text Book**

1. Dr. M.K.Venkataraman & Mrs. Manorama Sridhar, **Analytical Geometry– 3D & Vector Calculus**, The National Publishing Company, First Edition. Dec 2001.

**Unit I:** Chapter 2(2.1 to 2.13)**Unit II:** Chapter 3(3.1 to 3.11)**Unit III:** Chapter 4(4.1 to 4.12)**Unit IV:** Chapter 2, 3(3.1 to 3.10)**Unit V:** Chapter 4 (4.1 to 4.4)**Reference Books:**

2. Dr. S. Arumugam & A. Thangapandi Isaac, **Analytical Geometry-3D and Vector Calculus**, New gamma publishing house. 2006.
3. T.K. Manicavachagom Pillay and T. Natarajan, **A text book of Analytical Geometry Part II – Three Dimensions**, S.Viswanathan (Printers & Publishers) Pvt. Ltd. 2010
4. P.K. Jain and Khalil Ahmad, **Analytical geometry of Three Dimensions**, Wiley Eastern Limited.1994

**Core IV - Graph Theory-I**  
(For those who joined since 2018-19)

**Semester: II****Sub.Code: FBMXC22 / GBMXC22****Hours Per Week: 4****Credit: 3****CO 1:** Able to apply basic definition of Graph Theory.**CO 2:** Understand the concept of connectedness**CO 3:** Determine the degree sequence of graph.**CO 4:** Ability to prove the Euler result in Eulerian graph.**Unit I** (12 hours)

Graphs and Subgraphs - Introduction - Definition and Examples – Degrees – Subgraphs - Isomorphism.

**Unit II** (12 hours)

Ramsey Numbers - Independent Sets and Coverings - Intersection graphs and Line graphs - Matrices - Operations on Graphs.

**Unit III** (12 hours)

Degree Sequences - Introduction - Graphic Sequences. Connectedness: Introduction - Walks, Trails and Paths.

**Unit IV** (12 hours)

Connectedness and Components - Blocks - Connectivity.

**Unit V** (12 hours)

Eulerian and Hamiltonian Graphs - Introduction - Eulerian Graphs - Hamiltonian Graphs. Trees: Introduction - Characterisation of Trees - Centre of a Tree.

**Text Book**

1. S. Arumugam & S. Ramachandran, **Invitation to Graph Theory**, Scitech Publications (India) Pvt. Ltd., 2001.

**Unit I:** Chapter 2 (sec 2.0 – 2.4)**Unit II:** Chapter 2 (sec 2.5 – 2.9)**Unit III:** Chapter 3,4 (sec 3.0 – 4.1)**Unit IV:** Chapter 4 (sec 4.2 – 4.4)**Unit V:** Chapter 5,6 (sec 5.0 – 6.2)**Reference Books:**

2. Robin J. Wilson, **Introduction to Graph Theory**, Prentice Hall Publication, Fourth Edition.
3. John Clark & Derek Allan Holtan, **A First Look at Graph Theory**, Allied Publishers Ltd, 1995.
4. Harary, **Graph Theory**, Narosa Publishing House, 10<sup>th</sup> Reprint, 2001.

**First Allied II – Statistics-II**  
(For those who joined since 2018-19)

**Semester: II****Sub.Code: FBMXA23 /GBMXA23****Hours per Week: 6****Credit: 5****CO 1:** Understand the various statistical distributions



- CO 2:** Know about sampling theory  
**CO 3:** Classify small samples along with errors  
**CO 4:** Understand the applications of various statistical tests  
**CO 5:** Understand different criterions  
**CO 6:** Apply them to real life problems.

**Unit I** (18 hours)  
 Some special distributions: Binomial, Poisson and Normal distribution.

**Unit II** (18 hours)  
 Test of significance (Large samples): Sampling - Sampling distribution - Testing of Hypothesis - Tests of significance for proportions and percentages - Tests of significance for means - Tests for Standard deviations - Tests of significance for Correlation coefficient.

**Unit III** (18 hours)  
 Test of significance (Small samples): Test of significance based on t-distribution. Test of significance based on F-test distribution - Test for significance of an Observed Sample Correlation

**UNIT IV** (18 hours)  
 Tests based on  $\chi^2$  - distribution:  $\chi^2$  test for population variance -  $\chi^2$  test to test the goodness of fit - Test for Independence of Attributes.

**UNIT V** (18 hours)  
 Analysis of variance: One criterion of classification - Two criteria of classification - Three Criteria of classification - Latin squares.

**Text Book:**

1. Dr. S.Arumugam and A. Thangapandi Isaac, **Statistics**, New Gamma Publishing House, June 2015.  
**Unit I:** Chapter 13  
**Unit II:** Chapter 14  
**Unit III:** Chapter 15  
**Unit IV:** Chapter 16  
**Unit V:** Chapter 17

**Reference Books:**

2. T. Veerarajan, **Fundamentals of Mathematical Statistics**, Published by Yes Dee Publishing Pvt Ltd, Reprint, 2017.
3. P. N. Arora, and P.K Malhan, **Biostatistics**, Himalaya Publishing House, First Edition 1996.
4. S. C. Gupta, **Fundamentals of Statistics**, Himalaya Publishing House, Sixth Edition, 2004.

**Skill Based Elective II - Fourier Series**  
**(For those who joined since 2018-19)**

**Semester: II**  
**Sub.Code: FBMXE24 /GBMXE24**

**Hours per Week: 2**  
**Credit: 2**

- CO1:** Understand the basic concepts of Fourier series and Fourier expansion.  
**CO2:** Understand the half range Fourier cosine and sine series.  
**CO3:** Understand the development in cosine and sine series.

**CO4:** Obtain a solution to the original problem or an approximation to it to a desired accuracy.

**Unit I** (6 hours)

Fourier series - Introduction - Trigonometric series - problems.

**Unit II** (6 hours)

Even and odd functions - Properties of odd and even functions - Half range fourier series.

**Unit III** (6 hours)

Development in cosine series - Development in sine series - Problems.

**Unit IV** (6 hours)

Change of interval - Combination of series

**Unit V** (6 hours)

Harmonic Analysis - Method 1 - Method 2

### Text Book

1. S. Narayanan & T. K. Manicavachagom Pillay, **Calculus - Volume - III**, S. Viswanathan Printers and Publishers Pvt. Ltd.,

**Unit I:** Chapter 6(sec 1,2)

**Unit II:** Chapter 6(sec 3,4)

**Unit III:** Chapter 6(sec 5.1,5.2)

**Unit IV:** Chapter 6(sec 6,7)

**Unit V:** Chapter 6(sec 8)

### References

2. T. Veerarajan, **Engineering Mathematics**, Tata McGraw Hill, Third Edition.
3. S. Arumugam and A. Thangapandi Isaac, **Calculus**, New Gamma Publishing House, 2008.
4. David V. Widder, **Advanced Calculus**, Prentice Hall of India Pvt. Ltd. New Delhi, Second Edition, 1996.

### Extra Credit- Arithmetic For Competitive Examinations (For those who joined since 2018-19)

**Semester: II**

**Sub.Code: FBMXX2 / GBMXX2**

**Credit: 2**

**CO1:** Understand the Concepts of Mathematics with Emphasis on Analytical Abilities.

**CO2:** Know about logical Rules to solve the Problem shortly.

**CO3:** Gain Knowledge, Understanding and Attitude.

**CO4:** Give Mental Strength.

**Unit I**

Numbers: Four Fundamental Rules- Solved Problems.

**Unit II**

Simplification: Solved Problems.

**Unit III**

Average: Solved Problems.

**Unit IV**

Chain Rules: Solved Problems.

**Unit V**

Allegation or Mixture: Solved Problems.

**Text Book**

1. R.S Aggarwal, **Arithmetic (Subjective & Objective) for Competitive Examinations**, S.Chand and Company limited, Reprint 2009.

**Unit I:** Chapter 1(Pg.No: 1 - 29)

**Unit II:** Chapter 4(Pg.No:73 - 89)

**Unit III:** Chapter 7(Pg.No: 142 -157)

**Unit IV:** Chapter 10(Pg.No: 205 -223)

**Unit V:** Chapter 17(Pg.No: 332 – 347)

**Reference Books:**

2. S.L Gulati, **A Complete Book on Objective Arithmetic** – Cosmos Bookhive (P) limited 32<sup>nd</sup> Edition.
3. R.S Aggarwal, **Objective Arithmetic (Numerical Ability Test) For Competitive Examinations**, S.Chand and Company limited.
4. R.S Aggarwal & S.Chand, **Quantitive Aptitude for Competitive Examinations**, Seventh Edition, 2008.

**Core V- Differential Equations  
(For those who joined since 2018-19)**

**Semester: III**

**Sub.Code: GBMXC31**

**Hours Per Week: 6**

**Credit: 4**

**CO 1:** Distinguish between linear, homogeneous, non-homogeneous differential equations.

**CO 2:** Recognize and solve complementary function and Particular integral.

**CO 3:** Understand the behavior of simultaneous equations.

**CO 4:** Recognize and solve the linear equations of the second order.

**CO 5:** Gain the knowledge to solve partial differential equations.

**CO 6:** Distinguish between Ordinary and Partial differential equations.

**Unit I**

**(18 hours)**

Equation of the first order and of the first degree: Variables separable – Homogeneous equations – Non-Homogeneous equations of the first degree in  $x$  &  $y$  – Linear Equation – Bernoulli's equation – Exact differential equations. Equations of the first order, but of the higher degree: Solvable for  $p$  – Equations Solvable for  $y$  and Equations Solvable for  $x$  – Clairaut's form – Equations Homogeneous in  $x$  and  $y$ .

**Unit II**

**(18 hours)**

Linear Equations with constant coefficients: Definitions - Complementary function of a linear equation with constant coefficients - Particular integral - General method of finding P.I - Special methods for finding P.I - Linear equations with variable coefficients, Equations reducible to the Linear equations.

**Unit III**

**(18 hours)**

Simultaneous differential equations: Simultaneous equations of the first order and first degree - Simultaneous linear differential equations - Simultaneous equations with variable co-efficients.

**Unit IV (18 hours)**

Linear equations of the second order: Complete solution given a known integral - Reduction to the normal form - Change of the independent variable - Variation of Parameters - Methods of Operational factors.

**Unit V (18 hours)**

Partial Differential equations of the first order: Classification of integral - Derivation of partial differential equations - Lagrange's method of solving the linear equation - Special method; standard forms - Charpit's method.

**Text Book:**

1. S. Narayanan and T.K. Manicavachagom Pillai, **Differential Equations and its Applications**, S. Viswanathan (Printers & Publishers) Pvt., Ltd, 2010.  
**Unit I:** Chapter II & IV (Pg.no: 7 - 28)  
**Unit II:** Chapter V (Pg.no: 68 - 102)  
**Unit III:** Chapter VI (Pg.no: 119 - 134)  
**Unit IV:** Chapter VIII (Pg.no: 145 - 160)  
**Unit V:** Chapter XII (Pg.no: 219 - 249)

**Reference Books:**

2. K.Venkataraman and Mrs.Manorama Sridhar, **Differential Equations and Laplace Transforms**, the national publishing company, 2004.
3. Dr. S. Arumugam and Mr A. Thangapandi Issac, **Differential Equations and Laplace Transforms** New Gamma Publishing House, 2014.
4. Nita H. Shah, **Ordinary and Partial differential equations - Theory and Applications**, PHI learning Private limited, New Delhi, 2010.

**Core VI - Graph Theory-II**  
**(For those who joined since 2018-19)**

**Semester: III****Sub.Code: FBMXC32 / GBMXC32****Hours Per Week: 6****Credit: 4**

**CO 1 :** Know the Algorithms for finding a maximum matching and a maximum weight matching in a Bipartite graph.

**CO 2 :** Know how to use Euler's Formula to check if a graph is planar.

**CO 3 :** Know about many different coloring problems for graphs. Able to formulate applied problems as coloring problems.

**CO 4 :** Able to tell what is a directed graph – Know how to represent a graph using matrix and list.

**Unit I (18 hours)**

Matchings: Introduction - Matchings - Matchings in Bipartite Graphs.

**Unit II (18 hours)**

Planarity: Introduction - Definition and Properties - Characterisation of Planar graphs - Thickness, Crossing and outer Planarity.

**Unit III (18 hours)**

Colourability: Introduction - Chromatic Number and Chromatic Index - The Five Colour Theorem - Four Colour Problem - Chromatic Polynomials.

**Unit IV (18 hours)**

Directed Graphs: Introduction - Definitions and Basic Properties - Paths and Connections - Digraphs and Matrices -Tournaments.

**Unit V (18 hours)**

Some Applications: Introduction - Connector Problem - Shortest Path Problem - Transformation and Kinematic Graph - Designing One way Traffic Systems - Applications without Solutions.

**Text Book:**

1. S. Arumugam and S. Ramachandran, **Invitation to Graph Theory**, SCITECH Publications (India) Pvt. Ltd. Edition June 2001.  
**Unit I:** Chapter 7(Sec 7.0 – 7.2)  
**Unit II:** Chapter 8(Sec 8.0 – 8.3)  
**Unit III:** Chapter 9(Sec 9.0 – 9.4)  
**Unit IV:** Chapter 10(Sec 10.0 – 10.4)  
**Unit V:** Chapter 11(Sec 11.0 – 11.5)

**Reference Books:**

2. Robin J. Wilson, **Introduction to Graph Theory**, Prentice Hall Publication, Fourth edition.
3. John Clark & Derek Allan Holtan, **A First Look at Graph Theory**, Allied Publishers Ltd, Edition 1995.
4. Harary, **Graph Theory**, Narosa Publishing House, 10<sup>th</sup> Reprint, 2001.

**Non-Major Elective I - Quantitative Aptitude for Competitive Examinations-I**  
**(For those who joined since 2018-19)**

**Semester: III****Hours per Week: 4****Sub.Code: FBNM3MX / GBNM3MX****Credits: 2****CO 1:** Understand the concepts of Time and Work**CO 2:** Developing the Problem Solving Skill based on Profit and Loss**CO 3:** Developing the Problem Solving Skill based on Simple Interest**CO 4:** Developing the Problem Solving Skill based on Compound Interest**CO 5:** Understand the Volume and Area of the Solid figure**Unit I (12 hours)**

Percentage - Time and Work.

**Unit II (12 hours)**

Profit and Loss- Formulae - Solved Problems.

<b>Unit III</b>	<b>(12 hours)</b>
Simple interest - Formulae - Solved Problems.	
<b>Unit IV</b>	<b>(12 hours)</b>
Compound interest - Formulae - Solved Problems.	
<b>Unit V</b>	<b>(12 hours)</b>
Volume and Area of Solid Figures.	

**Text Book:**

- R.S.Aggarwal, **Arithmetic Subjective & Objective for Competitive Examinations**, S.Chand & Company Ltd. Reprint 2009.  
**Unit I:** Chapter 6, 11 ( pg.no 112 - 141 & pg.no 224 - 245)  
**Unit II:** Chapter 16 (pg.no 300 - 331 )  
**Unit III:** Chapter 18 (pg.no 348 - 361)  
**Unit IV:** Chapter 19 ( pg.no 362 - 379)  
**Unit V:** Chapter 21 (pg.no 419 - 453)

**Reference Books:**

- Sarvesh Kumar Verma, **The Quantitative Aptitude for CAT** Arihant Publications (1) Pvt Ltd Meerut Edition 1, 2009
- Chand S **Quantitative Aptitude (Mathematics & Statistics)** S.Chand& Company Ltd First Edition, 2008.
- Mark Alan Stewart, **Master the GMAT**, 14<sup>th</sup> Edition, 2007.

**Skill Based Elective III- Applied Statistics**  
**(For those who joined since 2018-19)**

**Semester: III****Sub.Code : GBMXE34****Hours per week : 3****Credit : 2****CO 1:** Analyse the least square method.**CO 2:** Understand the Interpolation concept.**CO 3:** Know the Fundamentals of Index number.**CO 4:** Demonstrate the ability to Analysis of Series.

<b>Unit I</b>	<b>(9 hours)</b>
Curve fitting: Introduction – Principle of least squares.	
<b>Unit II</b>	<b>(9 hours)</b>
Interpolation: Finite differences	
<b>Unit III</b>	<b>(9 hours)</b>
Interpolation: Newton's Formula – Lagrange's Formula	
<b>Unit IV</b>	<b>(9 hours)</b>
Index numbers: Index numbers – Weighted Index Numbers – Consumer Price Index Number – Conversion of the Chain Base Index Number into Fixed Base Index and Conversely.	
<b>Unit V</b>	<b>(9 hours)</b>
Analysis of time series: Introduction –Time series – Components of a time series - Measurement of trends.	

**Text Book:**

1. Dr. S. Arumugam and A.Thangapandi Issac, **Statistics**, New Gamma Publishing House, Edition June 2015.

**Unit I:** Chapter 5

**Unit II:** Chapter 7 (sec 7.0 – 7.1)

**Unit III:** Chapter 7 (sec 7.2 – 7.3)

**Unit IV:** Chapter 9

**Unit V:** Chapter 10

**Reference Books:**

2. S.C. Gupta & V.K. Kapoor, **Mathematical Statistics**, Sultan Chand & Sons, Eleventh Edition 2007.
3. N.P. Bali, **Statistics**, Lakshmi Publications, 1970.
4. D.C.Sancheti, V.K.Kapoor, **Statistics (Theory, Methods and applications)**, Sultan Chand & Sons, 2012.

**Extra Credit - Logical Reasoning  
(For those who joined since 2018-19)**

**Semester : III**

**Subject Code : FBMXX3 / GBMXX3**

**Credit : 2**

**CO 1:** Demonstrate the ability to perform Logical Venn Diagrams and to solve different puzzles.

**CO 2:** Use analysis of variance techniques to Alphabet test.

**CO 3:** Understand the Alpha Numeric Sequence Puzzle.

**CO 4:** Formulate the problem quantitatively and use appropriate inserting the missing character.

**Unit I**

Puzzle Test.

**Unit II**

Logical Venn Diagrams.

**Unit III**

Alphabet Test.

**Unit IV**

Alpha - Numeric Sequence Puzzle.

**Unit V**

Inserting the Missing Character.

**Text Book:**

1. Dr R S Aggarwal, **A Modern Approach to Verbal Reasoning**, S. Chand & Company Pvt., Ltd., Edition 2013.

**Unit I:** Chapter 6

**Unit II:** Chapter 9

**Unit III:** Chapter 10

**Unit IV:** Chapter 11

**Unit V:** Chapter 16

**Reference Books:**

2. Dr R S Aggarwal, **A Modern Approach to Verbal and Non-verbal Reasoning**, S.Chand & Company Pvt., Ltd., Edition 2012.
3. Dr R S Aggarwal, **A Modern Approach to Logical Reasoning**, S. Chand & Company Pvt., Ltd., Edition 2013.
4. P K Agarwal, **Test of Verbal Reasoning for Competitive Examinations**, Edition 2004.

**Core VII - Abstract Algebra-I**  
**(For those who joined since 2018-19)**

**Semester: IV****Hours Per Week: 5****Sub.Code: FBMXC41 / GBMXC41****Credit: 4****CO 1 :** Assess properties implied by the definitions of groups and rings,**CO 2 :** Analyze and demonstrate examples of normal subgroups, quotient groups**CO 3 :** Use the concepts of isomorphism and homomorphism for groups and rings.**CO 4 :** Produce rigorous proofs of proposition arising in the context of abstract algebra.**Unit I****(15 hours)**

Groups: Introduction - Definition and Examples - Elementary Properties of a Group - Equivalent Definitions of a Group - Permutation Groups - Subgroups - Cyclic Groups - Order of an Element.

**Unit II****(15 hours)**

Cosets and Lagrange's theorem - Normal subgroups and Quotient Groups.

**Unit III****(15 hours)**

Isomorphism - Homomorphisms.

**Unit IV****(15 hours)**

Rings: Definition and Examples - Elementary properties of rings – Isomorphism - Types of Rings.

**Unit V****(15 hours)**

Characteristic of a ring - Subrings - Ideals - Quotient rings.

**Text Book:**

1. S. Arumugam & A.T. Issac, **Modern Algebra**, SCITECH Publications (India) Pvt. Ltd., 2003.

**Unit I:** Chapter 3 (sec 3.0 – 3.7)

**Unit II:** Chapter 3 (sec 3.8 – 3.9)

**Unit III:** Chapter 3 (sec 3.10 – 3.11)

**Unit IV:** Chapter 4 (sec 4.1 – 4.4)

**Unit V:** Chapter 4 (sec 4.5 – 4.8)

**Reference Books:**

2. William J. Gilbert, **Modern Algebra with applications**, John Wiley & Sons, Inc. 2005.
3. Surjeeth Singh, **Linear Algebra**, Vikas Publishing House Pvt. Ltd., First Edition. 1997
4. Jimmie Gilbert, Linda Gilbert, **Elements of Modern Algebra**, Cengage Learning, 5<sup>th</sup> Edition.



**Core VIII - Real Analysis-I**  
(For those who joined since 2018-19)

**Semester: IV****Sub.Code: FBMXC42 / GBMXC42****Hours per Week: 5****Credits: 4****CO 1 :** Lay a good foundation for Classical Analysis.**CO 2 :** Compare the Behaviour of Sequence and Series.**CO 3 :** Understand the techniques to test the Convergent and Divergent.**CO 4 :** Understand the terms Absolute and Conditional Convergence.**Unit I** (15 hours)

Sequences: Introduction - Bounded Sequences - Monotonic Sequences - Convergent Sequences - Divergent and Oscillating Sequences - The Algebra of Limits.

**Unit II** (15 hours)

Behavior of Monotonic Sequences - Some Theorems on Limits - Subsequences - Limit Points.

**Unit III** (15 hours)

Cauchy Sequences - Infinite Series - Comparison Test.

**Unit IV** (15 hours)

Kummer's Test - Root Test and Condensation Test.

**Unit V** (15 hours)

Series of Arbitrary Terms: Alternating series – Absolute Convergence - Tests for Convergence of Series of Arbitrary Terms.

**Text Book:**

1. Dr. S. Arumugam and A.Thangapandi Issac, **Sequences and Series**, New Gamma Publishing House, Jun 2014.

**Unit I:** Chapter 3(3.1 – 3.6)**Unit II:** Chapter 3(sec 3.7 – 3.10)**Unit III:** Chapter 3(Sec 3.11) & Chapter 4(4.1 – 4.2)**Unit IV:** Chapter 4(4.3 – 4.4)**Unit V:** Chapter 5(5.1 – 5.3)**Reference Books:**

2. S.C.Malik, **Principles of Real Analysis**, New age international Publishers, 2006.
3. Robert G Bartle, Donald R Sherbert, **Introduction to Real Analysis**, WileyIndia, Third Edition, 2007.
4. T.K. Manicavachagam Pillay, T. Natarajan and K.S. Ganapathy, **Algebra - Volume I**, Vijay Nicole prints, 2004.

**Core IX - Statics**  
(For those who joined since 2018-19)

**Semester: IV****Sub.Code: FBMXC43 / GBMXC43****Hours per Week: 5****Credit: 4****CO 1:** The students to realize the nature of the forces when more than one force acting on a particle.**CO 2:** Develop the ability to describe parallel forces and moments.

**CO 3:** The student should realize the concept about Friction and Center of the gravity. Also the student can differentiate to static and dynamic forces .

**CO 4:** Develop a working knowledge to handle practical problems.

**Unit I (15 hours)**

Forces acting at a point: Resultant and components - Parallelogram of forces - Analytical expression for the resultant of two forces acting at a point - The polygon of forces - Lami's theorem - An Extended form of the parallelogram law of forces - Resolution of a force - Theorem on resolved parts - Resultant of any number of forces acting at a point - Conditions of equilibrium of any number of forces acting upon a particle.

**Unit II (15 hours)**

Parallel forces and moments: Resultant of two like and unlike parallel forces acting on a rigid body - Conditions of equilibrium of three coplanar parallel forces - Varignon's theorem of moments - Moment of a force about an axis – Couples - Equilibrium of two couples - Couples in parallel planes - Representation of a couple by a vector - Resultant of a couple and a force.

**Unit III (15 hours)**

Equilibrium of three forces acting on a rigid body: Rigid body subjected to any three forces - Three coplanar forces; Theorem - Conditions of equilibrium - Two trigonometrical theorems.

**Unit IV (15 hours)**

Coplanar forces: Reduction of any number of coplanar forces - Conditions for a system of forces to reduce to a single force or to a couple - Change of the base point - Equation to the line of action of the resultant - Conditions of equilibrium of a system of coplanar forces.

**Unit V (15 hours)**

Friction: Experimental results - Static, Dynamical and Limiting friction - Laws of friction – Friction - A passive force - Angle of friction - Cone of friction - Equilibrium of a particle on a rough inclined plane - Equilibrium of a body on a rough inclined plane under a force parallel to the plane - Equilibrium of a body on a rough inclined plane under any force - Problems.

**Text Book:**

1. Dr. M. K. Venkataraman, **Statics**, Agasthiar publications, 13<sup>th</sup> Edition, 2009.

**Unit I:** Chapter 2(Pg. No 6 - 51)

**Unit II:** Chapter 3, 4(Pg. No 52 - 83, 84 - 97)

**Unit III:** Chapter 5(Pg. No 98 - 134)

**Unit IV:** Chapter 6(Pg. No 143 - 191)

**Unit V:** Chapter 7(Pg. No 206 - 269)

**Reference Books:**

2. P. Duraipandiyar, **Mechanics** (vector treatment), S.Chand and Co, 2007.
3. A. S. Ramsey, **Statics**, CBS publishers and Distributers, Delhi, First Indian edition, 1985.

4. A.V. Dharmapadam, **Statics**, S. Viswanathan (Printers & Publishers) Pvt. Ltd, Reprint, 2011.

**Non-Major Elective II - Quantitative Aptitude for Competitive Examinations-II  
(For those who joined since 2018-19)**

**Semester: IV**

**Hours per Week: 4**

**Sub.Code: FBNM4MX / GBNM4MX**

**Credit: 2**

**CO 1:** Gain knowledge of Indices and Logarithms.

**CO 2:** Understand the concepts of the Permutation and Circular Permutation.

**CO 3:** Understand the basic concepts of Arithmetic Progression and Geometric Progression.

**CO 4:** Gain the knowledge based on Sets and Operations on Sets.

**Unit I** (12 hours)

Ratio – Proportion – Indices - Logarithm.

**Unit II** (12 hours)

Basic concepts of Permutations and Combinations: Fundamental Principles of counting – Factorial – Permutations – Circular Permutations – Combinations.

**Unit III** (12 hours)

Sequence and Series: Progressions – Arithmetic Progression (A.P) – Geometric Progression (G.P) – Harmonic progression (H.P) – Some special sequences.

**Unit IV** (12 hours)

Set: Meaning of a set – Methods of writing a set – Types of sets – Some operations on sets – Some results on complementation – Laws of Operations – Some important results – Venn diagram and some of the Applications of Set Theory.

**Unit V** (12 hours)

Probability: Definition of Probability – Importance of the concept of Probability - Classical or a Priori Probability approach – Modern definition of Probability – Objective approach and Subjective approach to Probability - Experiment – Event – Types of events – Theorems of probability.

**Text Book:**

1. Bharat Jhunjunwala, **Quantitative Aptitude (Mathematics & Statistics) for CA Common proficiency Test (CPT)**, S. Chand and company limited – First Edition, 2008.

**Unit I:** Chapter 1 (1 – 4)

**Unit II:** Chapter 5 (1 -5)

**Unit III:** Chapter 6 (3 – 7)

**Unit IV:** Chapter 7A (1 – 8)

**Unit V:** Chapter 9 section B( Pg.No: 9.1 – 9.21)

**Reference Books:**

2. R. Gopal. Prof. J. V. Subrahmanyam, **Arithmetic & Quantitative Aptitude for Competitive Exams**, Sura College of competition.
3. Ashish Aggarwal, **Quick Arithmetic**, S.Chand publications, 2<sup>nd</sup> Edition 2007.
4. Dr.R.S. Aggarwal, **Quantitative Aptitude**, S.Chand publications.7<sup>th</sup> Edition 2015.

**Skill Based Elective IV - Verbal Reasoning**  
(For those who joined since 2018-19)

**Semester: IV****Sub.Code: FBMXE45 / GBMXE45****Hours per Week: 3****Credit: 2****CO 1:** Understand the concepts of Blood Relations and Directions Sense.**CO 2:** Gain Knowledge of Arithmetical and logical Reasoning.**CO 3:** Explain the Concepts of Data Sufficiency.**CO 4:** Appear all Competitive Examinations.

<b>Unit I</b>		<b>(9 hours)</b>
	Blood Relations.	
<b>Unit II</b>		<b>(9 hours)</b>
	Direction Sense Test.	
<b>Unit III</b>		<b>(9 hours)</b>
	Logical Sequence of Words .	
<b>Unit IV</b>		<b>(9 hours)</b>
	Arithmetical Reasoning.	
<b>Unit V</b>		<b>(9 hours)</b>
	Data Sufficiency.	

**Text Book:**

1. R.S.Aggarwal, **A Modern approach to Verbal Reasoning**, S.Chand & company Pvt., Ltd., 2013.  
**Unit I:** Chapter 5  
**Unit II:** Chapter 8  
**Unit III:** Chapter 14  
**Unit IV:** Chapter 15  
**Unit V:** Chapter 17

**Reference Books:**

2. S.N.Prasad, **Competitive Reasoning Verbal & Non-Verbal**, kiran institute of carrer excellence Pvt., Ltd., (kicx) Delhi Presentation. New Edition.
3. P.K. Agarwal, **Test of Verbal Reasoning for Competitive Examinations**, Asian Book, 2012.
4. B. S. Sijwali and Indus Sijwali, **A New Approach to Verbal, Nonverbal & Analytical**, Arihant inspring minds, 2014.

**Extra Credit – Applications of Group Theory**  
(For those who joined since 2018-19)

**Semester: IV****Sub.Code: FBMXX4/GBMXX4****Credit: 2****CO 1:** Understand the group theory in matrices.**CO 2:** Gain the knowledge of rectangular, inverse, rank and nullity matrices.**CO 3:** Know the group theory in information theory.

**CO 4:** Know the algebraic operations on group codes and application of group theory.

**Unit I**

Group theory in matrices: Linear transformations and Matrices - Matrix addition - Matrix multiplication- Diagonal, Permutation, and Triangular Matrices.

**Unit II**

Rectangular Matrices – Inverses - Rank and Nullity - Elementary Matrices - General Equivalence Canonical form - Quaternions.

**Unit III**

Group theory in information theory-Two metric spaces of continuous random variable - Hamming's codes-Group codes-A detection scheme for group codes- Slepian's Technique for single-error correcting group codes - Hamming's lemma.

**Unit IV**

Further notes on group codes - Algebraic operations on group codes.

**Unit V**

The application of group theory to parity check coding - Matrix of code words - Error patron vectors and received sequences for a group code.

**Text Book:**

1. P.N. Arora, **Group theory and Mathematics**, Anmol Publishing House,1995.

**Unit I:** Part II (Pg.no: 379 – 395)

**Unit II:** Part II (Pg.no: 395 – 418)

**Unit III:** Part II (Pg.no: 435 – 450)

**Unit IV:** Part II (Pg.no: 450 – 458)

**Unit V:** Part II (Pg.no: 458 – 468)

**Reference Books:**

2. Dr. M.K. Venkatraman, Dr. N. Sridharan & Dr. N. Chandrasekaran, **Discrete Mathematics**, Edition 2006.
3. Arumugam .S & Issac. A.T, **Modern Algebra**, Scitech publications(India) Pvt. Ltd.2007.
4. J K Sharma, **Discrete Mathematics**, Macmillan India Ltd., Second edition. 2005.

**Core X- Abstract Algebra-II**

(For those who joined since 2018-19)

**Semester: V**

**Sub.code: FBMXC51/GBMXC51**

**Hours per Week: 4**

**Credit: 3**

**CO 1:** Understand the basic concepts of Vector spaces

**CO 2:** Use the definition and properties of linear transformations and matrices of LT and change of basis

**CO 3:** Compute inner products and determine orthogonality on vector spaces

**CO 4:** Compute with the characteristic polynomial, eigenvectors, eigenvalues and apply the basic results

**Unit I**

**(12 hours)**

Vector spaces: Introduction - Definition and examples - Subspaces - Linear transformation - Span of a set - Linear independence.

- Unit II** (12 hours)  
Basis and dimension - Rank and nullity - Matrix of a Linear Transformation.
- Unit III** (12 hours)  
Inner product spaces: Definition and examples - Orthogonality - Orthogonal complement.
- Unit IV** (12 hours)  
Theory of Matrices - Introduction - Algebra of matrices - Types of matrices - The inverse of a matrix - Elementary transformations - Rank of a matrix.
- Unit V** (12 hours)  
Simultaneous linear equations - Characteristic equation and Cayley Hamilton Theorem - Eigen values and Eigen vectors.

**Text Book:**

- S. Arumugam & A. T. Issac, **Modern Algebra**, Scitech publications(India) Pvt. Ltd., 2003.  
**Unit I:** Chapter 5 (sec 5.0 – 5.5)  
**Unit II:** Chapter 5 (sec 5.6 – 5.8)  
**Unit III:** Chapter 6 (sec 6.0 – 6.3)  
**Unit IV:** Chapter 7 (sec 7.0 – 7.5)  
**Unit V:** Chapter 7 (sec 7.6 – 7.8)

**Reference Books:**

- G.Hadley, **Linear Algebra**, Addison-Wesley, Eighth Edition. 1980.
- Surjit Singh, **Linear Algebra**, Vikas Publishing House Pvt. Ltd., First Edition. 1997
- William J.Gilbert. **Modern Algebra with application**,. Wiley India Pvt., Ltd. Wiley student edition.

**Core XI- Dynamics**  
(For those who joined since 2018-19)

**Semester: V****Sub.Code: FBMXC52/GBMXC52****Hours per Week: 5****Credit: 4****CO 1:** Understand the concept of Laws.**CO 2:** Understand the Mathematical Ideas.**CO 3:** Gain the knowledge of the Behavior of Object in Motion.**CO 4:** Develop a working knowledge to handle Practical Problems.**Unit I** (15 hours)

Kinematics : Speed - Displacement - Velocity – Resolution of Velocities - Triangle of Velocities - Polygon of Velocities - Relative Velocity - Angular Velocity - Change of Velocity - Acceleration - Relative Acceleration - Examples - The Laws of motion: Newton's Laws of Motion Composition of forces - Weight – Distinction between Mass and Weight – Force of Friction.

**Unit II** (15 hours)

Projectiles: Definitions - Two fundamental Principles - Path of a Projectile - Characteristics of the Motion of a Projectile - Maximum Height Reached, Range, Time of Flight - The Velocity of the Projectile - Range, Greatest Distance, Time of Flight on an Inclined Plane.

**Unit III (15 hours)**

Impulsive Forces - Impact of Two Bodies - Loss of Kinetic Energy Impact- Collision of Elastic Bodies – Fundamental Laws of Impact- Impact of a Smooth Sphere on a fixed Smooth Plane – Direct Impact of Two Smooth Spheres – Loss of Kinetic Energy due to Direct Impact of Two Smooth Spheres - Oblique Impact of Two Smooth Spheres - Loss of Kinetic Energy due to Oblique Impact of Two Smooth Spheres.

**Unit IV (15 hours)**

Simple harmonic motion : Simple harmonic motion in a straight line – General solution of the SHM equation – Geometrical representation of a SHM – Change of origin – composition of two simple harmonic motion – Motion of a particle suspended by a spiral spring - Horizontal oscillations of a particle tied to an elastic spring – Simple pendulum –The seconds pendulum – loss or gain in the number of oscillations made by a pendulum.

**Unit V (15 hours)**

Motion under the action of central forces : Velocity and acceleration in polar coordinates – equations of motion in polar coordinates – Note on the equiangular spiral – Motion under a central force – Differential equation of central orbits – Pedal equation of the central orbit – Velocities in a central orbit – Two fold problems in the central orbits.

**Text Book:**

1. Dr M K Venkataraman, **Dynamics**, Agasthiyar publications, Sixteenth Edition. 2014.

**Unit I:** Chapter 3, 4(Pg.no: 14 – 64 & 77 - 91)

**Unit II:** Chapter 6 (Pg.no: 139 - 184)

**Unit III:** Chapter 7, 8 (Pg.no: 201 – 256)

**Unit IV:** Chapter 10 (Pg.no: 309 – 355)

**Unit V:** Chapter 11 (Pg.no: 356 – 384)

**Reference Books:**

2. A.V. Dharmapadam, **Dynamics**, S.Viswanathan publishers pvt., Ltd, 2006.
3. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, **Mechanics**, S.Chand & Company pvt., Ltd., First Edition, 2014.
4. P. Duraipandian, **Vector Treatment**, S. Chand and Co. June 1997.

**Core XII- Astronomy**  
(For those who joined since 2018-19)

**Semester: V**

**Sub.Code: FBMXC53/ GBMXC53**

**Hours per Week: 4**

**Credit: 3**

**CO 1 :** Gain Knowledge about Spherical Concepts in Space and Plane Trigonometrical Formula.

**CO 2 :** Know about Celestial Phenomenon.

**CO 3 :** Discuss how light is used by Astronomers to learn about Universe.

**CO 4 :** Acquained Knowledge about Lunar Librations in Moon.

**Unit I (12hours)**

Spherical Trigonometry: Sphere – Great Circles and Small Circles – Axis and Poles of a Circle – Distance between Two points on a Sphere – Angle between Two Circles - Secondaries – Angular radius or Spherical Radius- Spherical Figures - Spherical Triangle – Polar Triangle – Cosine Formula – Sine Formula – Cotangent formula- Five Parts Formula –

Functions of Half an Angle - Functions of Half a Side – Delambre’s Analogies – Napier’s Analogies – Spherical Co-ordinates – General Proof of the Cosine Formula – Formulae in Plane Trigonometry

**Unit II** (12 hours)

Celestial Sphere, Diurnal Motion: Celestial Sphere – Celestial coordinates – Sidereal time.

**Unit III** (12 hours)

Refraction: Laws of Refraction – Astronomical Refraction – Tangent formula for Refraction- General Effects of Refraction – Cassini’s Formula – Horizontal Refraction.

**Unit IV** (12 hours)

Kepler’s Laws: Kepler’s laws – Newton’s deductions from Kepler’s Laws -To fix Position of a Planet in its Elliptic Orbit – Mean Anomaly.

**Unit V** (12 hours)

The Moon: Moon – Sidereal Month and Synodic Month – Successive Phase of Moon – lunar Librations – Path of the Moon with respect to the sun – Harvest Moon – Surface Structure of Moon- lunar Mountains – Earth Shines – The Tides.

**Text Book:**

1. S. Kumaravelu, and Susheela Kumaravelu, **Astronomy**, A Bhaskara Selvan, Sivakasi, 2007.

**Unit I:** Chapter I (Pg.no: 1 – 8 & 12 – 37)

**Unit II:** Chapter II (Pg.no: 38 – 71)

**Unit III:** Chapter IV (Pg.no: 140 – 157)

**Unit IV:** Chapter VI (Pg.no: 172 – 197)

**Unit V:** Chapter XII (Pg.no: 334 – 357)

**Reference Books:**

2. Rukmani Ramachandran, Trichirapally, **Astronomy for Under Graduate & Post Graduate classes**, 1968.
3. G.V.Ramachandran , **Astronomy**, Mission Press, Palayamkottai.
4. Jayant Narlikar, **A Journey through the Universe**, National book trust, India, Sixth Edition, 2004.

**Core Elective I- Fourier And Laplace Transforms**

(For those who joined since 2018-19 )

**Semester:** V

**Sub.Code:** FBMXE5A/GBMXE5A

**Hours per Week:** 5

**Credit:** 5

**CO 1:** Familiarize the students with the concept of Fourier transform.

**CO 2:** Understand the Finite Fourier Transforms.

**CO 3:** Gain knowledge of solving linearity properties of laplace and inverse laplace Transforms.

**CO 4:** Understand differential and integral problems.

**CO 5:** Know the initial and final value theorems of laplace transform.

**CO 6:** Know the relation between Fourier Transform and Laplace transform .

**Unit I** (15 hours)

Fourier Transforms: Introduction - Fourier Integral Theorem - Fourier Transforms - Alternative Form of Fourier Complex Integral Formula - Relationship Between Fourier Transform and Laplace Transform - Worked Example.



**Unit II (15 hours)**

Properties of Fourier Transforms - Worked Example - Finite Fourier Transforms - Worked Example .

**Unit III (15 hours)**

Laplace Transforms : Introduction - Linearity Property of Laplace and Inverse Laplace Transforms - Laplace Transforms of Some Elementary Functions - Laplace Transforms of Some Special Functions - Properties of Laplace Transforms - Worked Example.

**Unit IV. (15 hours)**

Laplace Transform of Periodic Functions - Derivatives and Integrals of Transforms - Worked Example.

**Unit V (15 hours)**

Laplace Transforms of Derivatives and Integrals - Initial and Final Value Theorems - The Convolution - Worked Example - Solutions of Differential and Integral Equations - Worked Example.

**Text Books :**

1. T.Veerarajan, **Engineering Mathematics(For semester III)** , Tata McGraw – Hill Publishing Company Limited, Third Edition 2008.  
**Unit I:** Chapter 6(6.1 – 6.5 )  
**Unit II:** Chapter 6(6.6 – 6.7)
2. T.Veerarajan, **Engineering Mathematics-II (For first year)**, Tata McGraw – Hill Publishing Company Limited, 2014 .  
**Unit III:** Chapter 3 (3.1 – 3.5 )  
**Unit IV:** Chapter 3 (3.6 – 3.7 )  
**Unit V:** Chapter 3 (3.8 – 3.11)

**Reference Books:**

3. S. Arumugam A. Thangapandi Isaac and A. Somasundaram, **Engineering Mathematics Volume – III**, S.Viswanathan Printers and Publishers Private limited. 2003.
4. K. Sankar, C. Valambal, L. BaraniKumar, **Engineering Mathematics – II** Sri Krishna Publications, Edition 2002.
5. Dr. J. K. Goyal and K. P. Gupta, **Laplace and Fourier Transforms**, Pragati Prakashan Publishers, Meerut 2000.

**Core Elective I - Combinatorics**  
**(For those who joined since 2018-19)**

**Semester: V****Sub.Code: FBMXE5B/GBMXE5B****Hours per Week: 5****Credit: 5**

**CO 1:** This course will give students the combinatorial tools to model and analyze practical problems in various areas.

**CO 2:** Students will be able to identify, formulate, and solve problems in Mathematics, including proof writing.

**CO 3:** They will put to practice problem solving techniques that they know, and learn new ones

**CO 4:** Students will be able to present technical information clearly in both oral and written formats.

**CO 5:** Understand a part of Discrete Mathematics that deals with enumeration and existence

problems.

**CO6:** Familiar with fundamental appear in various other fields of Mathematics and Computer Science

**Unit I (15 hours)**

Classical Techniques: Basic Combinatorial numbers - Stirling numbers of the first kind - Stirling numbers of the second kind - Patterns of distributions.

**Unit II (15 hours)**

Generating functions and Recurrence relations - The algebra of formal power series - Recurrence relations - Symmetric functions.

**Unit III (15 hours)**

Multinomials - Inclusion and Exclusion principle - Applications of the sieve formula.

**Unit IV (15 hours)**

Permutations with forbidden positions - The 'Menage' problem - Problem of Fibonacci.

**Unit V (15 hours)**

Polya Theory: Necklace problem and Burnside's lemma - Cycle index of a permutation group - Polya's theorems and their immediate applications.

**Text Book:**

1. V. Krishnamurthy, **Combinatorics - Theory and Applications**, East - West Press private limited New Delhi, 1985.

**Unit I:** Chapter 1 (sec 1)

**Unit II:** Chapter 1 (sec 2,3)

**Unit III:** Chapter 1 (sec 4,5 )

**Unit IV:** Chapter 1 (sec 6)

**Unit V:** Chapter 2 (sec 1,2,3)

**Reference Books:**

2. V.K. Balakrishnan, **Theory and Problems of Combinatorics**, Tata McGraw-Hill publishing company limited, New Delhi.
3. C.T. Liu, **Introduction to Combinatorial Mathematics**, Tata McGraw Hill New Delhi, 1968.
4. Alan Tucker, **Applied Combinatorics**, Wiley Student edition India, Fifth Edition, New Delhi.

**Core Elective II - Fluid Dynamics**  
(For those who joined since 2018-19)

**Semester: V**

**Sub.Code: FBMXE5C / GBMXE5C**

**Hours per Week: 5**

**Credit: 5**

**CO 1:** Able to find the gradient, divergence and curl of vector expressed in terms of orthogonal curvilinear coordinates.

**CO 2:** Identity the fundamental kinematics of fluid elements.

**CO3:** Explain how Bernoulli equation is related to conservation of energy.

**CO 4:** Develop the knowledge of axi-symmetric flows.

**CO 5:** Describe its applicability, potential and limitation.

**CO 6:** Familiar with two dimensional flow.

**Unit I (15 hours)**

Vector Analysis: Relations between Line and Surface Integrals-Conservative Vector Fields –Conservative Fields of Force- General Orthogonal Curvilinear Coordinates - Arc Length, Gradient, Divergence, Laplacian, Curl of a Vector Function in Orthogonal Coordinates.

**Unit II (15 hours)**

Kinematics of fluids in motion: Real fluids - Ideal fluids - Velocity of a Fluid at a Point - Streamlines and Pathlines; Steady and unsteady flows - The Velocity Potential - The Velocity Vector - Local and Particle Rates of Change - The Equation of Continuity - Worked Examples - Acceleration of a Fluid.

**Unit III (15 hours)**

Equations of motion of a fluid: Pressure at a point in a Fluid at Rest-Pressure at a Point in a Moving Fluid - Conditions at a Boundary of Two Viscid Immiscible Fluids - Euler's Equations of Motions - Bernoulli's Equation - Worked Examples

**Unit IV (15 hours)**

Some Three dimensional flows: Introduction - Sources - Sinks and Doublets - Images in a Rigid Infinite Plane - Images in Solid Spheres - Axi-symmetric flows; Stokes Stream Function - some special forms of the Stream Function for Axi - Symmetric Irrotational motions .

**Unit V (15 hours)**

Some Two Dimensional Flows: Meaning of Two Dimensional Flow - Use of Cylindrical Polar Coordinates - The Stream Function - The Complex Potential for Two - Dimensional, Irrotational. Incompressible Flow - Complex Velocity Potentials for Standard Two Dimensional Flows - Uniform Stream - Line Sources and Line Sinks Line Doublets - Line Vortices - Some Worked Examples.

**Text Book:**

1. F.Chorlton, **Fluid Dynamics**, CBS publishers & Distributors Pvt, Ltd., New Delhi, First Indian Edition – 1985. reprint – 2004.

**Unit I:** Chapter 1 (sec 1.17 – 1.19)

**Unit II:** Chapter 2 (sec 2.1 – 2.9)

**Unit III:** Chapter 3 (sec 3.1 – 3.6 )

**Unit IV:** Chapter 4

**Unit V:** Chapter 5 (sec 5.1 – 5.6)

**Reference Books:**

2. Herbert Goldstein, **Classical Mechanics**, Narosa Publishing House. New Delhi. Second Edition reprint-2001.
3. Shanti Swarup, **Fluid dynamics**, Krishnan prakashan Mandir, Meerut, 1992-93.
4. M.D.Raisinghania **Hydrodynamics**, S.Chand & Co.ltd.,1995.

**Core Elective II - Operations Research**  
(For those who joined since 2018-19)

**Semester: V**

**Sub.Code: FBMXE5D /GBMXE5D**

**Hours per Week: 5**

**Credit: 5**

**CO 1:** To familiarize the concepts of Linear Programming Problem

**CO 2:** Mathematical tools that are needed to solve the Optimization Problem

**CO 3:** Gain knowledge of solving the Transportation and Assignment Problem

**CO 4:** Understand the Optimization Technique in Games and Strategies Problem

**CO 5:** Gain knowledge of Network Construction

**CO 6:** Students can solve the Real life problem through OR techniques

**Unit I (15 hours)**

Linear Programming Problem - Mathematical formulation - Illustrations on Mathematical Formulation of LPPs - Graphical solution and Extension: Graphical solution method - some exceptional cases - General L.P.P - Canonical and standard forms of L.P.P.- Linear Programming - Simplex method- Introduction - Fundamental properties of solutions -The computational procedure

**Unit II (15 hours)**

Use of Artificial variables - Degeneracy in L.P.P.- Duality in Linear Programming - Introduction - General Primal - Dual Pair - Formulating a Dual Problem - Primal-Dual Pair in Matrix Form - Dual Simplex method.

**Unit III (15 hours)**

Transportation Problem - LP formulation of the Transportation Problem - Existence of solution in T.P - Duality in Transportation problem - The Transportation Table - Loops in Transportation tables - Triangular basis in a T.P - Solution of a T. P - Finding an initial basic feasible solution - Test for optimality - Degeneracy in Transportation Problem - Transportation Algorithm (MODI Method) - Stepping Stone solution method - Assignment Problem - Introduction - Mathematical formulation of the problem - Solution methods of Assignment Problem - Special cases in Assignment Problems

**Unit IV (15 hours)**

Games and Strategies - Introduction - Two-Person Zero-Sum Games - Some Basic terms - The Maximin - Minimax Principle - Games without Saddle Points - Mixed Strategies - Graphic Solution of  $2 \times n$  and  $m \times 2$  Games - Dominance Property.

**Unit V (15 hours)**

Network Scheduling by PERT/CPM - Introduction - Network: Basic Components - Logical Sequencing - Rules of Network construction - Concurrent activities - Critical Path Analysis - Probability Considerations in PERT - Distinction between PERT and CPM.

**Text Book:**

1. Kanti Swarup, P.K. Gupta & Man Mohan, **Operations Research**, Sultan chand & sons. Eighteenth Edition.2015.

**Unit I:** Chapter 2(2:3 – 2:4), Chapter 3(3:2 – 3:5) & Chapter 4(4:1 – 4:3)

**Unit II:** Chapter 4(4:4 – 4:5), Chapter 5(5:1 – 5:4 & 5:9)

**Unit III:** Chapter 10(10:2 – 10:10, 10:12 – 10:14) & Chapter 11(11:1 – 11:14)

**Unit IV:** Chapter 17 (17:1 – 17:7)

**Unit V:** Chapter 25(25:1 – 25:8)

**Reference Books:**

2. S.D. Sharma, **Operations Research**, Dedar Nath Ram Nath. 2009.
3. Hamdy A. Taha, **Operations Research** An Introduction, Prentice Hall. Eighth Edition. 2007.
4. Srinivasan, **Operations Research** Principles and Applications, PHI Learning pvt., Ltd. second Edition 2012.

**Skill Based Elective V- Non-Verbal Reasoning**  
(For those who joined since 2018-19)

**Semester: V****Sub.Code: FBMXE54 / GBMXE54****Hours per Week: 3****Credit: 2****CO 1:** Understand the basic concepts of logical reasoning skills**CO 2:** Understand the basic concepts of quantitative ability**CO 3:** Test a candidate's overall Knowledge Power of Reasoning**CO 4:** To compete in various competitive exams like CAT, GATE, UPSC, GPSC etc.

<b>Unit I</b>	<b>(9 hours)</b>
Analytical Reasoning	
<b>Unit II</b>	<b>(9 hours)</b>
Rule Detection	
<b>Unit III</b>	<b>(9 hours)</b>
Cubes and dice	
<b>Unit IV</b>	<b>(9 hours)</b>
Construction of Squares and Triangles	
<b>Unit V</b>	<b>(9 hours)</b>
Figure Formation & Analysis	

**Text Book:**

1. R.S. Aggarwal, **A Modern Approach to Non - Verbal Reasoning**, S.Chand & Company Ltd. 2014  
**Unit I:** Chapter 4  
**Unit II:** Chapter 12  
**Unit III:** Chapter 14  
**Unit IV:** Chapter 16  
**Unit V:** Chapter17

**Reference Books:**

2. R.S.Aggarwal. **Test of Verbal and Non-verbal Reasoning for Competitive Examinations**, S. Chand & company Ltd, 2014.
3. B. S. Sijwali, Indus Sijwali, **Non verbal Reasoning**, Arihant publishers Dec 2014.
4. Dipak Kumar, **Reasoning, Verbal, Non verbal & Analytical for Competitive Examinations**, yugnimal unicorn Editorial department.

**Extra Credit – Quantitative Techniques**  
(For those who joined since 2018-19)

**Semester: V****Sub.Code: FBMXX5/GBMXX5****Credit: 2****CO 1:** Understand the concept of optimal sequence model and Processing through the job and machines.**CO 2:** Know the concept of application of dynamic programming model in industries.**CO 3:** Calculate the probabilities, and derive the marginal and conditional distributions of bivariate random variables.

**CO 4:** Understand the values and use of quantitative methods in administrative and optimal problem solving and decision making.

### Unit I

Linear programming Problem - Advanced techniques: Introduction - Revised simplex method - Simplex Method versus Revised simplex method - Bounded variables - parametric linear Programming - linear fractional programming - Application of linear fractional Programming – karmarkar Algorithm.

### Unit II

Sequencing problem: Introduction - Problem of sequencing - basic terms used in sequencing - Processing n jobs through two machines - Processing n jobs through k machines - Processing 2 jobs through k machines.

### Unit III

Dynamic programming: Introduction - the recursive equation approach - characteristics of Dynamic Programming - Dynamic Programming Algorithm - solution of discrete D.P.P - Some applications - Solution of L.P.P by Dynamic Programming.

### Unit IV

Probability: Introduction - uncertainty and probability - sample space and probability - algebra of events - conditional probability - random variables - Expectation of a random variable - central tendency and dispersion - some probability distributions.

### Unit V

Decision Analysis: Introduction - Decision Making Problem - Decision Making Process - Decision Making Environment - Decisions Under Uncertainty - Decisions Under Risk - Decision Tree Analysis - Decision Making With Utilities.

### Text Book:

1. Kanti Swarup, P. K. Gupta, Man Mohan, **Operations Research**, Sultan Chand & Sons, New Delhi. Eighteenth edition 2015.

**Unit I:** Chapter 9

**Unit II:** Chapter 12(Sec 12:1 – 12:6)

**Unit III:** Chapter 13

**Unit IV:** Chapter 14

**Unit V:** Chapter 16

### Reference Books:

2. P.K.Gupta and Man Mohan, **Problems in Operations Research**, Sultan Chand & Sons, New Delhi. Fourteenth edition, 2002.
3. Prem Kumar Gupta and D.S. Hira, **Operations Research**, Sultan Chand & Sons, New Delhi. First edition.1993.
4. Hamdy A. Taha, **Operations Research: An Introduction**, Prentice Hall, Eighth Edition. 2007

### Core XIII- Real Analysis-II (For those who joined since 2018-19)

**Semester: VI**

**Sub.Code: FBMXC61/GBMXC61**

**Hours per Week: 5**

**Credit: 4**

**CO 1 :** Understand the Countable Set, Metric space, Closed and Open set.

**CO 2 :** Analyze the Limit Point.

**CO 3 :** Understand the concept of Continuity.

**CO 4 :** Demonstrate the Connectedness and Compactness.

**Unit I (15 hours)**

Sets and Functions - Countable and Uncountable sets - Inequalities of Holder and Minkowski - Metric spaces: Definitions and example - Bounded sets in a Metric Space - Open ball in a Metric Space - Open Sets - Subspaces - Interior of a set-closed sets.

**Unit II (15 hours)**

Closure - Limit Point - Dense Sets - Complete Metric Space: Introduction - Completeness - Baire's Category Theorem.

**Unit III (15 hours)**

Continuity - Homeomorphism - Uniform continuity.

**Unit IV (15 hours)**

Connectedness: Introduction - Definition and Examples - Connected Subsets of  $\mathbb{R}$  - Connectedness and Continuity.

**Unit V (15 hours)**

Compactness: Introduction - Compact Space - Compact Subsets of  $\mathbb{R}$  - Equivalent Characterization for Compactness - Compactness and Continuity.

**Text Book:**

1. S. Arumugam & A.Thangapandi Issac, **Modern Analysis**, New Gamma Publishing house. 2013.

**Unit I:** Chapter I, II(Sec 1.1 – 1.4 & 2.1 – 2.7)

**Unit II:** Chapter II, III(Sec 2.8 – 2.10 & 3.0 – 3.2)

**Unit III:** Chapter IV(Sec 4.0 – 4.3)

**Unit IV:** Chapter V(Sec 5.0 – 5.3)

**Unit V:** Chapter VI(Sec 6.0 – 6.4)

**Reference Books:**

2. M.K.Singal – Asha Rani Singal, **A first course in Real Analysis**, S. Chand & Co Ltd. NewDelhi, Twentieth Edition.1998.
3. Shanthi Narayanan and P.K.Mittal, **A course of Mathematical Analysis**, S. Chand & Co Ltd., New Delhi,2007.
4. Richard R.Goldberg, **Method of Real Analysis**, Oxford & IBH publishing co pvt. ltd, New Delhi,1970.

**Core XIV- Number Theory**  
(For those who joined since 2018-19)

**Semester : VI**

**Sub.Code : FBMXC62 / GBMXC62**

**Hours per week : 5**

**Credit : 4**

**CO 1:** Apply Divisibility properties and the Fundamental theorem of Arithmetic.

**CO 2:** Solve system of linear congruence and apply the Chinese Remainder theorem.

**CO 3:** Understand Fermat's little theorem to prove relations involving prime numbers.

**CO 4:** Understand the concept of Euler's phi theorem and Phi Functions.

**Unit I (15 hours)**

Mathematical Induction - The Binomial Theorem – Divisibility Theory in the Integers: Early Number Theory - The Division algorithm - The Greatest Common Divisor.

**Unit II (15 hours)**

The Euclidean Algorithm - The Diophantine Equation  $ax + by = c$ . Primes and their Distribution: The Fundamental Theorem of Arithmetic - The Sieve of Eratosthenes – The Goldbach Conjecture.

**Unit III (15 hours)**

The Theory of Congruence: Carl Friedrich Gauss - Basic Properties of Congruence – Binary and Decimal Representations of Integers – Linear Congruence and the Chinese Remainder Theorem .

**Unit IV (15 hours)**

Fermat's Theorem: Pierre de Fermat – Fermat's little Theorem and Pseudo Primes – Wilson's Theorem - The Fermat Kraitchik Factorization Method.

**Unit V (15 Hours)**

Euler's Generalization of Fermat's Theorem: Leonhard Euler - Euler's Phi Functions – Euler's Theorem - Some Properties of the Phi-Function.

**Text Book:**

1. David M. Burton, **Elementary Number Theory**, Tata McGraw Hill Education Pvt., Ltd., Seventh Edition 2009.

**Unit I:** Chapter 1, 2 (sec 2.1 – 2.3)

**Unit II:** Chapter 2 (sec 2.4 – 2.5), 3

**Unit III:** Chapter 4

**Unit IV:** Chapter 5

**Unit V:** Chapter 7

**Reference Books:**

2. R.K.Pandey, **Number Theory**, first Edition 2014.
3. Neville Robbi, **Beginning Number Theory**, Second Edition 2006.
4. S B Malik, **Basic Number Theory**, Second revised Edition 2011.

**Core XV-Numerical Analysis**  
(For those who joined since 2018-19)

**Semester: VI**

**Sub.Code: FBMXC63 /GBMXC63**

**Hours per Week: 5**

**Credit: 4**

**CO 1:** Be familiar with calculation and interpretation of errors in numerical computations

**CO 2:** Be familiar with numerical interpolation and approximation of functions

**CO 3:** Be familiar with numerical differentiation and integration

**CO 4:** Be familiar with numerical solution of differential equations.

**Unit I (15 hours)**

Algebraic and Transcendental Equations: Errors in numeric computations - Iteration method - Aitken's  $\Delta^2$  method - Bisection method - Regula-falsi method - Newton-Raphson method



**Unit II (15 hours)**

Finite Differences: Difference operators - Other difference operators.

**Unit III (15 hours)**

Interpolation: Newton's interpolation formula - Central difference interpolation formulae - Lagrange's interpolation formula - Divided difference - Divided difference formula - Inverse interpolation.

**Unit IV (15 hours)**

Numerical Differentiation: Derivatives using Newton's forward difference formula - Derivatives using Newton's backward difference formula - Derivatives using Newton's central difference formula - Maxima and minima of the interpolating polynomial - Numerical integration: Newton's Cote's quadrature formula - Trapezoidal Rule - Simpson's one third rule - Simpson's three eighth rule - Weddle's rule.

**Unit V (15 hours)**

Numerical solution of Differential Equation: Taylor series method – Picard's method – Euler's method - Runge-kutta method - Predictor-corrector formula.

**Text Book:**

1. Dr S Arumugam, A Thangapandi Isaac & Dr A.Somasundaram, **Numerical Analysis**, New Gamma Publishing House, Palayamkottai, Edition 2011  
**Unit I:** Chapter 1  
**Unit II:** Chapter 3 (sec 3.1 – 3.2)  
**Unit III:** Chapter 4  
**Unit IV:** Chapter 5,6  
**Unit V:** Chapter 7

**Reference Books:**

2. S. Sastry, **Introductory Methods of Numerical Analysis**, PHI Learning Pvt., Ltd., Fourth Edition, 2009.
3. H.C. Saxena, **Finite Differences and Numerical Analysis**, S. Chand & Company Ltd., 2001.
4. T. K. Manicavachagom pillay, S. Narayanan, **Numerical Analysis**, S.Viswanathan (Printer & Publisher), Pvt., Ltd., Edition 2001.

**Core XVI- Complex Analysis**  
**(For those who joined since 2018-19)**

**Semester: VI****Sub.Code: FBMXC64/GBMXC64****Hours per Week: 5****Credits: 4**

**CO1:** Understand the significance of differentiability for complex functions and be familiar with the Cauchy Riemann equations.

**CO2:** Understand the Concept of Bilinear transformations.

**CO3:** Gain knowledge of integrals along a path in the complex plane and understand the Statement of Cauchy's theorem.

**CO4:** Know the Taylor and Laurent expansions of simple functions, determining the Singularities and calculating residues.

**CO5:** Gain knowledge of Cauchy Residue theorem.

**CO6:** Apply in almost every branch of Mathematics and is one of the Powerful tools for the Mathematicians.

**Unit I (15 hours)**

Complex Numbers: Introduction - Complex Numbers - Conjugation and Modulus - Inequalities - Square Root - Geometrical Representation of Complex Numbers -  $n^{\text{th}}$  Roots of Complex Numbers - Circles and Straight Lines - Analytic Functions : Introduction - Functions of a Complex Variable - Limits - Theorems on Limit - Continuous Functions - Differentiability - The Cauchy - Riemann Equations .

**Unit II (15 hours)**

Analytic Functions - Harmonic Functions - Bilinear Transformations: Introduction - Elementary Transformations - Bilinear Transformations - Cross Ratio - Fixed Points of Bilinear Transformations - Some Special Bilinear Transformations.

**Unit III (15 hours)**

Complex Integration: Introduction - Definite integral - Cauchy's Theorem - Cauchy's Integral Formula - Higher Derivatives.

**Unit IV (15 hours)**

Series Expansions: Introduction - Taylor's Series - Laurent's Series - Zeros of an Analytic Function - Singularities.

**Unit V (15 hours)**

Calculus of Residues: Introduction - Residues - Cauchy's Residue Theorem - Evaluation of Definite Integrals.

**Text Book:**

1. S. Arumugam, A. Thangapandi Issac and A.Somasundaram, **Complex Analysis**, Scitech Publication (India) Pvt, Ltd., 2014 .

**Unit I:** Chapter 1(1.0 - 1.7) & Chapter 2 (2.0 - 2.6)

**Unit II:** Chapter 2(2.7 - 2.8) & Chapter 3(3.0 – 3.5)

**Unit III:** Chapter 6

**Unit IV:** Chapter 7

**Unit V:** Chapter 8

**Reference Books:**

2. S. Narayanan & T.K. Manickavasagampillai, **Complex Analysis**, J.Visvanathan Printer's Publications Pvt, Ltd., Edition 2008.
3. Santhinarayan, **Theory of functions of Complex Variable**, S.Chand and Company, Meerut, 1995.
4. P. Duraipandian and Laxmi Duraipandian, **Complex analysis**, Emerald Publishers, Chennai –2, 1997.

**Core Elective III - Discrete Mathematics**  
(For those who joined since 2018-19)

**Semester: VI**

**Sub.Code: FBMXE6A / GBMXE6A**

**Hours per Week: 5**

**Credit: 5**

**CO 1:** Gain knowledge in recurrence relations and generating functions

**CO 2:** Understand the concept of logic operators.

**CO 3:** Understand the techniques for replacement process

**CO 4:** Recognize basic properties of lattices.

**CO 5:** Have a good foundation in the concept of Boolean Algebra.

**CO 6:** Apply knowledge about discrete Mathematics in problem solving

**Unit I (15 hours)**

Mathematical Induction: Techniques of Proof - Mathematical Induction - Recurrence Relations and Generating Functions: Recurrence - an introduction - Polynomials and their Evaluations - Recurrence Relations.

**Unit II (15 hours)**

Logic: Introduction - TF Statements - Connectives - Atomic and Compound Statements - Well-Formed Statement Formulae - Truth Table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae.

**Unit III (15 hours)**

Replacement Process - Functionally Complete sets of connectives and Duality law - Normal Forms - Principal Normal Forms.

**Unit IV (15 hours)**

Lattices and Boolean Algebra: Lattices - Some properties of Lattices - New Lattices - Modular and Distributive Lattices.

**Unit V (15 hours)**

Boolean Algebras - Boolean Polynomials - Karnaugh Map.

**Text Book:**

- 1 Dr M.K. Venkataraman, Dr N. Sridharan, Dr N. Chandrasekaran, **Discrete Mathematics**, The National Publishing Company. 2012.

**Unit I:** Chapter IV (sec 1,2) & Chapter V (sec 1 - 3)

**Unit II:** Chapter IX (sec 1 - 8)

**Unit III:** Chapter IX (sec 9 - 12 )

**Unit IV:** Chapter X (sec 1 - 4)

**Unit V:** Chapter X (sec 5 - 7)

**Reference Books:**

- 2 J.P. Tremblay & R. Manohar , **Discrete Mathematical Structures with Applications to Computer Science** , Mc’Graw-Hill Publishing Company Ltd., 1997.
- 3 C.L. Liu, **Elements of Discrete Mathematics**, Mc Graw Hill Book Company, New Delhi.1986.
- 4 J.K Sharma, **Discrete Mathematics**, Macmillan publishers India Ltd., Third Edition, 2011.

**Core Elective III - Mathematical Modeling**  
(For those who joined since 2018-19)

**Semester: VI**

**Sub.Code: FBMXE6B /GBMXE6B**

**Hour per Week: 5**

**Credit: 5**

**CO 1:** Learn techniques of mathematical modeling

**CO 2:** Construct appropriate Ordinary differential equations with relevant parameters and conditions.

**CO 3:** Ability to determine the basic theory of linear difference equations

**CO 4:** Understand the concept of graphs and directed graph.

**CO 5:** Gain knowledge about calculus of variations.

**CO 6:** Formulate and specify a real life problems

**Unit I (15 hours)**

Mathematical modeling: Need, Techniques, Classifications and Simple Illustrations: some characteristics of Mathematical Models - Mathematical modeling through Geometry - through Algebra - through Trigonometry - through Calculus – Limitations of Mathematical Modelling.

**Unit II (15 hours)**

Mathematical modeling through ordinary differential equations of first order: Mathematical modeling through differential equations - linear growth and decay models - Non-Linear growth and decay models compartment models - mathematical modeling in dynamics through ordinary differential equations of first order – Mathematical modeling of Geometrical Problems through ordinary differential equations of first order.

**Unit III (15 hours)**

Mathematical modeling through difference equations – The Need of mathematical modeling through difference equations: Some simple models - Basic theory of linear difference equations with constant coefficients - Mathematical modeling through difference equation in economics and finance - Mathematical modeling through difference equation in probability theory.

**Unit IV (15 hours)**

Mathematical modeling through graphs – Situations that can be modeled through graphs – Mathematical models in terms of directed graphs - signed graphs - weighted diagraphs - Unoriented graphs.

**Unit V (15 hours)**

Mathematical modeling through calculus of variations and dynamic programming - optimization principles and techniques – Mathematical Models through calculus of variations - Mathematical Models through dynamic programming.

**Text Book:**

- 1 J.N. Kapur, **Mathematical Modelling**, New Age International Pvt., 2008.

**Unit I:** Chapter 1 (sec 1.3 - 1.9)

**Unit II:** Chapter 2 (sec 2.1 - 2.6)

**Unit III:** Chapter 5 (sec 5.1 - 5.3, 5.5)

**Unit IV:** Chapter 7 (sec 7.1 - 7.5)

**Unit V:** Chapter 9 (sec 9.1 – 9.3)

**Reference Books:**

- 2 A.C.Fowler, **Mathematical Models in the Applied Science**, Cambridge University Press 1997.
- 3 I.LiangChern, **Mathematical Modelling and Ordinary differential equations**, 2016.
- 4 Prof Sara Billey, **Discrete Mathematical Modeling**, University of Washington, Winter Quarter, 2011.

**Skill Based Elective VI- Quantitative Aptitude  
(For those who joined since 2018-19)**

**Semester: VI**

**Sub.Code: FBMXE65 / GBMXE65**

**Hours per Week: 3**

**Credit: 2**

**CO 1:** After through learning of aptitude will be able to critically evaluate various real life situations by restoring to analysis of key issues and factors.

**CO 2:** Able to read between the lines and understand various language structures.

**CO 3:** Able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

**CO 4:** Solve the sums by applying shortcut methods with the time management.

**Unit I (9 hours)**

Shares, stocks and Debentures: Introduction - Shares - Nominal Value/Face value/Par Value of Shares - Market value of shares - Dividend - Important formulae - Types of Shares - Stocks - Debentures - Brokerage - Some useful Relations - Some important points .

**Unit II (9 hours)**

Races and Games of Skill: Race - Some Important points - Calendars: Introduction - Odd days - Ordinary year - Leap year - Some important points.

**Unit III (9 hours)**

Surds and indices: Introduction - Order of Surds - Quadratic Surd - Cubic Surd - Quartic Surd - Difference between Simple Surd and Compound Surd - Difference between Pure Surd and Mixed Surd - Similarity of Surds - Conjugate Surds - Laws of Surds - Short Cut to convert Mixed Surd into Pure Surd - To Convert the Surds of Different Orders to those of Same Order - Comparison of Surds - Addition and Subtraction of Surds - Multiplication and Division of Surds - Rationalisation of Surds - Rationalisation of the Denominator of a Fraction.

**Unit IV (9 hours)**

Data Interpretation and Analytical Tool: Tabulation - Simple Table - Complex Table - Graphs - Data Interpretation - Problems on Tabulation.

**Unit V (9 hours)**

Problems on line Graph: Problems on Bar Graph - Problems on Circle Graph.

**Text Book:**

1. P.Gupta, **Quantitative Aptitude**, Unique publication, Edition 2010.

**Unit I:** Chapter 12 (Pg. No 353 - 356)

**Unit II:** Chapter 22 (Pg. No 567 - 572, 573 - 579)

**Unit III:** Chapter 26 (Pg. No 627 – 629, 630 - 632)

**Unit IV:** Chapter 38(Pg. No 1079 - 1081)

**Unit V:** Chapter 38 (Pg. No 1135 - 1207)

**Reference Books:**

2. R. S. Agarwal, **Quantitative Aptitude**, S. Chand & company Ltd., 2014.
3. U. Mohan Rao, **Quantitative Aptitude For Competitive Examinations**, SCITECH Publications (india) Pvt., Ltd., Chennai, Reprint, 2012.
4. AbhijitGuha, **Quantitative Aptitude For MBA Competitive Examinations**, TATA MC GRAW HILL Publishing Company Ltd, Reprint, 2008.

**Core V- Mathematics for Computer Science-I  
For B.Sc., Information Technology  
(For those who joined since 2018-19)**

**Semester: III**

**Sub.Code: FBITC31 /GBITCA31**

**Hours per Week: 5**

**Credit: 4**

**CO 1:** Understand the concept of basic measure of central tendencies and dispersion

**CO 2:** Develop skills in basic statistical concepts

**CO 3:** Understand the use of language of probability

**CO 4:** Use mathematical knowledge to analyse and solve problems.

**Unit I** (15 hours)

Central tendencies: Introduction - Arithmetic Mean - Partition values - Mode - Geometric mean - Harmonic mean - Relative advantages of Different Averages.

**Unit II** (15 hours)

Measures of Dispersion: Introduction - Range - Quartile deviation - Mean deviation - Standard deviation - Mean square deviation - Moments - Skewness and Kurtosis.

**Unit III** (15 hours)

Correlation and Regression: Introduction - Correlation - Rank Correlation - Regression - Correlation coefficient for a bivariate frequency distribution.

**Unit IV** (15 hours)

Probability: Introduction - Probability - Conditional Probability - Properties of independent events.

**Unit V** (15 hours)

Random Variable: Introduction - Random Variables - Discrete Random Variable - Continuous Random Variable - Mathematical Expectation of continuous Random Variable - Moment generating function - Characteristic function.

**Text Book:**

1. Dr. S.Arumugam and A. Thangapandi Isaac, **Statistics**, New gamma publishing house, June 2015.

**Unit I:** Chapter 2

**Unit II:** Chapter 3,4

**Unit III:** Chapter 6

**Unit IV:** Chapter 11

**Unit V:** Chapter 12

**Reference Books:**

2. K. R. Gupta, **Mathematical Statistics**, Atlantic publishers & Distributors (p) Ltd., 2015.
3. P. N. Arora and P. K. Malhan, **Biostatistics**, Himalaya publishing house, First edition, 1996.
4. S. C. Gupta, **Fundamentals of statistics**, Himalaya publishing house, Sixth Edition, 2004.

**Core VIII - Mathematics for Computer Science-II**  
**For B.Sc., Information Technology**  
**(For those who joined since 2018-19)**

**Semester: IV**

**Sub.Code: FBITC41/GBITCA41**

**Hours Per Week: 6**

**Credit: 4**

**CO 1:** Learn the concepts of matrices and set theory

**CO 2:** Understand the basic principles of relations and its types

**CO 3:** Have an understanding in the concepts of logic

**CO 4:** Gain knowledge about graphs and trees.

**Unit I (18 hours)**

Matrices: Introduction - Algebra of Matrices - Types of Matrices - The Inverse of a Matrix - Rank of a Matrix - Eigen values and Eigen vectors.

**Unit II (18 hours)**

Set theory: Introduction - Set and its Elements - Set Description - Types of Sets - Venn-Euler Diagrams - Set operations and Laws of Set Theory - Fundamental Products - Partitions of Sets - Minsets - Algebra of Sets and Duality - Computer Representation of sets - The Inclusion and Exclusion Principle.

**Unit III (18 hours)**

Relations: Introduction - Binary Relations - Set operations on relations - Types of Relations - Partial order Relations - Equivalence relation - Composition of relations - Functions: Introduction - Types of Functions - Invertible functions - Composition of Functions.

**Unit IV (18 hours)**

Mathematical Logic: Introduction - Propositional calculus - Basic logical operations - Tautologies - Contradiction - Contingency - Argument - Methods of proof - Equivalence and implication - Predicate calculus.

**Unit V (18 hours)**

Graph Theory: Introduction - Basic Terminology - Paths, Cycles and Connectivity - Subgraphs - Types of graphs - Isomorphic Graphs - Homeomorphic Graphs - Representation of graphs in computer memory - Trees: Introduction - Definitions and Properties of trees - Binary trees - Complete Binary tree - Traversing Binary trees - Computer Representation of general trees.

**Text Books:**

1. Dr. S. Arumugam and A. Thangapandi Isaac, **Modern Algebra**, Scitech Publications Pvt. Ltd., 2003.

**Unit I:** Chapter 7 (sec 7.0 – 7.3, 7.5, 7.8)

2. J K Sharma, **Discrete Mathematics**, Macmillan India Ltd., Second Edition, 2005.

**Unit II:** Chapter 1 (sec 1.1 – 1.7, 1.9 – 1.10, 1.12 – 1.14)

**Unit III:** Chapter 3 (sec 3.1, 3.3 – 3.7, 3.11)

Chapter 4 (sec 4.1, 4.3 – 4.5)

**Unit IV:** Chapter 12 (sec 12.1 – 12.3, 12.8 – 12.14)

**Unit V:** Chapter 9 (sec (9.1 – 9.8)

Chapter 10 (sec 10.1 – 10.4, 10.6, 10.8)

**Reference Books:**

3. Dr. M K Venkataraman, Dr. N Sridharan, N Chandrasekaran, **Discrete Mathematics**, The National Publishing Company, 2012.
4. Dr S Arumugam, S Ramachandran, **Invitation to Graph theory**, Scitech Publications Pvt., Ltd., June 2001.
5. J P Tremblay, R Manohar, **Discrete Mathematical Structures with Applications to Computer Science**, Tata McGraw Hill Education Pvt., Ltd., 2009.

**Second Allied I - Mathematical Foundation for Computer Science  
For B.Sc., Computer Science  
(For those who joined since 2018-19)**

**Semester: III**  
**Sub.Code: GBCSA33**

**Hours per week: 6**  
**Credit: 5**

- CO 1:** Understand the ideas of statements and notations in logic  
**CO 2:** Understand how to apply statements to normal forms  
**CO 3:** Understand the basic proofs involving sets and functions  
**CO 4:** Understand the concept of Boolean algebra and Boolean function  
**CO 5:** Understand the use of graphs  
**CO 6:** Communicate clearly and effectively using the technical language of the field.

**Unit I (18 hours)**

Mathematical Logic: Statements and Notations - Connectives – Negations - Conjunctions - Disjunctions - Statement Formulas and Truth Tables - Conditional and Biconditional – Well-formed Formulas - Tautologies - Equivalence of Formulas - Duality Law - Tautological Implications - Formulas with Distinct Truth Tables - Functionally Complete Sets of Connectives - Other Connectives.

**Unit II (18 hours)**

Normal Forms - The Theory of Inference for the Statement calculus -The Predicate Calculus - Inference Theory of Predicate Calculus: valid formulas and equivalences -some valid formulas over finite universes - special valid formulas involving quantifiers - theory of inference for the predicate calculus.

**Unit III (18 hours)**

Set Theory: Basic concepts of set theory - Relations and Ordering: Relations - Relation matrix and the graph of a relation - Composition of binary relations.

**Unit IV (18 hours)**

Boolean algebra: Definition and examples - sub algebra, direct product and homomorphism - Boolean Function: Boolean forms and free Boolean algebras - values of Boolean expressions and Boolean functions

**Unit V (18 hours)**

Basic concepts of Graph theory – Basic Definitions - Paths, Reachability and connectedness - Matrix representation of graphs - Trees

**Text Book:**

- J. P. Tremblay and R. Manohar, **Discrete Mathematical Structures with Applications to Computer Science**, Tata McGraw Hill, New Delhi, 2009.  
**Unit I:** Chapter 1 (Pg no: 1 – 14, 18 - 41)  
**Unit II:** Chapter 1 (Pg no: 50 - 99)  
**Unit III:** Chapter 2 (Pg no: 104 – 126, 148 – 154, 156 – 162, 176 - 182 )  
**Unit IV:** Chapter 4 (Pg no: 397 - 418)  
**Unit V:** Chapter 5 (Pg no: 468 - 501)

**Reference Books:**

- Narsingh Deo, **Graph Theory with Applications to Engineering and Computer Science**, Prentice Hall of India, New Delhi, 2007.
- Kenneth H Rusen, **Discrete Mathematics and its Applications**, Tata McGraw Hill, New Delhi, Sixth Edition, 2007.
- J K Sharma, **Discrete Mathematics**, Macmillan India Ltd., Second edition, 2005.



**Second Allied II – Operations Research  
For B.Sc., Computer Science  
(For those who joined since 2018-19)**

**Semester: IV****Sub.Code: FBCSA43/FBCSA441/GBCSA44****Hours per week: 6****Credit: 5****CO 1:** Understand the various techniques of Operations Research.**CO 2:** Convert real life problems into mathematical models.**CO 3:** Design new simplex model using simplex and Big M**CO 4:** Understand to build and solve assignments models and transportation models.**CO 5:** Understand optimization techniques Business problems.**CO 6:** Gain knowledge to solve real life problems using concept of operations research.**Unit I (18 hours)**

What is operations research?: Introduction - The historical development - The nature and meaning of OR - Management application of OR - Modeling in OR - Principles of modeling - Approximations of OR models - General methods for solving OR models - Characteristics & Phases - tools Techniques & Methods - Scope of OR

**Unit II (18 hours)**

Linear Programming Problem - Formulation of LPP - Graphical Solution of two variable problems - General formulation of LPP - Slack & Surplus Variables – Standard form of LPP

**Unit III (18 hours)**

Simplex Method: Introduction - Some more definitions and notations - Computational Procedure of simplex method - Simple way for simplex method computations - Artificial Variables techniques.

**Unit IV (18 hours)**

Assignment models: Introduction - Mathematical formulation of assignment problem - Fundamental Theorems - Hungarian method for assignment problem - More illustrative examples - Unbalanced assignment problem - Variations in the Assignment problem - Sensitivity in Assignment problem - the Travelling-Salesman problem

**Unit V (18 hours)**

Transportation problems: Introduction - Mathematical formulation of transportation problem - Matrix Form of Transportation Problem - Feasible Solution, Basic feasible solution and Optimum Solution - Tabular Representation - Special Structure of Transportation Problem - Loops in Transportation Table and their problems - Initial basic Feasible Solution - Optimum Solution

**Text Book:**

1. S. D. Sharma, **Operations Research**, Kedar Nath Ram Nath publishers, Meerut, Fifteenth Edition, 2005.

**Unit I:** Chapter 1 (sec 1.1 – 1.11)**Unit II:** Chapter 3 (sec 3.1 – 3.6)**Unit III:** Chapter 5 (sec 5.1 – 5.5)**Unit IV:** Chapter 12 Full**Unit V:** Chapter 11 Full

**Reference Books:**

2. Nita H. Shah, Ravi M. Gor and HardikSoni, **Operation Research**, Prentice-Hall of India Pvt. Ltd., New Delhi, Sixth Edition, 2008.
3. Taha H.A, **Operations Research an introduction**, 8th Edition, Pearson prentice, Hall, 2005.
4. P.K Gupta, Man Mohan, Problems in **Operations Research**, Sultan Chand & Sons Educational publishers, New Delhi-1997.

**Allied I -Ancillary Mathematics-I  
For B.Sc Chemistry  
(For those who joined since 2018-19)**

**Semester: I****Sub.Code: FBCHA131/GBCHA13****Hours perWeek: 6****Credit: 5****CO 1:** Recognize and use the binomial series.**CO 2:** Solve exponential and logarithmic series.**CO 3:** Find the solution of roots.**CO 4:** Define and determine the rank of matrix.**CO 5:** Understand the concept of algebraic operation.**CO 6:** Explain the relation between hyperbolic and trigonometric function.**Unit I****(18 hours)**

Algebra: Partial fractions - Binomial series - Application of the binomial theorem to the summation of series - approximation and limits.

**Unit II****(18 hours)**

Exponential series - Logarithmic series.

**Unit III****(18 hours)**

Theory of Equations: Nature of Roots - Relation between the coefficients and the roots of an algebraic equation - Transformation of equations - Reciprocal equations - Transformation of equation in general.

**Unit IV****(18 hours)**

Matrices: Definition and algebraic operations - Rank of matrix

**Unit V****(18 hours)**

Trigonometry: Expansions of  $\sin n\theta$  and  $\cos n\theta$  - powers of sines and cosines of  $\theta$  in terms of functions of multiple of  $\theta$  - Expansion of  $\sin \theta$  and  $\cos \theta$  in a series of ascending powers of  $\theta$  - Hyperbolic functions.

**Text Book:**

1. S. Narayanan, R. Hanumantha Rao, T.K. Manicavchagam Pillay and Dr. P. Kandaswamy. **Ancillary Mathematics Volume – I**, S.Viswanathan (Printers & Publishers) Pvt., Ltd. 2010.

**Unit I:** Chapter 1(sec 1.1 - 1.2)**Unit II:** Chapter 1(sec 1.3 - 1.4)**Unit III:** Chapter 2(sec 2.1 - 2.5)**Unit IV:** Chapter 3(sec3.1 - 3.2)**Unit V:** Chapter 5 (sec 5.1 - 5.4)

**Reference Books:**

2. K. Thilagavathy. P. Kandaswamy, **Allied Mathematics**, S.Chand and company Limited New Delhi second edition, 2004.
3. Dr. M.K. Venkataraman and Mrs. Manorama Sridhar, **Allied Mathematics**, Agasthiar Publication, First edition, 2005.
4. Prof. P. Duraipandian and Dr. S. Udayabaskaran, **Allied Mathematics vol-2**, S. Chand & Company Pvt. Ltd, Reprint 2016.

**Allied II- Ancillary Mathematics-II  
For B.Sc.. Chemistry  
(For those who joined since 2018-19)**

**Semester: II****Sub.Code: FBCH231/GBCHA23****Hours perWeek: 6****Credit: 5**

**CO 1:** Gain the knowledge about solving the linear equations numerically and finding interpolation by using difference formulae.

**CO 2:** Gain the knowledge about the method of solving differential equations.

**CO 3:** Inculcate the basics integration and their applications.

**CO 4:** Understand the basic concept of fourier series.

**CO 5:** To know the concept of laplace transforms and its inverse with applications.

**CO 6:** To expose the standard numerical techniques as a powerful tool in scientific computing.

**Unit I****(18 hours)**

Finite Differences: Forward difference - Backward difference - Interpolation - Newton's forward interpolation formula - Newton's backward difference formula.

**Unit II****(18 hours)**

Differential Calculus: Higher derivatives - Jacobian - polar coordinates.

**Unit III****(18 hours)**

Integration: Integrals of functions containing linear functions of x - Integrals of functions involving  $a^2 \pm x^2$  - Integrals of functions of the form  $\int \{f(x)\}^n f'(x) dx$ .

**Unit IV****(18 hours)**

Fourier series: properties of odd and even functions - change of interval - combination of series

**Unit V****(18 hours)**

Laplace Transform: Definition - Method 1, 2 and 3 - some general theorems - The inverse transform

**Text Books:**

1. S. Narayanan, R. Hanumantha Rao, T.K. Manicavchagam Pillay and Dr. P. Kandaswamy, **Ancillary Mathematics**, volume I, S. Viswanathan (Printers and Publishers), Pvt., Ltd. 2010.

**Unit I:** Chapter 4 (pg.no: 172- 192)

**Unit II:** Chapter 6 (pg.no: 266 – 285)

2. S. Narayanan, R. Hanumantha Rao, T.K. Manicavchagam Pillay and Dr. P. Kandaswamy, **Ancillary Mathematics**. volume II, S. Viswanathan (Printers and Publishers). PVT..LTD..2010.

**Unit III:** Chapter 1 (pg.no: 1 - 18)

**Unit IV:** Chapter 2 (pg.no: 123- 159)

**Unit V: Chapter 7 (pg.no: 289 - 317)****Reference Books:**

3. K. Thilagavathy and P. Kandaswamy, **Allied Mathematics paper I**, S. Chand and company Limited, Reprint 2010.
4. Dr. M.K. Venkataraman and Mrs. Manorama Sridhar **Allied Mathematics**, Agasthiar Publications, First edition, 2015.
5. Prof. P. Duraipandian and Dr. S. Udayabaskaran, **Allied Mathematics vol-2**, S. Chand & Company. Pvt. Ltd, Reprint, 2016.

**Allied III - Psychological Statistics  
For B.Sc.. Psychology  
(For those who joined since 2018-19)**

**Semester: III****Sub.Code: FBSYA33 /GBSYA33****Hours per Week: 6****Credit: 5****CO 1:** Identify the Primary objectives of Psychology in Statistical Method.**CO 2:** Capable of Preparing Frequency table using Raw data.**CO 3:** Capable of drawing Pie diagram, Histogram, Frequency Polygon and Ogives.**CO 4:** Acquainted with the Knowledge of various Measures of Central Tendency and their Characteristics.**CO 5:** Calculate and Interpret Correlation and Co-efficient of correlation.**CO 6:** Learn how to use a Chi Square test to evaluate the fit of Hypothesized Distribution.**Unit I (18 hours)**

Meaning of Statistics - Need and Importance of Statistics in Education & Psychology- Prerequisites for Studying Statistics- Organization of Data: Statistical Tables- Rank Order-Frequency Distribution.

**Unit II (18 hours)**

Graphical Representation of Data: Graphical Representation of Ungrouped Data - Bar diagrams - Pie diagrams - Line Graphs - Graphical Representation of Grouped Data: Frequency Polygon - Histogram - Cumulative Frequency Graph - Ogive.

**Unit III (18 hours)**

Measures of Central Tendency: Meaning of the Measures of Central Tendency: Arithmetic Mean - Median - Mode - Computation of Median and Mode from the Curves of Frequency Distribution - When to Use the Mean, Median and Mode - Measures of Variability: Meaning and Importance of the Measures of Variability - Types or Measures of Variability: Range - Quartile Deviation - Average Deviation-Standard Deviation - When and Where to Use the Various Measures of Variability: Range - Average Deviation - Quartile Deviation - Standard Deviation.

**Unit IV (18 hours)**

Linear Correlation: Meaning and Types - Coefficient Of Correlation - Computation of Coefficient of Correlation - Construction of Scatter Diagram - Computation of r.

**Unit V (18 hours)**

Chi-Square And Contingency Coefficient: Use of Chi Square as a Test of Goodness of Fit - Use of Chi-Square as a Test of Independence between two Variables - Contingency Coefficient - Correction for Small Frequencies in a 2x2 table - Underlying Assumptions, Uses and Limitations of Chi Square test.

**Text Book:**

1. Mangal S.K. **Statistics in Psychology and Education** , PH Learning Private Limited, New Delhi , Second Edition 2016.  
**Unit I:** Chapter 1,2 (Pg No:1 – 10, 12 – 15)  
**Unit II:** Chapter 3 (Pg No: 23 – 39)  
**Unit III:** Chapter 4 (Pg No: 41 – 52, 68 – 77)  
**Unit IV:** Chapter 7 (Pg No: 79 – 110 )  
**Unit V:** Chapter 11 (Pg No:181 – 204 )

**Reference Books:**

2. Henry E.Garrett, **Statistics in Psychology and Education**, Surjeet Publications, Second Edition 2012.
3. Arthur Aron, Elliot J. Coups, Elaine N.Aron , **Statistics for Psychology**, Sixth Edition.
4. K.R. Gupta, **Statistical Methods in Education and Psychology**, Hardcover, 2017.

**Certificate in LATEX**  
**(1- year regular programme)**  
**(For those who joined since 2018-19)**

**PSO 1:** LATEX is a document preparation system for high-quality typesetting.

**PSO 2:** Automatic generation of table of contents, bibliographies and indexes.

**PSO 3:** Control over large documents containing sectioning, cross-references, tables and figures.

**PROGRAMME STRUCTURE**

<b>Subject Code</b>	<b>Course</b>	<b>Subject Title</b>	<b>Hrs</b>	<b>Credits</b>	<b>ESE Marks</b>
GCLT1	Core I	Documentation Techniques in LATEX	30	5	100
GCLT2P	Core II	Pictures and Colors Lab	50	5	100
		<b>Total</b>	<b>80</b>	<b>10</b>	<b>200</b>

**Core I - Documentation Techniques in LATEX**  
**(For those who joined since 2018-19)**

**Sub.Code: GCLT1**

**Hours: 30**  
**Credit: 5**

**CO 1:** Create input file and documents.

**CO 2:** Knows changing the type style, symbols, multiline Formulas.

**CO 3:** Create Bibliography and table of content using Latex programme.

**CO 4:** Insert Picture and change the colors using in graphics package in Latex.

**CO 5:** Create line and page breaking and document page style and different types of Boxes using Latex.

**CO 6:** Knows how to make numbering, definition and moving information around.

**Unit I (6 Hours)**

Getting Started: Preparing an Input file - The Input - Sentences and Paragraphs - The Document - Sectioning - Displayed Material - Quotations - Lists - Poetry - Displayed formulas - Declarations - Running LATEX - Helpful hints - Summary.

**Unit II (6 Hours)**

Carrying On: Changing the Type Style - Symbols from Other Languages - Mathematical formulas - Some common Structures - Mathematical Symbols - Arrays - Delimiters - Multiline formulas - putting one thing above another - Spacing in Math mode - Changing style in Math mode - When all else fails - Defining commands and environments - Figures and Other Floating Bodies - Lining It Up in Columns - Simulating Typed Text.

**Unit III (6 Hours)**

Moving Information Around: The table of contents - Cross-References - Bibliography and Citation - Splitting Your Input - Making an Index or Glossary - Keyboard Input and Screen Output - Sending Your Document - Other Document Classes: Books - Slides - Letters.

**Unit IV (6 Hours)**

Pictures and Colors: Pictures - The graphics Package - Color - Errors: Finding the Error - LATEX's Error Messages - TEX's Error Messages - LATEX Warnings - TEX Warnings.

**Unit V (6 Hours)**

Definitions – Numbering and Programming - Figures and Other Floating Bodies - Lining it up in Columns - Moving Information Around - Line and Page Breaking - Lengths, Spaces and Boxes - Pictures and Color - Font selection.

**Text Book:**

1. Leslie Lamport, **A Document Preparation System LATEX**, Addison-Wesley, Second Edition. 2009.

**Unit I:** Chapter 2

**Unit II:** Chapter 3

**Unit III:** Chapter 4, 5

**Unit IV:** Chapter 7, 8

**Unit V:** Chapter Appendix C

**Reference Book:**

2. Helmut Kopka and Patrick W.Daly, **Guide to LATEX**, Addison - Wesley, Fourth Edition.
3. David F. Griffiths and Desmond J. Higham, **Learning LaTeX**, Siam Society for industrial and Applied mathematics Philadelphia, Second Edition.

**Core II - Pictures and Colors Lab  
Practical  
(For those who joined since 2018-19)**

**Sub.Code: GCLT2P**

**Hours: 50**

**Credit: 5**

1. Create a document using input files.
2. Create a document using special symbols, dashes.
3. Create a document using line breaks and foot notes.
4. Create a document using sectioning command.
5. Create a document using Quotations.

6. Create a document using type style.
7. Create a document using commands and environments.
8. Create a document using mathematical formulas.
9. Create a document using mathematical symbols.
10. Create a document using arrays.
11. Create a document using table.
12. Create a document using bibliography.
13. Create a document using clauses.
14. Create a document using page style.
15. Create a document using pictures.
16. Create a document using colors.
17. Create a document using basic of the math index.
18. Create a document using fine print.
19. Create a document using bibliography database.
20. Create a document using math mode environment.
21. Create a document using tabbing environment.
22. Create a document using files.
23. Create a document using line and page breaking.
24. Create a document using boxes.
25. Create a document using graphics packages.

**DEPARTMENT OF MATHEMATICS**  
**NOMINATION FOR THE NEXT BOARD OF STUDIES [2018-19]**  
**SUBJECT EXPERTS LIST**

S.No	Name & Designation
1	<b>Mr M. Jeyakumar</b> Associate Professor & Head (PG) American College Madurai.
2	<b>Dr M Lellis Thivagar</b> Professor & Head, Chairperson Department of Mathematics M.K. University Madurai.
3	<b>Dr G Gopala Krishnamoorthy</b> Principal & Head Department of Mathematics Sri Krishnasamy Arts and Science College Sathur.
4	<b>Dr C Parameswaran</b> Head and Associate Professor, Department of Mathematics (PG), Ayya Nadar Janaki Ammal College, Sivakasi.
5	<b>Dr R Bakthavachalam</b> Head & Assistant Professor Mathematics, Alagappa University M.C. College of Arts and Science Paramakudi.