RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS & SCIENCE

Affiliated to Bharathiar University, Coimbatore – 641 402

SCHEME OF EXAMINATION – CBCS PATTERN

PROGRAMME: M.Sc. (Mathematics)

(Effective from the academic year 2017-18)

HOD PRINCIPAL COE

RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS AND SCIENCE

DEPARTMENT OF MATHEMATICS

VISION AND MISSION OF THE DEPARTMENT

VISION ***Global centre of excellence in Mathematics for the growth of science and Technology through digital technology.***
MISSION ***Department of Mathematics provide quality education and research in Mathematics through updated curriculum, effective teaching and learning process and to inculcate innovative skills, team work and ethical practice among students so as to meet social expectations.***

PROGRAMME OUTCOMES (POs): (Common for all PG Programmes)

PO1	To provide outcome based education in the respective disciplines and to impart skills which will enable the students secure job in their core disciplines in this digitally transforming era.
PO2	To develop the art of critical thinking, creativity and to imbibe emerging trends thereby to excel in their interested domains of specializations.
PO3	To inculcate and develop research competence systematically besides the capacity to analyze the viability of new ideas, entrepreneurship and professionalism based on the students' choice and aptitude.
PO4	To instill a culture of life-long learning and the ability to understand the socio-economic issues.

PROGRAMME SPECIFIC OUTCOMES: (PSOs)

(The concerned department has to formulate their respective PSOs)

Upon completion of Master of Mathematics Degree, STUDENTS are able to achieve the following outcomes.

PSO1	Mould the students for prominent career as Computational Fluid Dynamics Analyst, Data scientist, Quality control, Big data Analyst, Meteorologist, Cosmologist, Cryptologists and Astronomers.
PSO2	To inculcate the concepts of Algebra, Analysis, Differential equations, Mechanics, Operations Research, Numerical methods, Topology, Fluid Dynamics and Control Theory.
PSO3	Impart the knowledge conceptual facts, skills in problem solving in the areas Discrete structure, Fuzzy Mathematics, Mathematical Methods and Graph Theory.
PSO4	To understand and realize the principle algebraic Structures in Algebra, Analysis, Number Theory, Differential Geometry, Functional Analysis to develop higher order thinking to do Research etc.

RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS), SULUR COIMBATORE – 641402

DEPARTMENT OF MATHEMATICS

M.Sc. MATHEMATICS

SCHEME OF EXAMINATIONS

2017 BATCH ONWARDS – BASED ON CHOICE BASED CREDIT SYSTEM

Semester	Type	TITLE OF THE PAPER	Hours of instructions/week		Credits	Duration of examination in Hours	MARKS		
			Lecture Hours	Tutorial Hours			CIA	EOS	TOTAL
I	M-I	ALGEBRA	5	1	4	3	25	75	100
	M-II	REAL ANALYSIS	5	1	4	3	25	75	100
	M-III	ORDINARY DIFFERENTIAL EQUATIONS	5	1	4	3	25	75	100
	M-IV	NUMERICAL METHODS	5	1	4	3	25	75	100
	M-V	FUZZY MATHEMATICS	5	1	4	3	25	75	100
II	M-VI	COMPLEX ANALYSIS	5	1	4	3	25	75	100
	M-VII	PARTIAL DIFFERENTIAL EQUATIONS	5	1	4	3	25	75	100
	M-VIII	MECHANICS	5	1	4	3	25	75	100
	M-IX	OPERATIONS RESEARCH	5	1	4	3	25	75	100
	EL-I	***ELECTIVE-I*** DIFFERENTIAL GEOMETRY	5	1	4*	3	25	75	100
III	M-X	TOPOLOGY	4	1	4	3	25	75	100
	M-XI	DISCRETE STRUCTURES	4	1	4	3	25	75	100
	M-XII	MATHEMATICAL STATISTICS	5	1	4	3	25	75	100
	M-XIII	FLUID DYNAMICS	4	1	4	3	25	75	100
	EL-II	***ELECTIVE-II*** CONTROL THEORY	4	1	4*	3	25	75	100
	EL-III	***ELECTIVE-III*** EDC-QUANTITATIVE APTITUDE	4		4	3	25	75	100
IV	M-XIV	FUNCTIONAL ANALYSIS	5	1	5	3	25	75	100
	M-XV	MATHEMATICAL METHODS	5	1	5	3	25	75	100
	M-XVI	GRAPH THEORY	5	1	5	3	25	75	100
	M-XVII	NUMBER THEORY	5	1	5	3	25	75	100
	PV	**PROJECT VIVA-VOCE****	6		6				200
		TOTAL			90				2200
I-III	ES	**EMPLOYABILITY SKILLS ***	-	2	-	-	-	Grade	

LIST OF ELECTIVES

1.FUZZY MATHEMATICS

2. DIFFERENTIAL GEOMETRY

3. EDC-QUANTITATIVE APTITUDE

4. CONTROL THEORY

5.STOCHASTIC DIFFERENTIAL EQUATIONS

6. CRYPTOGRAPHY

7.NEURAL NETWORKS

8.MATLAB

9.MATHEMATICA

M- MAJOR PAPER **,** ***MP***- MAJOR PRACTICAL**,** ***EL****-ELECTIVE PAPERS **,** ***EDC***- EXTRA DECIPLINARY COURSE.

ES*-EMPLOYABILITY SKILLS classes are held in first three semesters .Exam will be conducted in their II and III semesters .Two Extra Credits will be given. This is 'Mandatory' to get a degree.

SEMESTER-I
MAJOR PAPER-I
ALGEBRA

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Groups, rings and fields.

PEDAGOGY

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT- I: **Lecture hour:18**

GROUP THEORY: Another Counting Principle- Conjugacy – Normalize- Cauchy's theorem – Sylow's theorem – Direct products- Finite Abelian Groups.

UNIT-II **Lecture hour:18**

RING THEORY : Euclidean Rings – Unique Factorization theorem- A particular Euclidean Ring – Fermat's Theorem- Polynomial Rings – Polynomials over the rational field – Gauss lemma – The Eisentein Criterion.

UNIT-III **Lecture hour:18**

FIELDS: Extension Fields – Algebraic Extension Fields- Roots of Polynomials – Remainder theorem- Splitting Fields.

UNIT-IV **Lecture hour:18**

FIELDS: More about roots- Simple Extension – The Elements of Galois theory – Fixed field of a Group –Normal extensions – The Galois group of polynomial – Fundamental theorem of Galois theory.

UNIT-V **Lecture hour:18**

LINEAR TRANSFORMATION: Canonical forms – Similar Transformations – Triangular form – Trace and Transpose – Symmetric matrix – Skew Symmetric matrix – Hermitian ,unitary and normal transformations-Real Quadratic Forms.

Text Book :

"TOPIC IN ALGEBRA" I.N.HERSTEIN (II-EDITION)

UNIT-I : Chapter-2 2.11 to 2.14
UNIT-II : Chapter-3 3.7 to 3.10
UNIT-III : Chapter-5 5.19 to 5.3
UNIT-IV: Chapter-5 5.5 to 5.6
UNIT-V : Chapter-6 6.4, 6.8 and 6.10,6.11

Reference Book:
J.B.Fraleigh**, A First course in Abstract Algebra ,** Narosa Publishing House, New Delhi, 1988.

SEMESTER-I
MAJOR PAPER-II
REAL ANALYSIS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the real and complex numbers, sets and metric spaces.

PEDAGOGY:

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT – I **Lecture hour:18**

THE RIEMANN – STIELTJES INTEGRAL : Definition and existence of the integral – Properties of the Integral – Integration and Differentiation – Integration of vector valued function – Rectifiable curves.

UNIT – II **Lecture hour:18**

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 functions – The Stone - Weierstrass theorem.

UNIT – III **Lecture hour:18**

SOME SPECIAL FUNCTIONS : Power series — The Exponential and Logarithmic Functions - The Trigonometric Functions - The Algebraic Completeness of the Complex Field Fourier series – The Gamma function.

UNIT – IV **Lecture hour:18**

FUNCTIONS OF SEVERAL VARIABLES : Linear transformations – Differentiation – the contraction principle – The inverse function theorem – The Implicit function theorem.

UNIT – V **Lecture hour:18**

THE LEBESGUE THEORY : Set functions – Construction of the Lebesgue measure – Measure spaces - Measurable functions – Simple functions – Integration – Comparison with the Riemann integral – Integration of complex functions.

Text book:-

Principle of Mathematical Analysis by Walter Rudin

Unit - I	Chapter 6	Unit – II	Chapter 7
Unit – III	Chapter 8	Unit – IV	Chapter 9
Unit – *V*	Chapter 11		

References Book:

1. R.G.Bartle, Elements of Real Analysis, 2nd Edition, John Wily and Sons, New York, 1976.
2. W.Rudin, Real and Complex Analysis, 3rd Edition, McGraw-Hill, New York, 1986.

SEMESTER-I

MAJOR PAPER-III

ORDINARY DIFFEENTIAL EQUATIONS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Linear equations and polynomials.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS: 90**

UNIT I: **Lecture hour:18**

Second order linear equations with ordinary points – Legendre equation and Legendre polynomials – Second order equations with regular singular points –Properties of Bessel functions.

UNIT II: **Lecture hour:18**

Systems of first order equations – existence and uniqueness theorem – Fundamental matrix.

UNIT III: **Lecture hour:18**

Non- homogeneous linear systems – linear systems with constant coefficients – linear systems with periodic coefficients.

UNIT IV: **Lecture hour:18**

Successive approximation – Picard's theorem - Non-uniqueness of solution –Continuation and dependence on initial conditions, Existence of solutions in the large –Existence and uniqueness of solutions of systems-Fixed Method.

UNIT V: **Lecture hour:18**

Oscillations of Second order equations: Fundamental results – Sturm's comparison theorem – Elementary linear oscillations. Comparison theorem of Hille-Winter

Text Book:

Ordinary Differential Equations and Stability Theory by S.G.Deo and V.Raghavendra.

Unit I - Chapter – 3 - Section 3.2 – 3.5

Unit II - Chapter – 4 - Section 4.2 – 4.4

Unit III - Chapter – 4 - Section 4.5 – 4.8

Unit IV - Chapter – 5 - Section 5.3 – 5.9

Unit V - Chapter – 8 - Section 8.1 – 8.4

References Book:

E.A.Coddington and N.Levinson **, Theory of Ordinary Differential Equations,** McGraw Hill, New York, 1955.

SEMESTER-I
MAJOR PAPER IV
NUMERICAL METHODS

OBJECTIVES:
On successful completion of this course the students should gain knowledge about the Ordinary differential equations and Partial Differential Equations.

PEDAGOGY:
Oral, Black Board Method and OHP **TOTAL HOURS: 90**

UNIT – I **Lecture hour:18**

TRANSCENDENTAL AND POLYNOMIAL EQUATIONS: Iteration Method Based on second degree Equations: Muller method – Chebyshev method – Multipoint Iteration method Polynomial Equations : Iterative Methods: Bridge Vieta method – Bairstow method .

UNIT – II **Lecture hour:18**

SYSTEM OF LINEAR ALGEBRAIC EQUATIONS:
Direct Methods: Cholesley method. Iteration Methods: Successive over relaxation (SoR) method.
NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Rungekutta methods – Predictor-Corrector Methods : Milne's method – Adam's method.

UNIT – III **Lecture hour:18**

INTERPOLATION: Hermite Interpolation – Bivariate Interpolation
NUMERICAL INTEGRATION: Trapezoidal Rule- Romberg's Method- Simpson's one third Rule- Simpson's three eight Rule

UNIT – IV **Lecture hour:18**

ITERATIVE METHOD FOR EIGEN VALUES: Power Method
NUMERICAL METHOD OF DOUBLE INTEGRALS: Gaussian Quadrature –Two points and three points Formulae-Numerical solution of Ordinary Differential equation by Finite Difference Method.

UNIT – V **Lecture hour:18**

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: -
Classification of Partial Differential equations of the second order-Elliptic Equations –Solution of Laplace's equation-The Poisson equations –Parabolic Equations: Bender Schmidt Methods-The Crank Nicolson method –Hyperbolic Equations.

Text Book:
T_1 : Numerical methods for scientific and engineering Computation by M.K. Jain, S.R.K. Iyengar, R.K Jain.
T_2 : Numerical Methods by Kandhasamy, Thilagavathi, Gunavathy.
Unit I : T_1
Unit II : T_1 and T_2
Unit III : T_1 and T_2
Unit-IV and Unit-V : T_2

Reference Book:

1. S.C. Chapra and P.C. Raymond: Numerical Methods for Engineers, tata McGraw Hill, New Delhi,
2. R.L. Burden and J. Douglas Faires: Numerical Analysis, P.W.S.Kent Publishing Company, Boston (1989), Fourth Edition.
3. S.S. Sastry: Introductory methods of Numerical Analysis, Prentice Hall of India, New Delhi, (1998)

SEMESTER-I

MAJOR PAPER V

FUZZY MATHEMATICS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the fuzzy sets and relations.

PEDAGOGY

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT-I **Lecture hour:18**

Crisp sets : An over view: Fuzzy Sets –Basic Types – Basic Concepts – α-cuts- Additional properties of α-cuts- Representation of Fuzzy Sets - Extension Principle for Fuzzy Sets.

UNIT-II **Lecture hour:18**

Operations of fuzzy sets- Types of Operations – Fuzzy Complements–Fuzzy Intersections:t-norms – Fuzzy Unions:t-conorms – Combinations of Operations – Aggregation Operations.

UNIT-III **Lecture hour:18**

Fuzzy Arithmetic- Fuzzy numbers – Arithmetic operations on intervals – Arithmetic operations on fuzzy numbers.

UNIT-IV **Lecture hour:18**

Fuzzy Relations –Crisp versus Fuzzy relations- Projections and Cylindrical Extensions - Binary Fuzzy Relation –Binary Relation on a single set-Fuzzy Equivalence Relation – Fuzzy Compatibility Relations- Fuzzy Ordering Relations – Fuzzy Morphisms.

UNIT-V **Lecture hour:18**

Fuzzy Relation Equations – General Discussion – Problem Partitioning – Solution Method – Fuzzy Relation Equations based on sup-i compositions - FuzzyRelation Equations based on inf – w_i compositions.

Text Book:

George J. Klir / Bo Yuan, Fuzzy Sets and Fuzzy Logic Theory and Applications, Prentice -Hall of India Private L.t.d New Delhi 2009

Reference Book: George J. Klir and Tina A.Folger , Fuzzy Sets ,Uncertainty and Information ,Prentice-Hall of India Private Limited-Fourth printing –June 1995.

SEMESTER-II

MAJOR PAPER-VI

COMPLEX ANALYSIS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the complex numbers and complex integration.

PEDAGOGY:

Oral, Black Board Method and OHP

TOTAL HOURS: 90

UNIT – I **Lecture hour:18**

COMPLEX FUNCTIONS: Introduction to the concept of analytic function: Limits and continuity – Analytic function – Polynomials – Rational functions. Elementary theory of power series: Power series – Abel's limit theorem.

ANALYTIC FUNCTIONS AS MAPPINGS: Conformality: Arcs and closed curves – Analytic function in regions – Conformal mapping – length and area – Linear Transformations :The Linear Group- The Cross Ratio-Symmetry.

UNIT – II **Lecture hour:18**

COMPLEX INTEGRATION: 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 – Higher derivatives. General form of Cauchy's theorem: Chain and Cycles- Simple connectivity – Homology – Locally exact Differentials – Multiple connected Regions .

UNIT – III **Lecture hour:18**

COMPLEX INTEGRATION :The calculus of Residues : The Residue theorem – The argument principle – Evaluation of definite Integrals. Harmonic functions: Definitions and Basic properties – The mean value property – Poisson's formula – Schwarz's theorem – The Reflection principle.

UNIT - IV **Lecture hour:18**

SERIES AND PRODUCT DEVELOPMENTS: Partial fraction and factorization: Partial fraction – Infinite production – canonical products – The Gamma function – Stirling's formula – Entire Function :Jensen's formula.

UNIT - V **Lecture hour:18**

CONFORMAL MAPPING: The Riemann mapping theorem: Statement and proof – Boundary behavior – use of the reflection principle – Analytic Arc. Conformal mapping of polygons: The Behavior at an angle – The Schwarz – Chirstoffel formula – Mapping on a Rectangle – The triangle functions of Schwarz.

Text Book:

COMPLEX ANALYSIS by L.V. Ahlfors, MC Graw Hill, New York, 1979

UNIT – I	Chapter 2	Section 1.1 – 1.4, 2.4, 2.5
	Chapter 3	Section 2.1 – 2.4, 3.1 -3.3
UNIT – II	Chapter 4	Section 1.1 – 1.5, 2.1 – 2.3, 4.1,4.2, 4.3, 4.6, 4.7
UNIT – III	Chapter 4	Section 5.1 – 5.3, 6.1 – 6.5
UNIT – IV	Chapter 5	Section 2.1 -2.5, 3.1
UNIT – V	Chapter 6	Section 1.1 – 1.4, 2.1 – 2.4.

SEMESTER-II

MAJOR PAPER-VII

PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the variables and functions.

PEDAGOGY:

Oral, Black Board Method and OHP

TOTAL HOURS:90

UNIT I **Lecture hour: 18**

Non linear Partial Differential Equations of the first Order: Cauchy's Method of Characteristics-Compatible systems of First Order Equations-Charpits Method-Special types of First Order Equations –Solutions Satisfying Given Conditions-Jacobi's Method.

UNIT II: **Lecture hour: 18**

Partial differential equations of the second order: The origin of Second order equations-linear partial differential equations with constant coefficients- Equations with variable coefficients.

UNIT III: **Lecture hour: 18**

The solution of linear hyperbolic equations-separation of variables-the method of integral transforms-non linear equations of second order.

UNIT IV: **Lecture hour: 18**

Laplace's Equation: Elementary Solution of Laplace's Equation- Families of Equipotential surfaces-Boundary value problems-separation of variables and problems with Axial symmetry.

UNIT V: **Lecture hour: 18**

The Wave Equation: Elementary Solutions of one dimensional wave Equation-vibrating membrances-application of the calculus of variations-Three dimensional problems-Elementary solution of Diffusion Equation-separation of variables.

Text Book:Elements Of Partial Differential Equations " Ian N.Sneddon " International Student Edition. Mc Graw Hill International Book Company.

Unit	Chapter	Sections
1	2	7 - 13
2	3	1 &4 -5
3	3	8-11
4	4	2-6
5	5	2&4-5
5	6	3&4

SEMESTER-II

MAJOR PAPER-VIII

MECHANICS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the dynamics and jacobi theory.

PEDAGOGY

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT – I **Lecture hour:18**

Generalized co-ordinates – Constraints – Derivation of Lagrange's Equation – Examples – Integrals of the motion – Velocity Dependant potentials

UNIT – II **Lecture hour:18**

Hamilton's principle – Hamilton's Equations – other variation principles

UNIT – III **Lecture hour:18**

Hamilton's Principal Function – The Hamilton – Jacobi Equation – Separability.

UNIT – IV **Lecture hour:18**

Differential Forms and Generating Functions –Special Transformations – Lagrange and Poisson Brackets

UNIT – V **Lecture hour:18**

Introduction – Relativistic Kinematics – Relativistic Dynamics.

Text Book:

"CLASSICAL DYNAMICS" by Donald T. Greenwood

Reference Book:

1. F. Gantmacher, Lectures in Analytic Mechanics, MIR Publishers, Moscow, 1975.
2. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice Hall.
3. S.L. Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi, 1979.

SEMESTER-II

MAJOR PAPER-IX

OPERATIONS RESEARCH

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Optimal use and resources.

PEDAGOGY:

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT – I **Lecture hour:18**

LINEAR PROGRAMMING PROBLEM –Formulation of L.P.P – Graphical solutions of L.P. Problems- Simplex Method –Big – M Method - Duality in L.P.P – Concept of duality – Duality and Simplex Method.

UNIT – II **Lecture hour:18**

ADVANCED LINEAR PROGRAMMING TECHNIQUES: Revised simplex method — Linear fractional programming – Application of linear fraction programming – Karmarkar Algorithm.

UNIT – III **Lecture hour:18**

MARKOV ANALYSIS: Introduction – Markov processer – State transition matrix – Transition diagram – Construction of a state – Transition matrix – n – step transition probabilities – Steady state (Equilibrium) conditions – Markov analysis algorithm.

UNIT – IV **Lecture hour:18**

NON-LINEAR PROGRAMMING METHOD: Quadratic programming – Wolfe's modified Simplex method –Separable convex programming – Separable programming algorithm.

UNIT –V **Lecture hour:18**

SIMULATION: Introduction-Simulation models-Event type simulation-Generation of Random Numbers-Monte Carlo Simulation-Simulation of Inventory problems.

TEXT BOOK:

OPERATIONS RESEARCH – Kandiswarup, P. K. Gupta, Man Mohan, S. Chand & sons Education publications, New Delhi, 12^{th} revised edition

REFERENCE BOOK:

OPERATIONS RESEARCH – Prem kumar Gupta, D. S. Hira, S. Chand & Company Ltd., Ram Nagar, New Delhi

SEMESTER-II

ELECTIVE PAPER-I

DIFFERENTIAL GEOMETRY

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the curves and fundamental forms.

PEDAGOGY

Oral, black Board Method and OHP **TOTAL HOURS: 90**

UNIT-I **Lecture hour:18**

THEORY OF SPACE CURVES: Arc length - Tangent and Osculating plane - Principal normal and Binormal - Curvature and torsion.

UNIT-II **Lecture hour:18**

THEORY OF SPACE CURVES: Behaviour of near one of its points-The Curvature and torsion of a curve as the intersection of two surfaces-Contact between curves and Surfaces - Osculating Circle and Osculating Sphere -Locus of centres of spherical curvature.

UNIT-III **Lecture hour:18**

THEORY OF SPACE CURVES: Tangent surfaces- Involutes and Evolutes – Intrinsic equations of space curves -Fundamental existence theorem for space curves – Helices.

UNIT-IV **Lecture hour:18**

THE FIRST FUNDAMENTAL FORM AND LOCAL INTRINSIC PROPERTIES OF A SURFACE: Definition of a surface – Nature of points on a surface – Representation of a surface – curves on surfaces-Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface –First fundamental form - Direction co-efficient on a surfaces.

UNIT-V **Lecture hour:18**

THE FIRST FUNDAMENTAL FORM AND LOCAL INTRINSIC PROPERTIES OF A SURFACE: Families of curves – Orthogonal trajectories –Double families of curves– Isometric correspondence -Geodesics and their differential equations – Canonical geodesics equations – Geodesics on surface of revolution

Text Book:

D. Somasundaram **"Differential Geometry A First Course"** Narosa Publishing House P v t. Ltd 2005…

UNIT	CHAPTER	SECTIONS
I	1	1.2 to 1.9
II	1	1.10 to1.13 & 1.16 to 1.18
III	2	2.2 to 2.10
IV	2 &3	2.11 to 2.15 & 3.2 to 3.4
V	3	3.5 to 3.8 & 3.10

Reference Book: D.struik, Lectures on Classical Differential Geometry, Addison Wesley Publishing company, 1961.

SEMESTER-III

MAJOR PAPER-X

TOPOLOGY

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the connectedness and compactness.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS: 75**

UNIT I: **Lecture hour:15**

Topological spaces – Basis for a Topology – The Order Topology – Product Topology on $X \times Y$ –The subspace topology-Closed sets and Limit Points – Continuous Functions –Product topology- Metric Topology.

UNIT II: **Lecture hour:15**

Connectedness : Connected Spaces – Connected subspaces of the real line -Components and Local connectedness .

UNIT III: **Lecture hour:15**

Compact Spaces – Compact subspaces of real line-Limit Point Compactness .

UNIT IV: **Lecture hour:15**

Count ability and Separation Axioms: Count ability Axioms – Separation Axioms-Normal spaces-Urysohn's Lemma – Urysohn Metrization Theorem-The Tietze Extension Theorem

UNIT V: **Lecture hour:15**

The Tychonoff Theorem –The stone Cech compactification. Complete Metric Spaces – Compactness in Metric Spaces –Baire Spaces.

TEXT BOOK:

Topology , James R. Munkers Second Edition Pearson Education (singapore) pvt ltd .

REFERENCE BOOK:

George F. Simmons , **Introduction to Topology and Modern Analysis** , Mcgraw hill Book Company , 1963.

SEMSTER – III

MAJOR PAPER – XI

DISCRETE STRUCTURES

OBJECTIVE:

On successful completion of this course the students should gain knowledge about the Discrete Structures.

PEDAGOGY:

Oral, Black board method and OHP **TOTAL HOURS: 75**

UNIT – I **Lecture hour:15**

RELATIONS

Cartesian products of two sets – Domain and Range of a relation – representation of relation – Operations on Relations – Composition of Relations – Equivalence relations.

FUNCTIONS

Functions and Operators – Range of a function – One-to-one, onto – Special types of functions – Invertible functions – Composition of function.

UNIT - II **Lecture hour:15**

LATTICES AND BOOLEAN ALGEBRA

Lattice – Duality- types of lattices - join irreducible elements – Boolean algebra – basic theorem on Boolean algebra – applications of Boolean algebra – logic gates and circuits – combinatorial circuits – Boolean expressions – Karnaugh map

UNIT – III **Lecture hour:15**

RECURRENCE RELATIONS AND GENERATING FUNCTION

Recursion and Iteration – Recurrence relations – Solution of finite order homogeneous (linear) relations – Solution of Non-Homogeneous relations – Generating functions – Some common Recurrence relations – Primitive recursive function – Recursive and partial recursive function.

UNIT - IV **Lecture hour:15**

LANGUAGE AND GRAMMER

Language : The set Theory of Strings – Languages – Regular Expressions and Regular Languages – Grammar – Finite –state Machine.

UNIT - V **Lecture hour:15**

AUTOMATA

Finite-state Automata – Pumping Lemma for Regular Sets – Finite Automation with Output – Minimization of Finite Automata – Turning Machines

TEXT BOOK:

1. UNIT I & III - "**Discrete Mathematics**" Dr. M. K. Venkataraman, Dr. N. Sridharan N. Chandrasekaran
2. UNIT II, IV & V – "**Discrete Mathematics**" J K. Sharma

REFERENCE BOOK: "**DiscreteStructures"** P. K. Mittal

SEMESTER-III

MAJOR PAPER-XII

MATHEMATICAL STATISTICS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Probability and theoretical Distributions.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS: 90**

UNIT : I **Lecture hour:18**

Probability and expected value: Introduction – Probability defined – Classical or priori probability – Axiomatic approch to probability – Calculation of probability – Theorems of probability – Conditional probability – Baye's theorem – Mathematical expectation – Random variable and probability distribution – Problems

UNIT : II **Lecture hour:18**

Theoretical distributions : Introduction – Binomial distribution – Obtaining coefficient of the binomial – Properties of the binomial distribution – Constants of binomial distribution – Importance of binomial distribution – Fitting a binomial distribution – Problems – Poission distribution – constants of the Poission distribution – Role of the Poission distribution – Fitting a Poission distribution – Problems – Normal distribution – Graph of Normal distribution – Relation between binomial and poisson , Normal distribution – Importance of Normal distribution – properties of Normal distribution – Area under the normal curve – Significance of Normal distribution – Fitting a normal curve – problems

UNIT : III **Lecture hour:18**

Test of Hypothesis : Introduction – Estimation – Point estimates - Interval Properties of a good estimator – Test of significance for Attributes – Test of significance for large samples – Difference between small and large samples – Two tailed test for difference between the means of two samples – Standard error of the difference between two standard deviations – Test of significance for small samples – The Assumption of normality – Student's t – distribution – Properties of t- distribution – The t – table – Application of the t – distribution – Problems

UNIT : IV **Lecture hour:18**

Chi square test : Introduction - Chi square defined – Degrees of freedom – The Chi square distribution – Constants of Chi square distribution – The Chi square test when the degrees of freedom exceed 30 – Uses of Chi square test – Problems – Additive property of Chi square - test for specified value of population variance – Problems

UNIT : V **Lecture hour:18**

F – test and Analysis of variance : Introduction - The F – test or the variance ratio test – Applications of F – test – Analysis of variance – Techniques of analysis of variance - Analysis of variance in two way classification model – Problems

TEXT BOOK:

Statistical Methods , Dr. S. P. Gupta, Sultan chand & Sons, Educational publishers, New delhi, Thiry eighth edition

REFERENCE BOOK:

Fundamentals of Mathematical statistics , S. C. Gupta, V. K. Kapoor, Sultan chand & Sons, Educational publishers, Sultan chand & Sons, New delhi, Eleventh edition

SEMESTER-III

MAJOR PAPER-XIII

FLUID DYNAMICS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Fluid Dynamics.

PEDAGOGY:

Oral, Black Board Method and OHP

TOTAL HOURS:75

UNIT I: **Lecture hour:15**

INTRODUCTORY NOTIONS –Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure.

EQUATIONS OF MOTION - Differentiation following the Fluid – Equation of continuity – Boundary conditions – Kinematical and Physical – Rate of change of linear momentum – Equation of motion of an inviscid fluid.

UNIT II: **Lecture hour: 15**

EQUATIONS OF MOTIONS: Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – energy equation for inviscid fluid – circulation – Kelvin's theorem – vortex motion –Helmholtz equation.

UNIT III: **Lecture hour: 15**

TWO DIMENSIONAL MOTION – Two Dimensional Functions – Complex Potential – basic singularities – source – sink – Vortex – doublet – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force. (Magnus effect)

UNIT IV: **Lecture hour: 15**

DYNAMICS OF REAL FLUIDS: Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid –Steady flow through an arbitrary cylinder under pressure – Staedy Couettc flow between cylinders in relative motion – Steady flow between parallel planes.

UNIT V: **Lecture hour: 15**

LAMINAR BOUNDARY LAYER IN INCOMPRESSIBLE FLOW: Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate – Blasius equation and its solution in series.

Text Book:

For **Units I and II:**

Theoretical Hydro Dynamics by L.M. Milne Thomson, McMillan Company, 5th Edition (1968).

Chapter I : Sections 1.0 – 1.3., 3.10-3.41 (omit 3.32)

Chapter III : Sections 3.42 – 3.53 (omit 3.44)

For **Units III, IV and V:**

Modern Fluid Dynamics – (Volume I) by N. Curle aand H.J. Davies, D Van Nostrand Company Limited., London (1968).

Chapter III : Sections 3.1 – 3.7.5 (omit 3.3.4, 3.4, 3.5.2,3.6)

Chapter V : Sections 5.1 – 5.3.3 ;Chapter VI : Sections 6.1 – 6.3.1 (omit 6.2.2., 6.2.5

SEMESTER-III

ELECTIVE PAPER-II

CONTROL THEORY

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the controllability and stability.

PEDAGOGY:

Oral, Black Board Method and OHP

TOTAL HOURS:75

UNIT I: **Lecture hour:15**

OBSERVABILITY: Linear Systems – Observability Grammian – Constant coefficient systems –Reconstruction kernel – Nonlinear Systems

UNIT II: **Lecture hour:15**

CONTROLLABILITY: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems

UNIT III: **Lecture hour:15**

STABILITY: Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear time varying systems – Perturbed linear systems – Nonlinear systems

UNIT IV: **Lecture hour:15**

STABILIZABILITY: Stabilization via linear feedback control – Bass method – Controllable subspace .

UNIT V: **Lecture hour:15**

OPTIMAL CONTROL: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Nonlinear Systems

Text Book:

Elements of Control Theory by K.Balachandran and J.P.Dauer, Narosa,Second Edition New Delhi, 2012.

Reference Book:

1. Linear Differential Equations and Control by R.Conti, Academic Press, London, 1976.

2. Functional Analysis and Modern Applied Mathematics by R.F.Curtain and A.J.Pritchard, Academic Press, New York, 1977.

3. Controllability of Dynamical Systems by J.Klamka, Kluwer Academic Publisher, Dordrecht, 1991.

4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, Marcel Dekker, New York, 1979.

5. E.B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley, New York, 1967

SEMESTER-III

ELECTIVE PAPER-III

EDC- QUANTITATIVE APTITUDE

OBJECTIVES:

On successful completion of this course the students should gain knowledge about primal use of resources.

PEDAGOGY:

Oral, Black Board Method and LCD **TOTAL HOURS:60**

UNIT I: **Lecture hour:12**

Decimal Fractions - Simplification – Square Roots & Cube Roots.

UNIT II: **Lecture hour:12**

Problems on Numbers – Problems on Ages – Percentage.

UNIT III: **Lecture hour:12**

Time and Work – Time and Distance – Problems on trains.

UNIT IV: **Lecture hour:12**

Simple Interest – Compound Interest – Logarithms.

UNIT V **Lecture hour:12**

Area – Volume and Surface Areas – Races and Games of Skill.

Text Book:

"Quantitative Aptitude" by R.S.Agarwal ,S.Chand & company Ltd,New Delhi,7th Edition.

SEMESTER-IV
MAJOR PAPER-XIV
FUNCTIONAL ANALYSIS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Hilbert spaces and Conjugate space.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS:90**

UNIT I: **Lecture hour:18**

Banach spaces – The definition and some examples – Continuous linear transformations– The Hahn-Banach theorem – The natural imbedding of N in N** - The open mapping problem.

UNIT II: **Lecture hour:18**

The conjugate of an operator – Hilbert spaces – The definition and some simple properties – Orthogonal complements - Orthonormal sets.

UNIT III **Lecture hour:18**

The Conjugate space H* - The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.

UNIT IV: **Lecture hour:18**

Matrices – Determinants and the spectrum of an operator – The spectral theorem.

UNIT V: **Lecture hour:18**

The definition and some examples of Banach algebra – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius.

Text Book:

1. G.F. Simmons**, Introduction to Topology and Modern Analysis,** McGraw –Hill Book Company, London, 1963.

Unit I: Sections: 46 – 50. Unit II: Sections: 51 – 54. Unit III: Sections: 55 – 59.
Unit IV: Sections: 60 – 63. Unit V: Sections: 64 – 68.

Reference Book:

C. Goffman and G. Pedrick, **A First Course in Functional Analysis,** Prentice Hall of India, New Deli, 1987.

SEMESTER-IV

MAJOR PAPER-XV

MATHEMATICAL METHODS

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the Fourier transforms and integral equations.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS:90**

UNIT I: Lecture hour:18

FOURIER TRANSFORMS: Fourier sine and cosine transforms – Fourier transforms of derivatives - Fourier transforms of simple functions - convolution integral – Parseval's Theorem - Solution of PDE by Fourier transform – Laplace equation in half plane in infinite strips; in semi infinite strip. The Linear diffusion equation on a semi infinite line – the two dimensional diffusion equation.

UNIT II: Lecture hour:18

HANKEL TRANSFORMS: Properties of Hankel Transforms – Hankel inversion theorem of derivatives of functions (proof deleted)- The Parseval's relation – relation between Fourier and Hankel transforms - Axisymmetric Dirichlet problem for a half space - Axisymmetric Dirichlet problem for a thick plate.

UNIT III: Lecture hour:18

INTEGRAL EQUATIONS: Types of Integral equations – Integral Fredholm Alternative - Approximate method – Equation with separable Kernel - Volterra integral equations – Fredholm's theory – Fredholm's first, second, third theorems.

UNIT IV: Lecture hour:18

Application of Integral equation to ordinary differential equation – initial value problems – Boundary value problems – singular integral equations – Abel Integral equation

UNIT V: Lecture hour:18

CALCULUS OF VARIATIONS: Variation and its properties – Euler's equation –Functional of the integral forms - Functional dependent on higher order derivatives – functional dependent on the functions of several independent variables – variational problems in parametric form – applications.

Text Book:

For Units I and II: **The Use of Integral Transforms** by I.N.Sneddon, Tata Mc Graw Hill, New Delhi, 1974.

For Units III and IV: **Linear Integral Equations Theory and Technique** by R.P.Kanwal, Academic Press, New York, 1971.

For Unit V: **Differential Equations and Calculus of Variations** by L.Elsgolts, Mir Publishers, Moscow, 1970.

Unit I : Chapter 2: 2.4 - 2.7, 2.9 – 2.10, 2.16 – 2-(a).(b).(c) 2.16.

Unit II : Chapter 5: 5.2 – 5.4, 5.6 – 5.7, 5.10 – 5.12.

Unit III : Chapter 2: 2.3 - 2.5, Chapter 3: 3.3 - 3.4.

Unit IV : Chapter 5: 5.1 – 5.2, Chapter 8: 8.1 – 8.2.

Unit V : Chapter 6: 6.1 – 6.7.

SEMESTER – IV

MAJOR PAPER – XVI

GRAPH THEORY

OBJECTIVES

On successful completion of this course the students should gain knowledge about the Graph and Coloring.

PEDAGOGY

Oral, Black Board method and OHP **TOTAL HOURS:90**

UNIT – I **Lecture hour:18**

GRAPHS: Graphs and their representation – Isomorphism's and Automorphism's - Graphs arising from other structures – Constructing graphs from other graphs – directed graphs – infinite graphs

UNIT –II **Lecture hour:18**

SUBGRAPHS : Sub graphs and super graphs – spanning and induced subgraphs – modifying graphs – decompositions and coverings – edge cuts and bonds – even subgraphs – graph reconstruction

Unit – III **Lecture hour:18**

CONNECTED GRAPHS: Walks and connection – cut edges – Euler tours – connection in Digraphs**.**

TREES: Forests and trees – Spanning trees

NON-SEPARABLE GRAPHS: Cut vertices – separations and blocks

UNIT –IV **Lecture hour:18**

CONNECTIVITY:Vertex connectivity – The fan lemma – edge connectivity – Three connected graphs

PLANAR GRAPHS: Plane and planar graphs – duality – Euler's formula – bridges – Kuratowski's theorem

UNIT –V **Lecture hour:18**

THE FOUR-COLOUR PROBLEM: Colourings of planar maps – the five colour theorem

HAMILTON CYCLES :Hamiltonian and non-Hamiltonian graphs – Non-Hamiltonian planar graphs – path and cycle exchanges – path exchanges and parity – Hamilton cycles in Random graphs.

TEXT BOOK

GRAPH THEORY by J.A.Bondy and U.S.R.Murty, Springer international edition – 2013

REFERENCE BOOK

Treatment as in " **GRAPH THEORY**" by Narsingh Deo, Prentice – Hall of India private limited, New Delhi, 1997

SEMESTER-IV

MAJOR PAPER – XVII

NUMBER THEORY

OBJECTIVES:

On successful completion of this course the students should gain knowledge about the primes and functions.

PEDAGOGY:

Oral, Black Board Method and OHP **TOTAL HOURS:90**

UNIT I: **Lecture hour:18**

Introduction, Divisibility, Primes**.**

UNIT II: **Lecture hour:18**

Congruences, solutions of congruences, Congruences of Degree 1. The functions $\varphi(n)$, congruences of higher degree, Prime power moduli, Prime modulus.

UNIT III: **Lecture hour:18**

Congruences degree 2, prime modulus, POWER Residues, Number theory from an algebraic view point , Multiplicative groups, Rings and fields, quadratic residues.

UNIT IV: **Lecture hour:18**

Quadratic reciprocity – The Jacobi Symbol – Greatest integer function.

UNIT V: **Lecture hour:18**

Arithmetic functions – The Moebius Inversion formula – The multiplication of arithmetic functions – Recurrence functions.

Text Book:

1. An Introduction to Theory of Numbers by Ivan Nivan and Herberts Zucherman**.**

Unit-I: Chapter I: Sections 1.1 – 1.3
Unit-II: Chapter II: Sections: 2.1 – 2.7
Unit-III: Chapter II: Sections: 2.8 – 2.11
Chapter III: Section: 3.1
Unit-IV: Chapter III: Sections: 3.2, 3.3
Chapter IV: Section: 4.1
Unit-V: Chapter IV: Sections: 4.2 – 4.5

Reference Book:

T.M. **Apostol, Introduction to Analytic Number Theory,** Springer Verlag, 1976.

SEMESTER-IV
PROJECT

PROJECT AND VIVA- VOCE

Students should do the project in any one of the following topic.

PROJECT AREAS (BROAD FIELD)

1. **Algebra**
2. **Operations Research**
3. **Functional Analysis**
4. **Graph Theory**
5. **Control Theory**
6. **Ordinary Differential Equations**
7. **Fuzzy Logic And Fuzzy Sets**
8. **Topology**
9. **Real Analysis**
10. **Partial Differential Equations**
11. **Mechanics**
12. **Discrete Structures**
13. **Complex Analysis**
14. **Number Theory**