DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(AUTONOMOUS)
Arumbakkam, Chennai - 600 106.

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(M Sc Mathematics)
Programme Code: 21

Academic Year 2020-21

SYLLABUS

(Choice Based Credit System)

OUTCOME BASED EDUCATION

PRINCIPAL
Dwaraka Doss Goverdhan Doss
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Course Title: Algebra I

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To understand the idea of class equation of finite groups and use them to prove Sylow's Theorems.**
- **To study in detail about Linear Transformations, Canonical Forms, Triangular Forms and Jordan Forms, Trace and Transpose.**
- **To know the structure of finite non-abelian groups and several possible forms of matrices associated with the corresponding linear transformations.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Illustrate class equations with suitable examples and summarize Sylow's Theorem in three cases
CO2	Demonstrate theorems related to Solvable Groups and illustrate with suitable examples
CO3	Recall the concept of Nilpotent Transformations and demonstrate important theorems related to Triangular Forms, Canonical Forms and Nilpotent Transformations
CO4	Demonstrate theorems related to Jordan and Rational Canonical forms with suitable examples.
CO5	Demonstrate theorems corresponding to Hermitian, Unitary and Normal transformations and Quadratic forms.

Units	CONTENTS OF MODULE
I	Counting Principles, Class Equations for finite groups and its applications, Sylow's Theorems (For theorem 2.12.1, First proof only)
II	Solvable Groups, Direct Products, Finite Abelian Groups, Modules
III	Linear Transformations, Canonical form, Triangular form, Nilpotent Transformation
IV	Jordan form, rational canonical form
V	Trace and Transpose, Hermitian, Unitary, Normal Transformations, real quadratic forms

Recommended Text Book:
I.N. Herstein, Topics in Algebra, Second Edition, Wiley (2002).

Unit 1	**Sections 2.11 and 2.12 (Omit Lemma 2.12.5)**
Unit 2	**Sections 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1), Sections 2.13 and 2.14,**

	(Theorem 2.14.1 only), Section 4.5
Unit 3	**Sections 6.4, 6.5**
Unit 4	**Sections 6.6, 6.7**
Unit 5	**Sections 6.8, 6.10 and 6.11 (Omit Section 6.9)**

Reference Books:

1. *M. Artin*, Algebra, Prentice Hall of India, 1991.
2. *P.B. Bhattacharya, S.K. Jain and S.R. Nagupaul*, Basic Abstract Algebra, (Second Edition), Cambridge University Press, Indian Edition, 1997.
3. *I.S. Luther* and *I.B.S. Passi*, Algebra – Volume I – Groups (1996), Volume II – Rings (1999), Narosa Publishing House, New Delhi
4. *D.S. Dummit and R.S. Foote*, Abstract Algebra. Second Edition, Wiley, 2002.
5. *N. Jacobson*, Basic Algebra, Vol I and II, Hindustan Publishing Company, New Delhi.

Mapping of course outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3				2	3	3	3
CO2	3	3	2				2	2	2	3
CO3	2	3	2				2	2	3	3
CO4	3	3	3				2	2	2	2
CO5	3	3	2				2	3	3	2

3 – High **2 – Medium** **1 – Low**

Course Title: Real Analysis I

Course	**M Sc Maths**
Exam Hours	**03**

Credits	**04**
CIA Marks	**40**
ESE Marks	**60**

Course objectives

- **To introduce the ideas of adherent and accumulation points, compactness, connectedness, uniform continuity, function of bounded variation, total variation, cesaro summation, Riemann – Stieltjes Integrals.**

- **The content of this course is viewed as extension of the ideas presented in Under Graduate course in Real Analysis. The course contains brief analysis of topological properties of sets in the space R^n and the concept of Riemann – Stieltjes integrals.**

Course Outcomes: **At the end of the Course, the Student will be able to**

CO1	Explain the concepts of Adherent points, Accumulation points and prove The Bolzano-Weierstrass theorem, The Cantor intersection theorem, The Lindeloff covering theorem, The Heine Borel covering theorem, Formulating the concept of Compactness in Rn with suitable examples
CO2	Point out the relationship between connectedness and Arc-wise connectedness, Homeomorphisms and Isometry and use contractions to prove fixed point theorem.
CO3	Categorize the concepts of Monotonic functions, functions of Bounded variation and Total variation and construct the proofs of Additive property of total variation, Functions of bounded variation expressed as the difference of two increasing functions, Continuous functions of bounded variation and define multiplication of Infinite Series and Infinite products with illustrations
CO4	Define the concept of Riemann – Stieltjes (RS) Sum and Riemann – Stieltjes (RS) Integral and discuss its properties
CO5	Point out properties of RS integrals, establish its existence and prove mean value theorems and two fundamental theorems of calculus regarding RS integrals.

Units	CONTENTS OF MODULE
I	**Elements of Point set Topology** Definition of Adherent points, Accumulation points, Closed sets and adherent points with suitable illustrations, Constructing the proofs of: The Bolzano-Weierstrass theorem ,The Cantor intersection theorem ,The Lindeloff covering theorem , The Heine Borel covering theorem, Formulating the concept of Compactness in R^n with suitable examples.
II	**Limits and Continuity** Definition and Explanation of Connectedness, Components of a metric space, arcwise connectedness, uniform continuity, Fomulating the concept of compact sets through uniform continuity, Construction of the proof of fixed point theorem with respect to contraction mappings.
III	**Functions of bounded variation** Classifying and explaining the Properties of monotonic functions, Explanation of Functions of bounded variation, Total variation with suitable illustrations. Constructing the proofs of Additive property of total variation, Total variation on [a, *x*] as a function of *x*, Functions of bounded variation expressed as the difference of two increasing functions, Continuous functions of bounded variation. Defining the Infinite Series and Infinite products, Explaining Multiplication of series and Illustrating the concept of Cesaro summability with examples and proofs.
IV	**The Riemann - Stieltjes Integral** Definition of the Riemann - Stieltjes integral, Constructing the proofs of Linear Properties, Integration by parts, Change of variable in a Riemann-Stieltjes integral, Reduction to a Riemann Integral, Step functions as integrators, Reduction of a Riemann – Stieltjes integral to a finite sum, Euler's summation formula. Definition of Monotonically increasing integrators upper and lower integrals and classifying Riemann's condition with equivalent conditions.
V	**The Riemann-Stieltjes Integral** Explanation of Integrators of bounded variation, Construction of proofs of Sufficient conditions for the existence of Riemann-Stieltjes integrals, Necessary conditions for the existence of Riemann-Stieltjes integrals, First and Second Mean value theorems for Riemann - Stieltjes integrals, The integrals as a function of the interval, First and Second fundamental theorem of integral calculus.

Recommended Text Book:

Tom M.Apostol, Mathematical Analysis, 2nd Edition, Narosa, 1989.

Unit 1	**Sections 3.6 to 3.12**
Unit 2	**Sections 4.16 to 4.21**
Unit 3	**Sections 6.1 to 6.8 and 8.24, 8.25**
Unit 4	**Sections 7.1 to 7.10**
Unit 5	**Section 7.11, 7.13 to 7.20 (Omit Section 7.12)**

REFERENCE BOOKS:

1. *Bartle, R.G.* Real Analysis, John Wiley and Sons Inc., 1976.
2. *Rudin,W.* Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 1976.
3. *Malik,S.C.* and *Savita Arora,* Mathematical Anslysis, Wiley Eastern Limited.New Delhi, 1991.

Mapping of Course Outcome to Program Outcome & Program Specific Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		3	2		2	3	2	1
CO2	2	2		3	2		2	3	2	1
CO3	3	2		2	2		2	3	2	2
CO4	2	2		2	2		2	3	2	2
CO5	3	2		3	2		2	3	2	2

3 – High 2 – Medium 1 – Low

Course Title: Probability Theory

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To restate the probability concept with reference to Borel fields and categorize the discrete and continuous distributions by analyzing their characterization and structure.**
- **To demonstrate the application of Levy-Cramer theorem in various situations.**
- **To prepare a probability model for any given real life situation through survey.**

Course Outcomes: At the end of the Course, the Student will be able

CO1	Able to Solve problems on random variables and functions of random variable.
CO2	Demonstrate the concepts of Expectations and moments.
CO3	Able to understand Characteristics functions and probability generating functions.
CO4	Able to distinguish between the Discrete and Continuous Distributions
CO5	Able to solve the limit theorems.

Units	CONTENTS OF MODULE
I	**Random Events and Random Variables:** Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.
II	**Parameters of the Distribution :** Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types. **Chapter 3 : Sections 3.1 to 3.8 (Generalization of Regression line of second type is omitted)**
III	**Characteristic functions :** Properties of characteristic functions – Characteristic functions and moments – semi invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.
IV	**Some Probability distributions:** **Discrete distributions:** One point , two point , Binomial – Polya – Hypergeometric – Poisson distributions **Continuous distributions** – Uniform – Normal – Gamma – Beta – Cauchy and Laplace distributions.
V	**Limit Theorems :** Stochastic convergence – Bernaulli law of large numbers –

	Levy-Cramer Theorems (only one part of the theorem can be asked) – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – LapunovTheroem – Borel-Cantelli Lemma – Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

Recommended Text Book:

M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

Chapter 1	**Sections 1.1 to 1.7**
Chapter 2	**Sections 2.1 to 2.9**
Chapter 3	**Sections 3.1 to 3.8 (Generalization of Regression line of second type is omitted)**
Chapter 4	**Sections 4.1 to 4.7**
Chapter 5	**Section 5.1 to 5.10 (Omit Section 5.11), (Omit examples 5.5.1 and 5.5.2)**
Chapter 6	**Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12. (Omit Sections 6.5, 6.10,6.13 to 6.15), (omit example 6.9.1)**

Reference Book:

V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern New Delhi, 1988(3rd Edition)

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	2	3	3	2
CO2	3	2	2	1	2	2	2	2	2	3
CO3	3	3	2	1	1	1	2	3	2	2
CO4	3	2	1	2	2	2	2	2	2	2
CO5	3	2	1	1	2	2	2	2	3	3

3 – High **2 – Medium** **1 – Low**

Course Title: Graph Theory

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course Objectives

- **To understand the different concepts of Graph Theory and its application in day today life.**
- **To enable the students to model the real world problems into Graph Theory problems and get solutions.**
- **To motivate the students to pursue their research in this field.**

Course Outcomes: **At the end of the Course, the Student will be able to**

CO1	Illustrates graphs and it's properties
CO2	Describe connectedness of graphs, Euler and Hamilton cycles
CO3	Explain matchings and colourings in graphs and measure edge chromatic number
CO4	Define Ramsey numbers, classify critical graphs and calculate chromatic polynomials of graphs
CO5	Summarize planar graphs and survey the planarity using Euler's formula

Units	CONTENTS OF MODULE
I	**Graphs, Subgraphs and Trees :** Graphs and simple graphs – Graph isomorphism – The Incidence and Adjacency Matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles – Trees – Cut Edges ana Bonds – Cut Vertices.
II	**Connectivity, Euler tours and Hamilton Cycles :** Connectivity – Blocks – Euler tours – Hamilton Cycles.
III	**Matchings, Edge Colourings :** Matchings – Matchings and Coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Theorem.
IV	**Independent sets and Cliques, Vertex Colourings**: Independent sets – Ramsey's Theorem – Chromatic Number – Brooks' Theorem – Chromatic Polynomials.
V	**Planar graphs :** Plane and planar Graphs – Dual graphs – Euler's Formula – The Five- Colour Theorem and the Four-Colour Conjecture.

Recommended Text:

J.A.Bondy and U.S.R. Murthy, Graph Theory and Applications, Macmillan, London, 1976.

UNIT I	**Chapter 1 Sections 1.1 – 1.7, Chapter 2 Sections 2.1 – 2.3**
UNIT II	**Chapter 3 Sections 3.1 – 3.2, Chapter 4 Sections 4.1 – 4.2**
UNIT III	**Chapter 5 Sections 5.1 – 5.2, 6apter 4 Sections 6.1 – 6.2**
UNIT IV	**Chapter 7 Sections 7.1 – 7.2, Chapter 8, Sections 8.1 – 8.2, 8.4**
UNIT V	**Chapter 9, Sections 9.1 – 9.3, 9.6**

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	1			2	2	1	2	2
CO2	2	2	1			1	2	1	2	2
CO3	3	2	1			1	2	2	3	2
CO4	2	2	1			2	3	2	2	3
CO5	3	2	2			2	2	2	2	2

3 – High **2 – Medium** **1 – Low**

Course Title: Numerical Analysis

Course	**M Sc Maths**		**Credits**	**03**
Exam Hours	**03**		**CIA Marks**	**40**
			ESE Marks	**60**

Course Objectives

- **To solve nonlinear equations and system of nonlinear equations.**
- **To apply Interpolation for unequal and equal intervals and Compute derivatives using numerical differentiation.**
- **To solve integrals using numerical methods.**
- **To develop numerical techniques to solve first order ordinary differential equations and Partial differential equations.**

Course Outcomes: **At the end of the Course, the Student will be able**

CO1	Apply numerical methods to find our solution of algebraic equations using different methods under different conditions
CO2	Apply various interpolation methods and finite difference concepts.
CO3	Able to evaluate differentiation and Integration using Numerical Methods.
CO4	Work numerically on the ordinary differential equations using different methods.
CO5	To Work numerically on the partial differential equations using different methods.

Units	CONTENTS OF MODULE
I	**Non Linear equation** Bisection method, The Secant method, Regulafalsi method , Newton Raphson method, The fixed point method, Muller's Method. Newton's method for multiple roots. System of non linear equations by Newton's method and fixed point method.
II	**Interpolation:**Lagrange's formula, Newton's divided difference formula, Newton's forward and backward Interpolation formula. **Numerical Differentiation:** Derivatives based on Newton's forward and backward Interpolation formula.
III	**Numerical Integration:**Basic Trapezoidal rule, Composite Trapezoidal rule , Basic Simpson's one third rule, Composite Simpson's one third rule, Basic Simpson's three eighth rule, composite Simpson's three eighth rule. Numerical double integration with constant limits by composite trapezoidal and composite Simpson's one third rule.
IV	**Numerical solution of ordinary differential equations:** Difference equation, Taylor's series method, Euler's method, Runge-kutta method (fourth order only). Predictor-corrector methods - Milne's method and Adam's method.
V	**Numerical solution of partial differential equation:** Introduction, Solution of Laplace's equation $U_{xx} + U_{yy} = 0$ and Poisson's equation by Jacobi's and Gauss Seidel method. Solution of parabolic heat conduction equation $U_{xx} = CU_t$ by Bender Schmidtrecurrence relation and Crank Nickolson formula.

Recommended Text Book:

1) *Devi Prasad*, An Introduction to Numerical Analysis, (Third edition) Narosa Publishing house, New Delhi,2008.
2) *S.S.Sastry*, Introductory methods of Numerical Analysis (Fourth Edition), PHI Learning Pvt Ltd, NewDelhi, 2009

UNIT	AUTHOR	CHAPTER- SECTIONS
Unit I	Devi Prasad	Chapter 2
Unit II	Devi Prasad	Chapter 4- 4.1 to 4.3 ; Chapter 5 - 5.1
Unit III	Devi Prasad	Chapter 5 - 5.3, 5.7.1, 5.7.3
Unit IV	Devi Prasad	Chapter 6- 6.1 to 6.4
Unit V	S.S. Sastry	Chapter 8- 8.1 ,8.2,8.3.1.8.3.2,8.4

Reference Books:

1) *K.Sankara Rao*, Numerical Methods for Scientists and Engineers, (Third edition) Prentice Hall of India Pvt Ltd New Delhi 2007.
2) *Jain, Iyengar*, Numerical Methods, (Fifth edition) New age Publishers, 2010.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02	PS03
CO1	3	3	1	1	2	3	3	2	2	2
CO2	3	3	1	1	1	3	3	3	2	2
CO3	3	3	1	1	2	3	3	3	2	2
CO4	2	2	1	1	1	3	2	2	1	2
CO5	2	2	1	1	1	3	2	2	1	2

3 – High **2 – Medium** **1 – Low**

Course Title: Algebra II

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To introduce the ideas of Extension Fields, Galois Theory, Finite Fields, Wedderburn's Theorem for finite division rings and Four Squares Theorem.**
- **To understand Algebra and Linear Algebra at Advanced level and apply it in various branches of Engineering and Science.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Demonstrate important theorems related to Fields and Extension Fields and getting an idea to prove the number e is transcendental.
CO2	Explain the theorems related to roots of polynomials and study about polynomials having integer and rational roots.
CO3	Demonstrate theorems related to Galois Theory and study the connections between Galois Theory and Extension Fields
CO4	Justify the concept of Finite Fields through examples and demonstrate Wedderburn's theorem for finite division rings
CO5	Explain the concepts of Solvability by Radicals and demonstrate Frobenius Theorem and Quaternions with examples

Units	CONTENTS OF MODULE
I	**Extension Fields** Extension Fields, Transcendence of e
II	**Roots of Polynomials** Roots of Polynomials, roots of polynomials with integer and rational coefficients, more about roots.
III	**Galois Theory** Galois Theory and proving theorems related to Galois Theory.
IV	**Finite Fields and Division Rings** Finite Fields, Examples, Theorems, Wedderburn's Theorem for finite division rings.
V	**Solvability by Radicals and Four Squares Theorem** Solvability by Radicals, Frobenius Theorem, Integral Quaternions, Four Squares Theorem

Recommended Text Book:

I.N. Herstein, Topics in Algebra, Second Edition, Wiley (2002).

Unit 1	**Sections 5.1 to 5.2**
Unit 2	**Sections 5.3 and 5.5 (Omit Section 5.4)**
Unit 3	**Section 5.6**
Unit 4	**Sections 7.1, 7.2**
Unit 5	**Sections 7.3, 7.4**

Reference Books:

1. *M. Artin*, Algebra, Prentice Hall of India, 1991
2. *P.B. Bhattacharya, S.K. Jain and S.R. Nagupaul,* Basic Abstract Algebra, (Second Edition), Cambridge University Press, Indian Edition, 1997
3. *D.S. Dummit and R.S. Foote*, Abstract Algebra, Second Edition, Wiley, 2002
4. *N. Jacobson,* Basic Algebra, Vol I and II, Hindustan Publishing Company, New Delhi

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2				3	3	3	3
CO2	3	3	3				2	2	2	3
CO3	3	3	3				2	2	3	3
CO4	2	2	3				2	2	2	2
CO5	3	3	2				3	3	3	2

3 – High **2 – Medium** **1 – Low**

Course Title: REAL ANALYSIS II

Course Code	**M Sc Maths**		**Credits**	**04**
Exam Hours	**03**		**CIA Marks**	**40**
			ESE Marks	**60**

Course objectives

- **To introduce the ideas of Measure Theory, Lebesgue Integrals, Functions of Several Variables and Fourier Series, Fourier Integrals and their convergence aspects.**
- **The content of this course is viewed as extension of the ideas presented in previous semester in Real Analysis. Overall, the content forms the core of understanding Real Analysis at Advanced Level.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Demonstrate important theorems regarding measures and expressing measure in terms of open sets and closed sets.
CO2	Discuss theorems concerned with integration of non-negative measurable functions and demonstrate one of the classical result in analysis namely Lebesgue Montone Convergence Theorem
CO3	Point out properties related to Lebesgue Integrals, Fatou's Lemma and Dominated convergence theorem and establish the relation between Lebesgue and Riemann Integrable functions and solve problems using Lebesgue Dominated Convergence Theorem.
CO4	Prove several important theorems concerned with Fourier Series and their coefficients.
CO5	Solve problems concerned with computation of directional and partial derivatives, Jacobian Matrix, Chain Rule and establish the sufficient condition for Mean Value theorem for functions of several variables and other related theorems namely Taylor's Formula for functions of several variables

Units	CONTENTS OF MODULE
I	**Measure on the Real line** Definition of Lebesgue Outer Measure, Measurable sets with suitable examples. Developing Regularity conditions and constructing the proofs regarding measurable sets.
II	**Measure on the real line and Integration of Functions of a Real variable** Definition of Measurable Functions, Borel and Lebesgue Measurability, Explanation of Integration of Non- negative functions and constructing proofs of properties of such functions.
III	**Integration of Functions of a Real variable** Definition of the general integral, Developing Integration of series, Classifying and Distinguishing between the concepts of Riemann and Lebesgue integrals.

IV	**Fourier Series and Fourier Integrals** Restating Orthogonal system of functions, Constructing the proofs of: The theorem on best approximation, The Fourier series of a function relative to an orthonormal system, Properties of Fourier Coefficients, The Riesz-Fischer Theorem, Developing the convergence and representation problems in for trigonometric series, Explanation of the proofs of: The Riemann - Lebesgue Lemma, The Dirichlet Integrals, An integral representation for the partial sums of Fourier series, Riemann's localization theorem, Sufficient conditions for convergence of a Fourier series at a particular point, Explanation of Cesaro summability of Fourier series, Consequences of Fejes's theorem, Constructing the proof of Weierstrass approximation theorem .
V	**Multivariable Differential Calculus** Definition of the concepts like Directional derivative, Continuity, The total derivative, The total derivative expressed in terms of partial derivatives with illustration of suitable examples, Definition of the matrix of linear function, The Jacobian matrix. Construction of the proofs of: The chain rule, The mean - value theorem for differentiable functions, Sufficient condition for differentiability, Sufficient condition for equality of mixed partial derivatives, Taylor's theorem for functions of R^n to R^1

Recommended Text Books:

1. *G. de Barra*, Measure Theory and Integration, New Age International, 2003 (for Units 1, 2 and 3)

2. *Tom M.Apostol*, Mathematical Analysis, 2nd Edition, Narosa 1989 (for Units 4 and 5)

Unit 1	**Sections 2.1 to 2.3 (Chapter 2 of de Barra Book)**
Unit 2	**Sections 2.4, 2.5, 3.1 (Chapters 2 and 3 of de Barra Book)**
Unit 3	**Sections 3.2 to 3.4 (Chapter 3 of de Barra Book)**
Unit 4	**Sections 11.1 to11.5 (Chapter 11 of Apostol Book)**
Unit 5	**Section 12.1 to 12.5 and 12.8, 12.9, 12.11 to 12.14 (Omit Sections 12.6, 12.7, 12.10, 12.13) (Chapter 12 of Apostol Book)**

Reference Books:

1.*Burkill,J.C.*, The Lebesgue Integral, Cambridge University Press, 1951.

2.*Munroe, M.E.*, Measure and Integration, Addison-Wesley, Mass.1971.

3.*Royden, H.L.* Real Analysis, Macmillan Pub. Company, New York, 1988.

4.*Rudin W.*, Principles of Mathematical Analysis, McGraw Hill Company, New York, 1979.

5.*Malik,S.C. and Savita Arora*, Mathematical Analysis, Wiley Eastern Limited, New Delhi, 1991.

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2		2		2	2	2	2	2
CO2	2	2		2		2	2	2	2	2
CO3	2	2		2		2	2	2	2	2
CO4	3	2	2	2		3	2	3	3	3
CO5	3	2	3	2		3	2	3	3	3

3 – High **2 – Medium** **1 – Low**

Course Title: Differential Equations

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To enable the students to have the theoretical background of the feasibility of expressing solutions in power series.**
- **To understand the notion of fundamental matrix and successive approximation and their applications in solving differential equations.**
- **To get a knowledge in the area of non-homogeneous linear systems with constant coefficients.**
- **To know the role of PDE in modern Mathematics.**
- **To enable the students to assimilate the fundamental concepts and the techniques for solving PDE.**
- **To understand the importance of variable separable method in solving second order PDE.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Solve Second order Differential Equations and Demonstrate the linear dependence and independence of the solutions.
CO2	Illustrate analytic functions, regular points and Obtain the series solutions of ordinary differential equations
CO3	Illustrate the existence and uniqueness of solution of ordinary differential equation and diagnose the application of the fundamental matrix in differential equations.
CO4	Classify second order PDE's and apply the separation of variables method to solve one dimensional heat and wave equation
CO5	Solve two dimensional Laplace equation and illustrate the exterior and interior Dirichlet problem

Units	CONTENTS OF MODULE
I	**Linear differential equations of higher order** Introduction-Linear dependence and Wronskian-linear equations-Method of variation of parameters-Two useful formulae-Homogeneous linear equation with constant coefficients
II	**Solutions in Power series** Introduction-second order linear equations with ordinary points- Legendre equation and Legendre Polynomials-Second order equations with regular singular points-Bessels equation .
III	**Systems of Linear Differential Equation** Introduction-Systems of first order equations-Existence and uniqueness theorem-Fundamental matrix-Non homogeneous linear systems-Linear systems with constant coefficients.
IV	**Second order Partial differential equation.** Methods for solving Linear PDE, Classification and canonical form **Parabolic differential Equations:** Solving One dimensional heat conduction equation $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$ by Separation of variables.

	Hyperbolic differential equation – one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by separation of variables
V	**Elliptic Differential Equations:** Solving Two dimensional Laplace's equation $\nabla^2 u = 0$ by Separation of Variables , Laplace equation in cylindrical and Spherical coordinates, Interior and Exterior Dirichlets's problems for a circle

Recommended Text :

1. *S.G.Deo and V.Raghavendra*, Ordinary Differential Equations and Stability theory, Tata Mcgraw-Hill Publishing company Ltd.

2. *J.N.Sharma and Keharsingh*, Partial Differential Equations for Engineers and scientists, Narosa Publishing House, New Delhi, 2000

Units	Text – Author	Chapter
Unit I	Deo & Raghavendra	Chapter 2 fully
Unit II	Deo & Raghavendra	Chapter 3 fully
Unit III	Deo & Raghavendra	Chapter 4 Sections 4.1 to 4.6
Unit IV	J. N. Sharma &Kehar Singh	Chapter 2, Sections2.1-2.3,2.4 ,2.4.1 Chapter 4, Section 4.3 Chapter 5, Section 5.5
Unit V	J. N. Sharma & Kehar Singh	Chapter 3, Sections 3.3 to 3.7

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2			2	2	1	2	2
CO2	3	3	2			1	2	1	2	2
CO3	2	2	2			1	2	2	3	2
CO4	2	3	2			2	3	2	2	3
CO5	3	2	3			2	2	2	2	2

3 – High **2 – Medium** **1 – Low**

Course Title: Mathematical Statistics

Course	**M Sc Maths**
Exam Hours	**03**

Credits	**04**
CIA Marks	**40**
ESE Marks	**60**

Course objectives

- **To summarize the importance of sampling distributions and their classifications.**
- **To appraise the parameter value of any given distribution using statistical tools.**
- **To use the hypotheses testing technique to sample (Variable or Constant in size) collected from real life situation and compare the outcome with the existing one.**

Course Outcomes: **At the end of the Course, the Student will be able to**

CO1	Able to Solve problems on chi square, t and f distributions.
CO2	Able to test the significance of small and large sample test
CO3	Able to understand the concepts of estimations
CO4	Able to solve problems on analysis of variance and its applications.
CO5	Demonstrate the concepts of sequential analysis.

Units	CONTENTS OF MODULE
I	**Sample Moments and their Functions:** Notion of a sample and a statistic – Distribution functions of $\bar{X}$, and ($\bar{X}$, S) – Chi square distribution– Student t-distribution – Fisher's Z-distribution –Snedecor's F distribution– Distribution of sample mean from non-normal populations
II	**Significance Test :** Concept of a statistical test – Parametric Tests for small samples and large samples – Chi square test – Independence Tests by contingency tables.
III	**Estimation :** Preliminary notion – Consistency estimation – Unbiased estimates – Sufficiency – Efficiency – Asymptotically most Efficient estimates – methods of finding estimates – confidence Interval.
IV	**Analysis of Variance :** One way classification and two-way Classification (theory only). **Hypotheses Testing:** Poser functions – OC function- Most Powerful test – Uniformly most powerful test – unbiased test.
V	**Sequential Analysis :** SPRT – Auxiliary Theorem – Wald's fundamental identity – OC function of SPRT – E(n) and Determination of A and B – Testing a hypothesis concerning p on 0-1 distribution and m in Normal distribution.

Recommended Text Book:

M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

Chapter 9	**Sections 9.1 to 9.8**
Chapter 12	**12.1 to 12.4 and 12.7 (omit 12.5, 12.6).**
Chapter 13	**Sections 13.1 to 13.8 (Omit Section 13.9), (omit examples 13.6.3, 13.6.4 and 13.7.2 to 13.7.4)**
Chapter 15	**Sections 15.1 and 15.2**
Chapter 16	**Sections 16.1 to 16.5 (Omit Section 16.6 and 16.7),(omitexample 16.2.3)**
Chapter 17	**Sections 17.1 to 17.9 (Omit Section 17.10)**

Reference Books:

V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics,Wiley Eastern New Delhi, 1988(3rd Edition)

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	2	3	3	2
CO2	3	2	1	1	2	1	2	2	2	3
CO3	3	3	2	1	1	1	3	3	2	2
CO4	3	2	1	2	2	2	2	2	3	3
CO5	3	2	1	2	2	2	2	3	2	2

3 – High **2 – Medium** **1 – Low**

Course Title: Fuzzy Sets and Their Applications

Course Code	M Sc Maths
Exam Hours	03

Credits	03
CIA Marks	40
ESE Marks	60

Course objectives

- **To apply the concepts of fuzzy sets and fuzzy relations.**
- **Apply analysis of function of fuzzy variable using fuzzy logic.**
- **Construct fuzzy numbers using operations.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Able to Solve problems on simple operations of fuzzy subsets.
CO2	Demonstrate the concepts of fuzzy relations, their projections and to Solve problems on simple operations of fuzzy relations
CO3	Able to understand Fuzzy Relations and its properties.
CO4	Able to understand Fuzzy Logic, characteristic function of fuzzy subsets and Fuzzy Variables
CO5	Able to Distinguish between the law of fuzzy internal and fuzzy external composition. Able to construct fuzzy groupoid using internal and external composition. Able to Construct various types of fuzzy numbers using operations.

Units	CONTENTS OF MODULE
I	**Fundamental Notions:** Introduction, review of the notion of membership, the concept of a fuzzy subsets, dominance relations, simple operations on fuzzy subsets, sets of fuzzy subsets for **E** and **M** finite, properties of the set of fuzzy subsets, product and algebraic sum of two fuzzy subsets.
II	**Fuzzy Graphs:** Introduction, fuzzy graphs, fuzzy relation composition of two fuzzy relation, fuzzy subsets induced by a mapping, conditioned fuzzy subsets, properties of fuzzy binary relation, transitive closure of fuzzy binary relation and paths in a finite fuzzy graph.
III	**Fuzzy Relations:** Fuzzy pre order relation, similitude relation, similitude sub-relations in a fuzzy preorder, antisymmetry, fuzzy order relations, antisymmetric relations without loops, dissimilitude relations, resemblance relation, various properties of similitude and resemblance, various properties of fuzzy perfect order relations and ordinary membership functions.
IV	**Fuzzy Logic:** Introduction, characteristic function of a fuzzy subset, Polynomial forms, analysis of a function of fuzzy variables, logical structure of a function of fuzzy variables, composition of intervals, fuzzy propositions and their functional representations and the theory of fuzzy subsets and the theory of probability.
V	**The Laws of Fuzzy Composition:** Introduction, review of the notion of a law of composition, law of Fuzzy internal composition, fuzzy groupoids, principal properties of fuzzy groupoids, fuzzy monoids, fuzzy external composition and operations of fuzzy numbers.

Recommended Text :

A.Kaufmann, Introduction to the theory of Fuzzy subsets,Vol.I**,** Academic Press, New York, 1975.

UNIT	CHAPTER- SECTIONS
Unit I	Chapter I: Sec. 1 to 8.
Unit II	Chapter II: Sec. 10 to 18
Unit III	Chapter II: Sec. 19 to 29.
Unit IV	Chapter III:Sec.31 to 40 (Omit Sec. 37, 38 and 41).
Unit V	Chapter IV: Sec.43 to 49.

Reference Books:

1. *H.J.Zimmermann*, Fuzzy Set Theory and its Applications, Allied Publishers, Chennai, 1996.

2. *George J.Klir and Bo Yuan*, Fuzzy sets and Fuzzy Logic- Theory and Applications, Prentice Hall India, New Delhi,2001.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02	PS03
CO1	3	3	2	1	2	2	2	2	3	2
CO2	3	3	2	1	2	2	2	2	2	3
CO3	3	3	2	1	1	1	2	3	2	2
CO4	3	2	1	2	2	2	2	2	2	2
CO5	3	2	1	2	2	2	2	2	2	2

3 – High **2 – Medium** **1 – Low**

Course Title: Complex Analysis I

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To get deeper insight into the study of functions of a complex variable.**
- **To analyze the behavior of an analytic function and harmonic function in specified domain**

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

CO1	Apply Cauchy's theorem and Cauchy's integral formula to evaluate line integrals**.**
CO2	Analyze an analytic function restricted to a neighbourhood of a point as well as its properties in any region.
CO3	Examine the line integral of an analytic function as a consequence of the general version of Cauchy's theorem.
CO4	Evaluate definite integrals using suitable contours as an application of the residue theorem and explore the properties of harmonic functions.
CO5	Represent a function as an infinite series and establish the region of convergence.

Units	CONTENTS OF MODULE
I	Line integrals – Rectifiable arcs – Line integrals as functions of arcs – Cauchy's theorems for a rectangle – Cauchy theorem in a disk -- The Index of a point with respect to a closed curve – The Integral formula Chapter 4 : Section 1 : 1.1 to 1.5 Chapter 4 : Section 2 : 2.1 to 2.2
II	Higher derivatives -- Removable Singularities - Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle. Chapter 4 : Section 2 : 2.3 Chapter 4 : Section 3 : 3.1 to 3.4
III	The general form of Cauchy'sTheorem: Chains and cycles -- Simple Connectivity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multilply connected regions - Residue theorem - The argument principle. Chapter 4 : Section 4 : 4.1 to 4.7 Chapter 4 : Section 5: 5.1 and 5.2
IV	Evaluation of Definite Integrals – Harmonic Functions: Definition and basic properties - Mean value property - Poisson formula. Chapter 4 : Section 5 : 5.3

	Chapter 4 : Sections 6 : 6.1 to 6.3
V	Schwarz theorem - The reflection principle. Series and product developments: Weierstrass theorem – Taylor's Series – Laurent series. Chapter 4 : Sections 6.4 and 6.5 Chapter 5 : Sections 1.1 to 1.3

Recommended Text :

Lars V. Ahlfors, Complex Analysis, (3rd Edition), McGraw Hill Co., New York,1979.

Reference Books:

1. *H. A. Presfly*, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
2. *J.B. Conway*, Functions of one complex variables, Springer – Verlag, International Student Edition, Naroser Publishing Co. 1978.
3. *E. Hille*, Analytic Function Theory (2 Vols.), Gonm & Co, 1959.
4. *M. Heins*, Complex Function Theory, Academic Press, New York, 1968.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2				2		2	1	2
CO2	3	2				2		2	1	2
CO3	3	2				2		2	1	2
CO4	2	3				2		2	1	2
CO5	2	2				2		2	1	2

3 – High **2 – Medium** **1 – Low**

Course Title: Topology

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To restate the concept of convergence, completeness and continuous mappings in metric spaces.**
- **To distinguish and explain the concept of topological spaces, compact spaces, T1 spaces, Hausdorff spaces and connected spaces.**
- **To demonstrate the applications of Tychonoff's theorem, Asocli's theorem, Urysohn's lemma, Urysohn's imbedding theorem, Tietze extension theorem, Weierstrass theorem in Topological spaces.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Distinguish between convergence and completeness and demonstrate these concepts in Baire's theorem.
CO2	Develop the concepts of topological spaces and illustrate with examples.
CO3	Distinguish between the open and sub cover and demonstrate the importance of Heine-Borel theorem, Tychonoff theorem, Lebesgue's covering lemma and Ascoli's theorem
CO4	Classify and categorize the T1 space, Hausforff space, completely regular space and normal space and demonstrate these concepts in Tietze extension theorem, Urysohn imbedding theorem.
CO5	Compare the connected spaces, components of a space and a totally disconnected spaces.

Units	CONTENTS OF MODULE
I	Metric Spaces: Convergence, completeness and Baire's Theorem; Continuous mappings;Spaces of continuous functions;Euclidean and Unitary spaces. Chapter Two (Sec 12 - 15)
II	Topological Spaces: Definition and some Examples; Elementary concepts. Open bases and subbases; Weak topologies; the function algebras C(X,R) and C(X,C): Chapter Three (Sec 16 - 20)
III	Compact spaces, Tychonoff's theorem and locally compact spaces; Compactness for metric spaces; Ascoli's theorem. Chapter Four (Sec 21,23,24,25)
IV	Separation: T1 – spaces and Hausdorff spaces; Completely regular spaces and normal spaces; Urysohn's lemma and the Tietze extension theorem; The Urysohn imbedding theorem. Chapter Five (Sec 26 – 29)
V	Connectedness: Connected spaces;The components of a space; Totally disconnected spaces; Locally connected spaces; The Weierstrass approximation Theorem.

	Chapter Six (Sec 31 - 34) Chapter Seven (Sec 35 only)

Recommended Text Book:
George F.Simmons, Introduction to Topology and Modern Analysis, Tata-McGraw Hill. New Delhi, 2004.

Reference Books:
1. *James R. Munkres*, Topology (2nd Edition) Pearson Education Pve. Ltd., Delhi-2002 (Third Indian Reprint)
2. *J. Dugundji*, Topology, Prentice Hall of India, New Delhi, 1975.
3. *J.L. Kelly*, General Topology, Van Nostrand, Reinhold Co.,New York
4. *S.Willard*, General Topology, Addison - Wesley, Mass., 1970

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PS02
CO1	3	3	2	2	3	2	3	1	2	2	3
CO2	3	2	2	3	2	1	3	2	2	2	3
CO3	3	2	2	2	2	1	2	2	2	3	2
CO4	2	2	3	3	2	1	2	1	2	2	2
CO5	3	3	3	3	2	1	3	1	2	2	2

3 – High 2 – Medium 1 - Low

Course Title: Mechanics

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **Recognize and use basic concepts and principles of classical mechanics, and apply them to simple examples.**
- **To represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation of classical mechanics, Legendre transformations, Canonical transformations and Poisson brackets.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Use the concept of Newtonian Mechanics for a system of particles,demonstrate D' Alembert's Principle and to classify the constraints (holonomic, non-holonomic, Sceleronomic,Rheonomic) on a system in solving physical problems.
CO2	Use D' Alembert's Principle derive Lagrangian Formulation for both Holonomic and Non-Holonomic System and discuss its applications.
CO3	Restate the concept of functional and determine stationary paths of a functional to solve the differential equation for stationary paths, Derive Hamilton's principle for both holonomic and non holonomic system with illustrations.
CO4	Define and demonstrate Hamilton- Jacobi equation,Separability,orthogonal system and discuss its applications.
CO5	Define Canonical transformation and discuss about various forms of generating function , Lagrange and Poisson Brackets with an illustration.

Units	CONTENTS OF MODULE
I	Mechanical Systems : The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energyand Momentum
II	Lagrange's Equations: Derivation of Lagrange's equations - Examples- Integrals of motion.
III	Hamilton's Equations: Hamilton's Principle- Hamilton's Equation - Other variational principle.
IV	Hamilton-Jacobi Theory: Hamilton Principle function – Hamilton-Jacobi Equation -Separability
V	Canonical Transformation: Differential forms and generating functions– Special Transformations–Lagrange and Poisson brackets.

Recommended Text Book:

D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985.

Chapter 1	**Sections 1.1 to 1.5**
Chapter 2	**Sections 2.1 to 2.3 (Omit Section 2.4)**
Chapter 3	**Sections 4.1 to 4.3 (Omit Section 4.4)**
Chapter 4	**Sections 5.1 to 5.3**
Chapter 5	**Section 5.1 to 5.10 (Omit Section 5.11), (Omit examples 5.5.1 and 5.5.2)**
Chapter 6	**Sections 6.1, 6.2 and 6.3 (Omit Sections 6.4, 6.5 and 6.6)**

Reference Books:

1. *H. Goldstein*, Classical Mechanics, (2ndEdition) Narosa Publishing House, New Delhi.
2. *N.C.Rane and P.S.C.Joag*, Classical Mechanics, Tata McGrawHill, 1991.
3. *J.L.Synge and B.A.Griffth*, Principles of Mechanics(3^{rd} Edition) McGraw Hill Book Co., NewYork, 1970.
4. *E.T.Whittaker*–A Treatise on Analytical dynamics of particles and rigid bodies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	3	2	3	3	1
CO2	1	3	1	1	1	3	2	1	3	2
CO3	3	3	1	1	1	3	2	2	3	2
CO4	3	3	1	1	1	3	2	3	3	2
CO5	1	3	1	1	1	3	3	3	2	1

3 – High **2 – Medium** **1 - Low**

Course Title: Differential Geometry

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **Know and use geometric quantities such as length, curvature, and torsion associated to planar and spatial curves**
- **Understand the technical definition of a smooth surface and its significance**
- **Use the first and second fundamental form for a surface and give formal and informal definitions of it.**
- **To define, use, and articulate the differences between normal curvature, geodesic curvature, Gaussian curvature, and mean curvature**
- **To define a geodesic on a surface and prove the basic properties of geodesics**
- **To prove that a connected compact surface with constant Gaussian curvature is a sphere**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Diagnose the concepts of space curve, tangent, normal and binormal associated with tangent, normal and rectifying plane leading to formulae of Serrate-Frenet.
CO2	Examine the concepts of curves, surfaces, involutes, evolutes and describe the equivalence of two curves by applying some theorems.
CO3	Examine the concept of surfaces and their properties, surface of revolution and metric.
CO4	Recognize geodesic on a surface, canonical geodesic equation and its normal property and describe the geodesic curvature leading to Gauss-Bonnet theorem.
CO5	Explain Gaussian curvature and Interpret different class of curves on a surface called line of curvature which are characterised by Rodrique's formula.

Units	CONTENTS OF MODULE
I	Definition of a space curve – Arc length – tangent – normal and binormal – curvature and torsion.
II	Contact between curves and surfaces- tangent surface- involutes and evolutes. Intrinsic equations – Fundamental Existence Theorem for space curves-Helices.
III	Definition of a surface – curves on a surface – Surface of revolutio – Helicoids - Metric - Direction coefficients – families of curves.

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IV	Geodesics – Canonical geodesic equations – Normal property of geodesics - Existence Theorems- Geodesic curvature – Gauss-Bonnet Theorem.
V	Gaussian curvature – surfaces of constant curvature – The second fundamental form- Principal curvatures – Lines of curvature

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Recommended Text Book:

T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press, (17th Impression) New Delhi 2002. (Indian Print)

Chapter 1	**Sections 1 to 9.**
Chapter 2	**Sections 1 to 7, 10 to 18**
Chapter 3	**Sections 1 to 3.**

Reference Books :

1. *Struik, D.T.* Lectures on Classical Differential Geometry, Addison – Wesley, Mass.1950.
2. *Kobayashi. S. and Nomizu. K.* Foundations of Differential Geometry, Interscience Publishers, 1963.
3. *Wilhelm Klingenberg*, A course in Differential Geometry, Graduate Texts inMathematics, Springer-Verlag 1978.
4. *J.A. Thorpe*, Elementary topics in Differential Geometry, Under- graduate Texts in Mathematics, Springer - Verlag 1979.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2			3	2	3	2	2
CO2	3	3	2			3	2	2	3	2
CO3	2	2	2			2	2	3	3	2
CO4	3	2	2			2	1	3	2	2
CO5	2	2	2			2	1	3	2	2

3 – High **2 – Medium** **1 - Low**

Course Title: Number Theory and Cryptography

Course	**M Sc Maths**
Exam Hours	**03**

Credits	**03**
CIA Marks	**40**
ESE Marks	**60**

Course objectives

- **To restate the number theory concept with reference to numbers in different bases and categorize the Euclidean Algorithm and congruences by analyzing their characteristics and structure.**
- **To demonstrate the application of some simple cryptosystem using matrices.**
- **To prepare a formula for primality test and application of elliptic curves in cryptography.**

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

CO1	Illustrate the time estimates for doing arithmetic and distinguish the concepts of Euclidean algorithm , congruences and its applications to factoring.
CO2	Judge the encryption and decryption of digraph vectors using matrices.
CO3	Develop the importance of Legendre symbol and Jacobi symbol to apply in quadratic residues and reciprocity.
CO4	Compare classical cryptosystem , public key cryptosystem and develop it to discrete logarithms in finite fields.
CO5	Examine primality, factoring and formulate it to elliptic curve cryptosystem.

Units	CONTENTS OF MODULE
I	**Some Topics in Elementary Number Theory:** Time estimates for doing arithmetic – Divisibility and the Euclidean algorithm – Congruences – Some applications to factoring.
II	**Cryptography :** Some simple cryptosystems – Enciphering matrices.
III	**Finite Fields and Quadratic Residues:** Finite fields – Quadratic residues and reciprocity.
IV	**Public Key:** The idea of Public key cryptography – RSA – Discrete log.
V	**Primality and Factoring:** Pseudo primes - rho method. – Fermat Factorization and factor bases. The quadratic sieve method. Elliptic Curves: Basic facts – Elliptic curve cryptosystem.

Recommended Text Book:

F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 1985.

Chapter 1	**Sections 1.1 to 1.4**
Chapter 2	**Sections 2.1 to2.2**
Chapter 3	**Sections 3.1 to3.2**

Chapter 4	**Sections 4.1 to4.3**
Chapter 5	**Section 5.1 to5.5 (Omit Section 5.4)**
Chapter 6	**Section 6.1 to6.2**

Reference Books:

1. *I.Niven and H.S. Zuckermahn*, An Introduction to Theory of Numbers (Edn.3), Wiley Eastern Ltd., New Delhi 1976.
2. *David M.Burton*, Elementary Number Theory, Brown Publishers, Dubuque, lowa, 1989.
3. *K.Ireland and. Rosesn*, A classical Introduction to Modern Number Theory, springer verlog, 1972.
4. *N.Koblitz*, Algebraic aspect of (cryptography), Springer 1998.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	3	3	2	3
CO2	3	3	3	2	1	2	3	2	2	3
CO3	3	3	2	1	2	3	3	2	3	3
CO4	3	2	3	1	2	3	3	3	2	3
CO5	2	2	3	3	2	3	3	2	3	3

3 – High **2 – Medium** **1 - Low**

Course Title: Digital Logic Fundamentals
Extra Disciplinary Paper

Course	M Sc Maths
Exam Hours	03

Credits	03
CIA Marks	40
ESE Marks	60

Course objectives

- **To learn number system with different bases.**
- **To learn the significance of Boolean algebra with reference to circuit designs.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Demonstrate the conversion process of a given number with reference to any base to a number with reference to a different base.
CO2	Sketch the algebraic operations performed on Binary numbers.
CO3	Summarize and design logical gates like NOT, OR, AND etc.
CO4	Explain De Morgan's theorem and its uses and produce NAND, NOR gates.
CO5	Classify minimum terms and maximum terms and match the relationship between K map and truth table

Units	CONTENTS OF MODULE
I	**NUMBER SYSTEMS** **Chapter 1** Binary, Hexadecimal ,Octal , Conversions to other base and to decimal.
II	**BINARY ARITHMETIC** **Chapter 2** Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division, One's and two's complements, Subtraction using Complements and Signed Binary numbers.
III	**LOGIC GATES AND LOGIC CIRCUITS** **Chapter 4** Introduction, Analog and digital signals, Basic Logic Gates, NOT, AND, OR, Logic circuits and expressions, Sum of Products , Product of sums, NAND and NOR gates, EX-OR and Ex-NOR gates.
IV	**BOOLEAN ALGEBRA** **Chapter 5** Laws, DeMorgan's theorems, NAND as Universal gate, NAND-NAND network, NOR as Universal gate, NOR-NOR Network, NOR to OR Gate network, NAND to AND gate Network.
V	**UNIT V- KARNAUGH MAP** **Chapter 6** Min terms and Max terms, Relation ship between K map and truth table, 2-varible , 3-variable and 4-variable K map using minterms . (Sections 6.1 to 6.5 only)

Recommended Text Book:

Vijayendran. V, S.Viswanathan, Digital Fundamentals, Publishers and Printers.

Reference Books

1. *Leach.D.P & Malvino.A.P*, Digital Principles and Applications, Fifth Edition, TMH.
2. *Moris Mano.M* , Digital Logic and Computer Design, Fourth Edition, PHI.
3. *Ananthi Shashasaayee*, *Sheshasaayee.J.G*, Digital Logic Fundamentals, Margham Publications.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**				**2**	**3**	**2**	**3**
CO2	**3**	**3**	**2**				**2**	**3**	**2**	**3**
CO3	**2**	**3**	**3**				**2**	**2**	**2**	**3**
CO4	**3**	**3**	**3**				**2**	**2**	**2**	**2**
CO5	**3**	**3**	**2**				**3**	**3**	**2**	**2**

3 – High **2 – Medium** **1 - Low**

Course Title : Complex Analysis II

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To study the properties of a meromorphic and an entire function.**
- **To appreciate the application of complex analysis to topics like number theory.**
- **To get a strong motivation for further study on applications of complex analysis.**

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

CO1	To obtain an infinite product representation of an analytic function and represent an entire function as the canonical product.
CO2	Determine the infinite product representation of Riemann zeta function and gamma function.
CO3	Interpret the boundary behavior, the behavior at an angle of a polygon of a conformal mapping.
CO4	Investigate the properties of an elliptic function.
CO5	Demonstrate understanding of Weierstrass function and obtain the differential equation satisfied by it.

Units	CONTENTS OF MODULE
I	Partial fractions & Factorization: Partial fractions – Infinite products – canonical products – The Gamma functions – Jensons formula. Chapter 5 : Sections 2.1 to 2.4 (omit 2.5) Chapter 5 : Sections 3.1 (omit 3.2)
II	The Riemann Zeta functions: The product development – Extension of (s) to the whole plane – The functional equation – Normal families :Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions. Chapter 5 : Sections 4.1 to 4.3 (omit 4.4) Chapter 5 : Sections 5.1 to 5.4 (omit 5.5)
III	The Riemann mapping Theorem : Statement and Proof – Boundary Behaviour – Use of the Reflection Principle – The Behaviour at an angle – The Schwarz-Christoffel formula – A closer look at the Hormonic functions : Functions with mean value property –Harnack's principle. Chapter 6 : Sections 1.1 to 1.3 (Omit Section1.4) Chapter 6 : Sections 2.1 to 2.2 (Omit section 2.3 & 2.4) Chapter 6 : Section 3.1 and 3.2.

IV	Elliptic functions: Representation by exponentials – The Fourier development – Functions of finite order – The Period module – Unimodular transformations - The canonical basis – General properties of elliptic functions. Chapter 7 : Sections 1.1 to 1.3 Chapter 7 : Section 2.1 to 2.4
V	The Weierstrass Theory :The Weierstrass-function – The functions(z) and (z) – The differential equations– The modular functions. Chapter 7 : Sections 3.1 to 3.4(Omit 3.5)

Recommended Text Book:

Lars V. Ahlfors, Complex Analysis, (3rd edition) McGraw Hill Co., NewYork, 1979

Reference Books

1.*H.A. Presfly*, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2.*J.B. Conway*, Functions of one complex variables, Springer Verlag International student Edition, Naroser PublishingCo.1978
3.*E. Hille*, Analytic function Thorey (2 vols.), Gonm & Co,1959.
4.*M.Heins*, Complex function Theory, Academic Press, NewYork,1968

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2				2		2	1	2
CO2	3	2				2		2	1	2
CO3	2	2				2		2	1	2
CO4	2	2				2		2	1	2
CO5	2	3				2		2	1	2

3 – High   2– Medium   1 - Low

Course Title: Functional Analysis

Course	**M Sc Maths**
Exam Hours	**03**

Credits	**04**
CIA Marks	**40**
ESE Marks	**60**

Course objectives

- To Summarize Linear Transformation, Continues linear transformations and Normed linear spaces.
- To Classify and categorize the Banach spaces, Hilbert spaces and Banach Algebras.
- To explain the importance of the Hanhn-Banach theorem, Open mapping theorem in Functional Analysis.

Course Outcomes: **At the end of the Course, the Student will be able to**

CO1	Compare Normed linear space, Banach space, continuous Linear transformations and illustrate with examples
CO2	Distinguish between the conjugate space, second conjugate apace , natural imbedding and conjugate operator .
CO3	Compare the Hilbert space and conjugate space H^* and illustrate with examples.
CO4	Classify the different types of operators and demonstrate the importance of projections.
CO5	Develop the concepts of Banach Algebra and demonstrate the uses of regular and singular elements.

Units	CONTENTS OF MODULE
I	**Banach Spaces** **:**Definition – Some examples –Continuous Linear Transformations – The Hahn-Banach Theorem. Chapter 9 : Sections 46-48
II	**Banach Spaces:** The natural embedding of N in N** -Open mapping theorem – conjugate of an operator. Chapter 9 : Sections 49-51
III	**Hilbert Spaces:** Definition and some simple properties – Orthogonal complements – Orthonormal sets Conjugate space H* Chapter 10 : Sections 52- 55.
IV	**Hilbert Spaces:** Adjoint of an operator – Self-adjoint operator – Normal and Unitary Operators – Projections Chapter 10 : Sections 56-59.
V	**Banach Algebras:** Definition and some examples – Regular and singular elements – Topological divisors of zero – spectrum – the formula for the spectral radius – the radical and semi-simplicity. Chapter 12: Sections 64-69

Recommended Text Book:

George F.Simmons, *Introduction to Topology and Modern Analysis*, Tata-McGraw Hill. New Delhi, 2004.

Reference Books:

1. *W. Rudin*, Functional Analysis, Tata McGraw-Hill Publishing Company, New Delhi, 1973
2. *G. Bachman & L.Narici*, Functional Analysis, Academic Press, New York ,1966.
3. *H.C. Goffman and G.Fedrick*, First course in Functional Analysis, Prentice Hall of India, New Delhi, 1987
4. *E. Kreyszig*, Introductory Functional Analysis with Applications, John Wiley& Sons, New York.,1978.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PS03
CO1	3	2	3	2	2	2	3	3	3	3
CO2	3	3	2	3	1	1	2	2	2	3
CO3	2	2	3	2	2	1	3	3	2	2
CO4	2	3	2	3	2	2	2	2	2	3
CO5	3	2	3	3	2	1	3	2	3	2

3 – High 2 – Medium 1 - Low

Course Title: Tensor Analysis and Theory of Relativity

Course	M Sc Maths
Exam Hours	03

Credits	04
CIA Marks	40
ESE Marks	60

Course objectives

- **To formulate and express a physical law in terms of tensors and simplify it by use of the common form which is independent of the reference coordinate system**
- **To learn the basic ideas and equations of Einstein's Special Theory of Relativity, Lorentz contraction, time dilation, the twin paradox and $E = mc^2$**
- **The objective of the course is to study the fundamental concept of special theory of relativity and its applications.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Explain the basics concepts of Tensors with illustrations.
CO2	Define metric tensor, conjugate or reciprocal tensor, associated tensor and illustrate with examples.
CO3	Discuss about Transformation laws for christoffel symbols, Tensor derivatives and problems.
CO4	Discuss about Galilean and Lorentz transformation, Principle of Relativity and Relativistic Kinematics.
CO5	Discuss about Principle of equivalence and Accelerated System.

Units	CONTENTS OF MODULE
I	Physical Laws – spaces of N dimensions – coordinate transformations – the summation convention – contravariant and covariant vectors – contravariant, covariant and mixed tensors – the kronecker delta – tensors of rank greater than two – scalars or invariants – tensor fields – symmetric and skew-symmetric tensors – fundamental operations with tensors.
II	Matrices – Matrix algebra – the line element and metric tensor – conjugate or reciprocal tensors – associated tensors – length of a vector – angle between vectors – physical components – Christoffel symbols.
III	Transformation laws of christoffel's symbols – Geodesics – covariant derivatives – permutation symbols and tensors – Tensor form of gradient, divergence and curl – the intrinsic or absolute derivative – Relative and absolute tensors.
IV	Introduction - Galilean Transformations - Maxwell's equations - The ether Theory - The Principle of Relativity – Relativistic Kinematics: Lorentz Transformation equations-Events and simultaneity - Example – Einstein Train – Time dilation – Longitudinal Contraction–The Invariant Interval–Proper time and Proper distance – The World line – Example – The twin paradox– addition of velocities – The Relativistic Doppler effect–Examples.
V	Relativistic Dynamics, Momentum – Energy – The Momentum-energy four

	vector – Force – Conservation of Energy – Mass and energy – Example – inelastic collision – The Principle of equivalence – Lagrangian and Hamiltonian formulations - Accelerated Systems: Rocket with constant acceleration – example – Rocket with constant thrust

Recommended Text Book:

1. *Murry R. Spiegel*, Theory and problems of vector and Tensor analysis, Mcgraw Hill Book Company **(Units I, II, III – Chapter 8)**
2. *Donald T.Greenwood*, Classical Dynamics Prentice Hall of India Pvt Ltd1990. **(Units IV, V Chapter 7.1, 7.2, 7.3, 7.4)**

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	3	1	3	1	3	3	3	2	1
CO2	1	3	1	3	1	3	2	3	3	2
CO3	3	3	1	2	1	3	2	3	3	2
CO4	2	2	2	2	3	3	3	3	3	3
CO5	2	1	2	2	1	1	2	2	2	1

3 – High **2 – Medium** **1 - Low**

Course Title: Fluid Dynamics

Course	M Sc Maths
Exam Hours	03

Credits	03
CIA Marks	40
ESE Marks	60

Course objectives

- **To restate the kinematics of a moving fluid in Vectorial form.**
- **To demonstrate the images and complex variable in three dimension for on incompressible fluid.**
- **To prepare a formula for coefficient of viscosity of a viscous fluid.**

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

CO1	Demonstrate the concept of equation of continuity and classify it for incompressible fluids.
CO2	Distinguish the pressure in fluids and judge the case of steady motion under conservative body forces.
CO3	Compare sources, sinks , doublets and develop the importance of Stoke's stream function.
CO4	Differentiate equipotentials and streamlines of two dimensional flow and demonstrate the applications of Milne Thomson circle theorem.
CO5	Formulate the coefficient of viscosity of a viscous fluid.

Units	CONTENTS OF MODULE
I	**Kinematics of fluids in motion:-** Real fluids and Ideal fluids – velocity of a fluid at a point – Streamlines and Path lines - Steady and Unsteady flows - Velocity Potential – Vorticity vector - Local and Particle rates of change - Equation of Continuity – Examples: Acceleration of a fluid – Conditions at a Rigid Boundary.
II	**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 inviscid immiscible fluids – Euler's equation of motion – Bernoulli's equation. Example: Discussion of the case of study motion under Conservative body focus.
III	**Some three – Dimensional flows:** Introduction – Sources, Sinks and doublets – Images in a Rigid Infinite plane – Axi – symmetric flows – Stoke's stream function.
IV	**Some Two – Dimensional flows:** Meaning of two – dimensional flow – Use of Cylindrical Polar Coordinates – Stream function – 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 – Examples – Two – Dimensional Image Systems – Milne Thomson Circle theorem – Applications of Circle therein, Extension of Circle

	therein.
V	**Viscous flow:** Stress Components in a real fluid – Relation between Cartesian components of stress – Translational motion of fluid clement – The Rate of strain Quadric and principal stresses – Some further properties of Rate of strain Quadric - stress Analysis in fluid motion – Relations between Stress and Rate of strain – Coefficient of viscosity and Laminar flow – Navier – Stokes equation of motion of viscous fluid.

Recommended Text Book:

F.Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 1985.

Chapter 2	**Sections 2.1 to 2.10**
Chapter 3	**Sections 3.1 to 3.7**
Chapter 4	**Sections 4.1 to 4.5 (omit Section 4.4)**
Chapter 5	**Section 5.1 to 5.8**
Chapter 8	**Section 8.1 to 8.9**

Reference Books:

1. R.W. Fox and A.T. McDonald, Introduction to Fluid Mechanics, Wiley 1985.
2. E. Krause, Fluid Mechanics with Problems and solutions, Springer 2005.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	1	1	2	3	3	2	3
CO2	3	3	3	1	2	2	3	3	2	3
CO3	3	2	3	1	2	3	3	3	3	2
CO4	3	3	3	2	1	3	3	3	3	3
CO5	3	3	3	2	2	2	2	3	3	3

3 – High   **2 – Medium**   **1 - Low**

Course Title: Integral Equations And Calculus Of Variations

Course	M Sc Maths
Exam Hours	03

Credits	03
CIA Marks	40
ESE Marks	60

Course objectives

- **Recognize and solve initial value problems and boundary value problems through integral equations**
- **Solve integral equations by finding eigen values and eigen functions**
- **Explore methods for finding extreme values of functionals**
- **Apply variational principles to problems of mechanics**

Course Outcomes: At the end of the Course, the Student will be able

CO1	Classify Volterra and Fredholm Integral Equations, First kind, Second kind, homogeneous, non-homogeneous and also to Solve linear Volterra, Fredholm integral equations, initial value problem using appropriate methods.
CO2	Solve and recover the boundary value problems.
CO3	Solve Fredholm integral equations of the second kind with separable kernels.
CO4	Recognize the insight of functionals, describe mathematically and solve the variational problems like Brachistochrone problem using Euler's equation.
CO5	Diagnose variational problems with moving boundaries and sufficient conditions for an extremum.

Units	CONTENTS OF MODULE
I	**Integral Equations:** Introduction – Integral equation Definition – Linear and non-linear integral equations – Fredholm integral equation – Volterra Integral equations – Special kinds of kernels – Resolvent kernel or reciprocal kernel – Eigen values and Eigen vectors – Solution of an integral equation – Solved examples based on integral equations **Initial value problem** – Method of converting an initial value problem into a Volterra integral equation – Alternative method of converting an initial value problem in to a Volterra integral equation.
II	**Boundary value problem** – Method of converting a boundary value problem into a Fredholm integral equation – Characteristic Values – Characteristic functions – Solution of homogeneous Fredholm integral equation of the second kind with separable kernels – Solved examples.
III	**Solution of Fredholm integral equations of the second kind with separable (or degenerate) kernels** – Solved examples.
IV	**Calculus of Variations:** The concept of Variation and its properties – Euler's equation – Variational problems for specific functional – Functionals dependent on

.

	Higher-Order derivatives – Variational problems in parametric form – Some applications to problem of Mechanics.
V	**Variational problems with moving Boundaries:** Functionals of special type – Variational problems with moving boundary for a functional dependent on two functions. **Sufficient conditions for an Extremum**: Field of extremals – Jacobi conditions – Weirstrass function – Legendre condition – Second Variation.

Recommended Text Book:

1. *M.D.Raisinghania*, Integral Equations and Boundary Value Problems by, S.Chand Publishers, First Edition 2007(For Units I, II and III)
2. *A.S.Gupta*, Calculus of Variations with Applications, Prentice Hall of India Private Limited, New Delhi -1, Seventeenth Printing April 2008. (For Units IV and V)

	Integral Equations
Chapter 1	**Sections 1.1 to 1.18 (Omit sections 1.2, 1.7, 1.9, 1.10, 1.13, 1.14, 1.15, 1.16)**
Chapter 2	**Sections 2.2 to 2.4, 2.5, 2.6 (Omit section 2.1)**
Chapter 3	**Sections 3.1 to 3.3**
Chapter 4	**Sections 4.1, 4.2**
	Calculus of variations
Chapter 1	**Sections 1.1 to 1.7 (Omit section 1.5)**
Chapter 2	**Sections 2.1 and 2.2 Chapter 3 : Sections 3.1 to 3.5**
Chapter 3	**Chapter 3 : Sections 3.1 to 3.5**

Reference Books:

1. *M.K. Venkatraman*, Higher Engineering Mathematics.
2. *L. Elsgolts*, Differential equations and the calculus of variations, Mir Publishers, Moscow,1970.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2			3	2	2	3	3
CO2	3	3	1			2	1	2	2	2
CO3	2	2	1			2	1	3	2	2
CO4	2	3	2			2	2	2	3	2
CO5	3	3	2			3	2	3	3	3

3 – High **2 – Medium** **1 - Low**

Course Title: ALGORITHMS

Extra Disciplinary Paper

Course	M Sc Maths
Exam Hours	3 hours

Credits	03
CIA Marks	40
ESE Marks	60

Course objectives

- **To define the mathematical concepts Fibonacci sequence, Factorial computation, sine function using algorithms.**
- **To learn the concept of base conversion and generating prime numbers and pseudo random numbers**
- **To restate array techniques and find maximum in a given set of numbers.**
- **To restate merging, sorting and searching in an array binary techniques**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Demonstrate summation of set of numbers using algorithms and restate the factorial and sine function using fundamental algorithm
CO2	Develop an algorithm for reversing the digits, generating Fibonacci numbers and some basic conversions.
CO3	Formulate algorithm to find the smallest divisor of an integer and greatest common divisor and generating prime numbers
CO4	Produce Pseudo random numbers using algorithm and calculate a number to large power and computes the nth Fibonacci number.
CO5	Define Array technique illustrate array counting and array order reversal and illustrate merging and sorting of arrays.

Units	CONTENTS OF MODULE
I	**Fundamental Algorithms:** Exchanging the values of two variables- counting- summation of a set of numbers – Factorial computation – sine function computation
II	**Fundamental Algorithms:** Generating of the Fibonacci numbers – reversing the digits of an integer – Base conversion – Character to number conversion.
III	**Factoring Methods:** Finding the square root of a number – The smallest divisor of an integer – The greatest common divisor of integers – generating prime numbers
IV	**Factoring Method:** Computing the prime factors of an integer – generating Pseudo random numbers – Raising a number to a larger power- computing the nth Fibonacci number

V	**Array Techniques: Array order reversal** – array counting or histogramming – Finding the maximum number in a set – Merging, sorting and searching- Binary search

Recommended Text Book:

R.G.Dromey, How to solve it by computer, Prentice Hall

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**				**2**	**2**	**3**	**3**
CO2	**2**	**3**	**2**				**2**	**2**	**2**	**3**
CO3	**2**	**3**	**3**				**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**			**2**	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**2**			**2**	**3**	**3**	**2**	**2**

3 – High **2 – Medium** **1 - Low**