GOBI ARTS & SCIENCE COLLEGE (AUTONOMOUS) : GOBICHETTIPALAYAM

SCHEME OF EXAMINATIONS - M.Sc. (MATHEMATICS) (18 BATCH)

No.	Code	Subject Title	Hrs	CIA	EOSE	Total	Credit
SEMESTER : 1							
1	14P3MA01	ALGEBRA	3	30	70	100	5.0
2	17P3MA02	REAL ANALYSIS	3	30	70	100	5.0
3	14P3MA08	THEORY OF ORDINARY DIFFERENTIAL EQUATIONS	3	30	70	100	5.0
4	17P3MA07	OPERATIONS RESEARCH	3	30	70	100	4.0
5	17P3MA05	NUMBER THEORY	3	30	70	100	4.0
SEMESTER : 2							
6	14P3MA06	MATHEMATICAL STATISTICS	3	30	70	100	5.0
7	16P3MA09	COMPLEX ANALYSIS	3	30	70	100	5.0
8	17P3MA10	TOPOLOGY	3	30	70	100	5.0
9	14P3MA03	PARTIAL DIFFERENTIAL EQUATIONS	3	30	70	100	5.0
10	14P3MA19	OBJECT ORIENTED PROGRAMMING WITH C++	3	30	70	100	3.0
11	14P3MAP1	PROGRAMMING LAB (C++)	3	30	70	100	1.0
SEMESTER : 3							
12	14P3MA15	DIFFERENTIAL GEOMETRY	3	30	70	100	5.0
13	17P3MA11	FUNCTIONAL ANALYSIS	3	30	70	100	5.0
14	17P3MA16	STOCHASTIC DIFFERENTIAL EQUATIONS	3	30	70	100	3.0
15	17P3MA17	ADVANCED COMPUTATIONAL PROGRAMMING	3	30	70	100	2.0
16	17P3MAP2	PROGRAMMING LAB (ADVANCED COMPUTATIONAL PROGRAMMING)	3	30	70	100	1.0
17		SUPPORTIVE PAPER	3	30	70	100	4.0
SEMESTER : 4							
18	14P3MA04	MECHANICS	3	30	70	100	5.0
19	14P3MA12	FLUID DYNAMICS	3	30	70	100	5.0
20	14P3MA14	CONTROL THEORY	3	30	70	100	5.0
21	17P3MA13	MATHEMATICAL METHODS	3	30	70	100	4.0
22	14P3MA18	ADVANCED FUNCTIONAL ANALYSIS	3	30	70	100	4.0

TOTAL CREDITS :90

M.Sc. Mathematics
SEMESTER - I
ALGEBRA

Instructional Hrs: 90

Objective: 1. Master the standard computations of group and ring theory.

2. Learn the elementary theorems and proof techniques of group and ring theory.
3. Apply the theorems, proof techniques and standard computations of group and ring theory to solve problems.

UNIT - I: Group Theory **18Hrs**

External direct product (149 - 163)
Internal direct product (181 - 189)
Conjugary classes - class equation Sylow theorems (395 - 411)

UNIT - II Ring Theory **18Hrs**

Polynomial Rings - Facterization of Polynomials - reducibility tests - Irreducibility Tests - Unique - factorization in z (x) - Divisibility in integral domains (279 - 310). Unique facterization domains - Euclidean domains (314 - 322)

UNIT - III Field Theory **18Hrs**

Extension fields - The fundamental theorem of field theory splitting fields - Existence of splitting fields. Splitting fields are unique - zeros of an irreducible polynomial (341 - 356)

UNIT - IV Algebric extensions **18Hrs**

Characterization of extensions - Properties of Algebric extensions (359 - 369) Finite fields -Classification of finite fields - sub fields of a finite field (372 - 380)

UNIT - V Galois theory: **18Hrs**

Fundamental theorem of Galois theory - Solvability - Solvable group (554 - 568)

Cyclotomic extensions - Cyclotomic polynomials (571 - 576)

Treatment as in

Joseph A.Gallian - Contemporay Abstract Algebra, Narosa publishing House New Delhi - Fourth edition.

M.Sc. (Mathematics)
SEMESTER - I
REAL ANALYSIS

Instructional Hrs: 90

Objectives: 1. To enable the students to use sequence and series of functions.
2. To enable the students to use multivariable differential calculus, differentiation and Integration of functions**.**

UNIT -I **18Hrs**

The Riemann – Stieltjes Integral – Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector Valued Functions – Rectifiable curves.

UNIT - II **18Hrs**

Sequences and series of Functions – Discussion of Main problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equi-Continuous Families of Functions – The Stone Weierstrass's Theorem.

UNIT - III **18Hrs**

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 **18Hrs**

Functions of Several Variable – Linear Transformations – Differentiation – The Contraction Principle – The Inverse Function Theorem.

UNIT - V **18Hrs**

Functions of Several Variable – The Implicit Function Theorem – The Rank Theorem – Determinants – Derivative of Higher order – Differentiation of Integrals.

Text Book:

"Principles of Mathematical Analysis" by Walter Rudin, 3rd Edition, McGraw Hill Book Company.

Unit I: Chapter 6
Unit II: Chapter 7
Unit III: Chapter 8
Unit IV: Chapter 9 – Sections 9.1 to 9.25
Unit V: Chapter 9 – Sections 9.26 to 9.43

M.Sc.Mathematics

SEMESTER - I
THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

Instructional Hrs: 90

Objectives: 1. To give the students an awareness of the system to linear differential equations.

2. To enable the students to use the methods of finding the solutions of Boundary value problems.

3. To enable the students to know, use and apply the results on oscillations of second order equations and stability of linear and non-linear systems.

UNIT - I **1. Systems of Linear Differential Equations:** **18Hrs**

Systems of first order equations - model for Arms competition between two nations - Existence and Uniqueness theorem - Fundamental Matrix - Non homogeneous Linear systems - Linear systems with Coefficients – Linear systems with Periodic coefficients.

UNIT - II **2. Existence and Uniqueness of Solutions:** **18Hrs**

Preliminaries - successive approximations - Picards' theorem - continuation and Dependence on initial conditions - Existence of solutions in the large - Existence and uniqueness of solutions of systems - fixed point method.

UNIT - III **3. Boundary value problems.** **18Hrs**

Sturm - Liouville problem - Green's function - Application of BVP - Picard's theorem.

UNIT - IV **4. Oscillations of Second order equations:** **18Hrs**

Fundamental results - Sturm's comparison theorem - Elementary linear oscillations - comparison theorem of Hille - Wintner - Oscillations of $x'' + a(t)\,x = o$

UNIT - V **5. Stability of Linear and Nonlinear systems.** **18Hrs**

Elementary Critical points - system of Equations with constant Coefficients - Linear equation with constant coefficients - Lyapunov stability - stability of Quasi - Linear systems - second order linear differential equations.

Treatment as in:

Text Book of Ordinary differential Equations (Second edition)
By SGDeo,V.Lakshmikantan and V.Raghavendra.

Unit - I: 4.1 to 4.8
Unit - II: 5.1 to 5.9
Unit - III: 7.1 to 7.5
Unit - IV: 8.1 to 8.5
Unit - V: 9.1 to 9.7

M.Sc. Mathematics
SEMESTER - I
OPERATIONS RESEARCH

Instructional Hrs: 90

Objectives:
1. To know the concept of game and Queuing theory.
2. To study the Quadratic and Dynamic programming problems and solving by different method.
3. To understand the replacement models.

UNIT - I **18Hrs**

Game theory – Two person zero sum games – the Maxima Minima Principle – Saddle point Mixed strategies – Graphical solution – Dominance property – reducing the game problem to an LPP – Algebraic Method.

UNIT - II **18Hrs**

Quadratic programming problem – Wolfe's method, Beale's method – Integer programming – All and mixed IPP. Gomory's All IPP Algorithm.

UNIT – III **18Hrs**

Dynamic programming – the Recursive equation – approach – characteristics of Dynamic Programming – Computational procedure – Tabular method of solution – some applications in production.

UNIT - IV **18Hrs**

Queuing Theory: Characteristics of Queuing system Poisson process and exponential Distribution – classification – Transisent and steady state – M/M/1 queuing system – birth death process – M/M/C queuing systems.

UNIT - V **18Hrs**

Replacement models: Elementary replacement models. Replacement of items that deteriorate with time Maintenance cost increases with time and the value of money remains the same the value of money change with time – individual – replacement and group replacement policy.

Book:

Operations Research – Kantiswarup, P.K. Gupta & Man Mohan.

Reference:

1. An introduction to Operations Research – H. TAHA.
2. Principles of Operations Research – H.M. Wagner.

M.Sc. Mathematics
SEMESTER - I
NUMBER THEORY

Instructional Hrs: 90

Objectives:1. To give Introduction to Elementary Number Theory.

2. To show how certain number theoretical theorems can be applied within Cryptography.

UNIT -I **18Hrs**

Divisibility:
Introduction, Divisibility, Primes.

UNIT -II **18Hrs**

Congruences:
Solutions of congruences, Congruences of Degree 1, The function ϕ (n), congruences of Higher Degree, Prime power Moduli, Prime Modulus.

UNIT -III **18Hrs**

Congruences of Degree 2, Prime Modulus, Power Residues, Number Theory from an Algebraic view point, Multiplicative Groups, Rings and Fields, Quadratic Residues.

UNIT -IV **18Hrs**

Quadratic Reciprocity:
Quadratic Reciprocity – The Jocabi Symbol – Greatest Integer function.

UNIT -V **18Hrs**

Some functions of Number Theory.
Arithmetic functions – The Moebius Inversion formula – The Multiplication of Arithmetic function – Recurrence functions.

Text Book:

Herberts Zucherman, Ivan Niran,
An Introduction of theory of Numbers.

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 Sections : 3.1

Unit-IV

Chapter III Sections : 3.2, 3.3

Chapter IV Sections : 4.1

Unit-V

Chapter IV Sections : 4.2 – 4.5

Reference Books:

1. Apostol T.M., Introduction to Analytic number Theory, Springer Verlag, 1976.
2. George E. Andrews, Number Theory, Hindustan publishing Corporation, New Delhi, 1989.
3. Kennath, Rosan, Elementary Number Theory and Its Application, Addison Wesley Publishing Company, 1968.

M.Sc.Mathematics
SEMESTER -II
MATHEMATICAL STATISTICS

Instructional Hrs: 90

Objectives: 1. To prepare students for lifelong learning and successful careers using their mathematical and statistical skills.

2. To train students thoroughly in methods of analysis and algebra, including the computational skills appropriate for mathematicians to use when solving problems.

3. To develop the skills pertinent to the practice of mathematics, including the student's abilities to formulate problems, to think creatively and to synthesize information**.**

UNIT - I **18Hrs**

Preliminary remarks - Random events and operations performed on them - The system of axioms of the theory of probability, conditional probability, Bayes theorem - independent events.

The concept of a random variable - the distribution function – Random variables of the discrete and the continuous - type - functions of Random variables - Multidimensional random variables - Marginal distribution - conditional distributions - Independent random variables - functions of multidimensional random variables.

Expected values - Moments - The Chebyshey inequality - Absolute moments - order parameters - Moments of random vectors.

UNIT - II **18Hrs**

Characteristic function: Properties of characteristic function and moments semi invariants - The characteristic function of sum of independent random variables. Determinations of the distributed function of the characteristic function - probability generating function One point and two point distributions - The Bernoulli scheme - The binomial distributions.

UNIT - III **18Hrs**

The Poisson distribution - The uniform distribution - The normal distribution - The Gamma distribution - Beta distribution - The Cauchy and Laplace distribution - compound distributions.

Preliminary remarks - Stochastic convergence - Bernoulli's law of large numbers - the Levy Cramer theorem - The De-Moivre Laplace theorem - The Lindebary Levy theorem.

UNIT - IV **18Hrs**

Sample moments and their functions: The notation of a sample - The notation of a statistic - the distribution of arithmetic mean - of independent normally distributed random variables Chi-square distribution. The distribution of the statistic (x, s) students‘t’ distribution - Fisher’s Z distribution.

UNIT - V **18Hrs**

Theory of estimation: Consistent estimates - unbiased estimates - The sufficiency of an estimate - The efficiency of an estimate Asymptotically most efficient estimates.

The power function and OC function - Most powerful tests - Uniformity most powerful tests - Unbiased tests.

Treatment as in:

Marek Fisz, Probability and mathematical Statistics, John Wiley, 3rd Edn.

M.Sc.Mathematics
SEMESTER - II
COMPLEX ANALYSIS

Instructional Hrs: 90
Objectives: 1. To study about the analytic functions and conformal mapping.

2. To study the evaluation of integration problems.

3. To study the series developments.

UNIT - I **18Hrs**

Concepts of Analytic functions - Limits & continuity, Analytic functions - Sequences. series Uniform convergence, Power series Abel's limit theorem - Polynomials - Rational functions - Exponential, trigonometric functions, Periodicity, Analytic functions in regions, Conformal mapping. Complex integration - Line integrals as functions for arcs - Cauchy's theorem for rectangle, Dics, - index of a point w.r.to a closed curve.

UNIT -II **18Hrs**

Zeros and singularities, Residue theorem, Argument principle, Evaluation of definite integrals.

UNIT - III **18Hrs**

Series and product developments Wierstrass theorem - Hurwitz theorem - Taylor series - Laurent series - partial fractions and factorizations - Mittag Leffler's theorem, infinite product, canonical product.

UNIT- IV **18Hrs**

The Reimann Mapping theorem - statement and proof - Boundary Behaviour, Analytic Arc, Conformal mapping of polygons - Behaviour at an angle - Schwarz - Christoffel formula - Mapping on a Rectangle.

UNIT - V **18Hrs**

Elliptic functions - Simply periodic functions - Doubly periodic functions - The Weierstrass theory.

Treatment as in:

Complex Analysis by AHLFORS McGraw Hill.

For Unit -I	Chapter2	1.1 to 3.3
	Chapter3	2.2 to 2.3
	Chapter4	2.1 to 2.3
Unit -II	Chapter4	3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3
Unit - III	Chapter5	1.1 to 2.3
Unit - IV	Chapter6	1.1 to 2.4
Unit - V	Chapter7	1.1 to 3.4

M.Sc.Mathematics
SEMESTER - II
TOPOLOGY

Instructional Hrs: 90

Objectives: 1. To study the basic concepts in Topological spaces.
2. To study connectedness and compactness in Topology.

UNIT – I **18Hrs**

Topological spaces – Basis for a Topology – The order Topology – The product topology on XxY – The subspace Topology – Closed sets and Limit Points – Continuous Functions – The Product Topology.

UNIT – II **18Hrs**

The Metric Topology – Connected spaces – Connected subspaces of the Real Line – Components and Local Connectedness.

UNIT – III **18Hrs**

Compact spaces – Compact subspaces of the Real Line – Limit point compactness – Local compactness – The Countability Axioms – The Separation Axioms – Normal Spaces.

UNIT – IV **18Hrs**

The Urysohn Lemma – The Urysohn Metrization Theorem – The Tietze Extension Theorem.

Tychnoff Theorem – Stone Check compactification.

UNIT – V **18Hrs**

Metrization Theorems and Para Compactness – Local Finiteness – The Negata Smirnov Metrization Theorem – Para Compactness – The Smirnov Metrization Theorem.

Text Book:

"Topology" by James R. Munkres, Second Edition, Pearson Education.

Unit - I:
Sections 2.12 to 2.19
Unit - II:
Sections 2.20, 2.21 and Sections 3.23 to 3.25
Unit - III:
Sections 3.26 to 3.29 and Sections 4.30 to 4.32
Unit - IV:
Sections 4.33 to 4.35 and Sections 5.37, 5.38
Unit - V:
Sections 6.39 to 6.42

M.Sc. Mathematics
SEMESTER - II
PARTIAL DIFFERENTIAL EQUATIONS

Instructional Hrs: 90

Objectives: 1. To understand the basics of partial differential equation, Mathematical models and classification of second order equations.

2. To study cauchy problem, separation of variable techniques and Boundary value problems.

3. Construction of Green's function and its application to boundary value problems.

UNIT - I Mathematical Models 18Hrs

The Vibrating String - The Vibrating Membrane - Waves in an Elastic Medium - Conduction of heat in Solids - The gravitational Potential - Classification of Second Order Equations with Constant Coefficients – General Solution.

UNIT -II The Cauchy Problem 18Hrs

The Cauchy Problem - Cauchy - Kowalewsky Theorem - Homogeneous Wave Equation - Initial - Boundary Value problems – Non Homogeneous Boundary Conditions - Finite String with Fixed Ends – Non Homogenous Wave Equation - Reimann's Method.

UNIT - III Method of separation of variables 18Hrs

Separation of Variables - The Vibrating String problem - Existence and Uniqueness of Solution of the Vibrating String Problem - The Heat Conduction problem - Existence and Uniqueness of Solution of the Heat Conduction Problem - The Laplace and beam Equations - Non Homogeneous problems Exercises.

UNIT - IV Boundary Value problems 18Hrs

Boundary - Value problems - Maximum and Minimum principles - Uniqueness and Stability Theorems - Dirichlet Problem for a Circle – Dirichlet problem for a circular Annulus- Neumann problem for a Circle - Dirichlet problem for a rectangle - Dirichlet problem Involving Poisson Equation - Neumann Problem for a rectangle- exercises.

UNIT - V Green's Function 18Hrs

The Delta Function - Green's Function - method of Green's Function - Dirichlet Problem for the Laplace Operator – Dirichlet problem for the Helmoltz operator Method of Images -Method of Eigenfunctions - Higher Dimensional Problems - Neumann Problem.

Treatment as in:

"Partial Differential Equations of Mathematical Physics
By
TYN MYINT - U

Chapters: 2, 3, 4, 6, 8, 10.

M.Sc.Mathematics
SEMESTER - II
OBJECT ORIENTED PROGRAMMING WITH C++

Instructional Hrs: 75

Objectives: 1. To know the concepts of objected – oriental programming.

2. To write simple programs using files and exception Handling.

3. To write simple applications using C++**.**

UNIT - I **15Hrs**

Principles of OOP. Basic concepts of OOP - Benefits and applications of OOP - C++ structure - tokens - expressions and control structures, Functions.

UNIT - II **15Hrs**

Classes and objects. Function prototyping - call by reference - return by reference - Inline functions - Function overloading - Friend and Virtual functions- specification on class - member function - private member functions. Arrays within a class - Memory allocation for objects - arrays of objects - Static and constant member functions.

UNIT - III **15Hrs**

Constructors, Distracters and operator overloading. Constructors - Parametrized. constructors - copy constructor - Dynamic constructors - Distracters - Definition of operator overloading - overloading binary operators - Manipulation of strings using operators - Rules for overloading operators.

UNIT - IV **15Hrs**

Inheritance, Pointers, Virtual Functions and Polymorphism. Derived classes, single and multiple Inheritance, hierarchical and hybrid Inheritance, Virtual base Classes, Abstract classes, pointers to objects, pointers to derived classes, virtual functions.

UNIT - V **15Hrs**

Files and Templates. File operations - Procedure oriented paradigms - object oriented paradigm - object oriented design and analysis. Templates, class templates, function templates, member function templates.

Treatment as in:
E.Balagurusamy - Object Oriented Programming with C ++, Tata McGraw Hill Company Limited, New Delhi, 1995.

Reference:

D.Ravichandran - Programming with C++, Tata McGraw Hill Company Limited, New Delhi, 1995.

M.Sc.Mathematics
SEMESTER - III
DIFFERENTIAL GEOMETRY

Instructional Hrs: 90

Objectives: 1. To study basic concepts of space curve theory.
2. To study basic concepts of surface theory.
3. To study the concepts of geodesics.

UNIT - I Curves: 18Hrs

Analytic representation - arc length, tangent osculating plane, curvature, Torsion, formulas of Frenet.

UNIT - II 18Hrs

Contact, Natural equations, Helices, General solution of the natural equations, evolutes and involutes.

Unit - III 18Hrs

Elementary theory of surfaces.
Analytic representation, first fundamental form, normal, tanpent plane, Developable surfaces.

UNIT - IV 18Hrs

Second fundamental form, Meusnier's theorem, Euler's theorem, Dupin's indicative the equations of Gauss - Weingarton, the theorem of Gauss and the equations of Codazzi.

UNIT - V 18Hrs

Curvilinear coordinates in space, some applications of the Gauss and the Codazzi equations, the fundamental theorem of surface theorey. Geodesic curvature Geodesics.

Treatment Book:

Lecturer on classical differential Geometry by Dirk.J.Struik, 2 ed. Addition - Wesley Publishing Company, In C.

Unit - I	Chapter 1	1-1 to 1-6
Unit - II	Chapter 1	1-7 to 1-11
Unit - III	Chapter 2	2-1 to 2-4
Unit - IV	Chapter 2	2-5 to 2-7
	Chapter 3	3-2 to 3-3
Unit - V	Chapter 3	3-4 to 3-6
	Chapter 4	4-1 to 4-2

M.Sc.Mathematics
SEMESTER - III
FUNCTIONAL ANALYSIS

Instructional Hrs: 90

Objectives: 1. To study the normed linear spaces and Banach spaces.

2. To study the operators on normed linear spaces.

3. To study Hahn – Banach theorem and uniform boundedness principle.

UNIT - I **18Hrs**

Norm on a Linear space – Examples of Normed linear spaces – Seminorms and Quotient spaces – Product space and Graph Norm – semi – inner product and sesquilinear Form – Banach spaces . (Omit Example 2.7 (vi) Page No: 83, 84)

UNIT - II **18Hrs**

Incomplete Normed Linear Spaces (Omit Theorem 2.28 – Page No: 88) – Completion of Normed Linear spaces – Some properties of Banach Spaces – Baire Category Theorem (Statement only) – Schauder Basis and Separability – Heine-Borel Theorem and Riesz Lemma – Best Approximation Theorems – Projection Theorem.

UNIT - III **18Hrs**

Operators on Normed Linear Spaces – Bounded Operators (Omit Example 3.1 (viii) – Page No: 130) – Some Basic Results and Examples – The Space B(X, Y) – Norm on B(X, Y) (Omit Example 3.3 (X) – Page No: 142 - 143 and Omit some estimates for norms of certain operators Page No: 144 - 148) – Riesz Representation Theorem – Completeness of B(X, Y) – Bessel's Inequality – Riesz-Fischer theorem.

UNIT - IV **18Hrs**

Hahn-Banach Theorem and Its consequences – The Extension Theorem – Consequences on Uniqueness of Extension – Separation Theorem.

UNIT - V **18Hrs**

Uniform Boundedness principle – The theorem and Its consequences – Closed Graph Theorem and Its consequences – Closed Graph Theorem – Bounded Inverse Theorem – Open Mapping Theorem – A Stability Result for Operator Equations.

Text Book:

Functional Analysis – A First Course, M. Thanban Nair, Prentice Hall of India Pvt Ltd., New Delhi, 2002.

Unit – I:

Sections 2.1, 2.1.1, 2.1.2, 2.1.4, 2.1.6, 2.2.

Unit – II:

Sections 2.2.1, 2.2.2, 2.2.3, 2.3 – 2.6.

Unit – III:

Sections 3.1, 3.1.1, 3.2, 3.2.1, 3.3, 3.4.1, 4.2, 4.3, 4.4.

Unit – IV:

Sections 5, 5.1 – 5.4.

Unit – V:

Sections 6, 6.1, 7, 7.1, 7.2, 7.3, 7.3.1.

M.Sc.Mathematics
SEMESTER - III
STOCHASTIC DIFFERENTIAL EQUATIONS

Instructional Hrs: 90

Objectives:
1. To understand the Stochastic Process.
2. To understand the Stochastic Differential Equations and prove some general theorems.
3. To understand various numerical methods for solving Stochastic differential Equations.

UNIT – I **18Hrs**

Introduction – Stochastic Analogs of Classical Differential Equations – Filtering Problems – Stochastic Approach to Deterministic Boundary value problems – Optimal Stopping – Stochastic Control and Mathematical Finance.

Some Mathematical Preliminaries – Probability Spaces, Random Variables and Stochastic processes – An Important Example: Brownian Motion.

UNIT – II **18Hrs**

Ito Integrals – Construction of the Ito Integral – Some properties of the Ito Integral – Extensions of the Ito Integral.

UNIT – III **18Hrs**

The Ito Formula and the Martingale Representation Theorem – The one dimensional Ito Formula – The Multidimensional Ito Formula – Extensions of the Ito Integral.

Stochastic Differential Equations – Examples and Some Solution Methods – An Existence and Uniqueness Result – Weak and Strong Solutions.

UNIT – IV **18Hrs**

The Filtering Problem – Introduction – The One dimensional Linear Filtering Problem – The Multidimensional Linear Filtering Problem.

UNIT – V **18Hrs**

Diffusions: Basic properties – The Markov property – The Strong Markov property – The Generator of an Ito Diffusion – The Dynkin Formula – The Characteristic Operator.

Text Book:

Stochastic Differential Equations – An Introduction with Applications by Bernt Oksendal, Sixth Edition, Springer – Verlag, Heidelberg, 2003.

Unit - I: Chapter 1 and 2
Unit - II: Chapter 3
Unit - III: Chapter 4 and 5
Unit - IV: Chapter 6
Unit - V: Chapter 7.

M.Sc. Mathematics
SEMESTER - III
ADVANCED COMPUTATIONAL PROGRAMMING

Instructional Hrs:90

Objectives: 1. To know the basic concepts of MATLAB.
2. This paper enables the students to learn the latest techniques that is helpful to prepare a printable document in an Enhanced manner.

UNIT -I **18Hrs**

Introduction to MATLAB – Matlab Environment – Help Feature – Types of Files. Constants, Variables and Expressions – Constants and Variables – Operators – Built-in-functions.

UNIT -II **18Hrs**

Vectors and Matrices: Scalars and Vectors – Multi-dimensional matrices and arrays – Matrix manipulations – Matrix and Array Operations.

Input - Output Statements – Interactive Inputs – Reading/Storing file data – Output Commands – Low level input-output functions.

UNIT -III **18Hrs**

Programming in MATLAB – Relational and logical operators – Conditional statements – The Switch-Case statement – Loops – Nested loops and Nested Conditional statements – The break and continue commands – Examples of MATLAB Applications.

UNIT -IV **18Hrs**

Polynomials, Curve Fitting and Interpolation – Polynomials – Curve fitting – Interpolation – The basic fitting Interface – Examples of MATLAB Applications.

UNIT -V **18Hrs**

MATLAB Graphics – Introduction – Two dimensional plots – Multiple plots – Specialized Two dimensional plots – Three Dimensional plots.

Ordinary Differential Equations and Symbolic mathematics: Introduction – Ordinary Differential Equation Solvers – Symbolic mathematics.

Text Book 1:

MATLAB and its Applications in Engineering by Rajkumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma.

Text Book 2:

MATLAB – An Introduction with Applications by Amos Gilat.

Unit – I:	Text Book 1:	Chapter 1 - Sections 1.3 – 1.5
		Chapter 2 - Sections 2.4, 2.5, 2.7
Unit – II:	Text Book 1:	Chapter 3 - Sections 3.2, 3.6, 3.7, 3.10
		Chapter 5 - Sections 5.3 – 5.6
Unit – III:	Text Book 2:	Chapter 7 - Sections 7.1 – 7.7
Unit – IV:	Text Book 2:	Chapter 8 - Sections 8.1 – 8.5
Unit – V:	Text Book 1:	Chapter 6 - Sections 6.1 – 6.3, 6.7, 6.8
		Chapter 9 - Sections 9.1 – 9.3

Reference Book:

Getting started with MATLAB – A Quick Introduction for Scientists and Engineers by Rudra Pratap.

M.Sc. Mathematics
SEMESTER - IV
MECHANICS

Instructional Hrs: 90

Objectives: 1. To study some basic concepts of Mechanics using Newton's law.

2. To study Hamiltonian Theory of Mechanics.

3. To study the concepts of Poisson & Lagrange brackets.

UNIT - I **18Hrs**

Introductory concepts: Mechanical Systems - Generalized Co-ordinates - Constraints - Virtual work - Energy and Momentum.

UNIT - II **18Hrs**

Lagrange's Equations: Derivation of Lagrange's Equations - Examples - Integrals of motion.

UNIT - III **18Hrs**

Hamilton's Equations: Hamilton's principle - Hamilton's equations.

UNIT - IV **18Hrs**

Hamilton - Jacobi Theory: Hamilton's principal function - Hamilton - Jacobi equation - Separabillity.

UNIT - V **18Hrs**

Canonical Transformations: Differential forms and generating functions - Lagrange and Poisson Brackets.

Treatment as in: Classical Dynamics - by D.T.Greenwood: Prentice Hall of India PVT.LTD, New Delhi. (1979)
Unit - I chapter 1 1.1 - 1.5
Unit - II chapter 2 2.1- 2.3
Unit - III chapter 4 4.1-4.2
Unit - IV chapter 5 5.1 - 5.3
Unit - V chapter 6 6.1 - 6.3

M.Sc.Mathematics
SEMESTER - IV
FLUID DYNAMICS

Instructional Hrs: 90

Objectives:
1. To know and understand the physical properties of fluid and its consequence on fluid flow.
2. Apply the basic applied mathematical tools that support fluid dynamics.
3. State the conservation principles of mass, linear momentum and energy for fluid flow.

UNIT - I **18Hrs**

General description of Fluid Mechanics - Continum Mechanics and properties methods of describing fluid motion - translation rotation and rate of Deformation - Streamlines path lines and streak lines - vorticity.

UNIT - II **18Hrs**

Nature of stresses - transformation of stress components - nature of strains- transformation of the rate of strain - relation between stress and rate of strain - the equation of continuity - Conservation of mass - Equations of motions (Navier Stokes equations) - Conversion of momentum - the energy equation - Conservation of energy.

UNIT - III **18Hrs**

Two and Three dimensional flow

Equations of continuity - Eulerian equation of motions - circulation theorems - velocity potential irrotational flow - integration of equations of motions Bernoulli's equation - the momentum theorems - the moment of momentum theorem - simple flows - Laplace's equations - stream function in two dimensional motions- Stream functions in three dimensional motions - two dimensional flow examples – three dimensional auxillary symmetric flow examples.

UNIT - IV **18Hrs**

Viscous flow:

Similarity of flows - Reynold's number - Viscosity from the point of view of the Kinetic theory - flow between parallel flat plates - Couette flow - plane poiseuille flow steedy flow in pipes - Hagen - poiseuille flow - flow between coaxial cylinders – flow between two concentric rotating cylinders - Hydrodynamics of bearing lubrications.

UNIT - V **18Hrs**

The Boundary layer:

Properties of Navier Stokes equations - Boundary layer concept - The boundary layer equations in two dimensional flow - the boundary layer along a flat plate The Blassius solutions - shearing stress and boundary layer thickness - Boundary layer on a surface with pressure gradient - momentum integral theorems for the boundary layer.

Treatment as in:

'Foundations of Fluid mechanies' by S.W.Yuan, Prentice - Hall of India, New Delhi, 1986.

Unit - I	Chapter - I	Sections 1.1 to 1.3
	Chapter - III	Sections 3.1 to 3.5
Unit - II	Chapter - IV	Sections 4.1 to 4.5
	Chapter - V	Sections 5.1 to 5.3
Unit - III	Chapter - VII	Sections 7.1 to 7.9 and 7.11 to 7.13
Unit - IV	Chapter - VIII	Sections 8.1 to 8.5 and 8.6b
Unit - V	Chapter - IX	Sections 9.1 to 9.5

M.Sc.Mathematics
SEMESTER - IV
CONTROL THEORY

Instructional Hrs: 90

Objectives: 1. Analyse the observability, controllability and stability of a given linear and nonleaner dynamical system.

2. Construct a suitable controller to stabilize an unstable dynamical system.

3. Solve optimal control problem.

UNIT - I **18Hrs**

Motivation - Basic Results of Differential Equations - Fixed point Methods - Observability of Linear systems - Nonlinear systems.

UNIT - II **18Hrs**

Controllability of Linear Systems - Nonlinear systems.

UNIT - III **18Hrs**

Stability of Linear systems - Perturbed Linear systems - Nonlinear systems.

UNIT - IV **18Hrs**

Stabilizability - Stabilization Via linear feed back control - The controllable Subspace - Stabilization with Restricted Feed back.

UNIT - V **18Hrs**

Optional Control - Linear Time varying systems - Time Invariant systems - Nonlinear systems.

Treatment as in:

"Elements of Control Theory"-Second edition.
by K.Balachandran and J.P.Daur.
Narosa Publishing House.

M.Sc. Mathematics
SEMESTER - IV
MATHEMATICAL METHODS

Instructional Hrs: 90

Objectives:
1. To provide the use of integral transform for students of applied mathematics, physics and engineering.
2. The students will be able to understand the Terminology, Scope, Main Results and to solve problems in Mathematics.

UNIT -I **18Hrs**

Fourier Transforms, Finite Fourier Transforms, Applications of Fourier Transforms in Initial and Boundary value problems.

UNIT -II **18Hrs**

Henkel Transforms and finite Henkel Transforms, Applications of Henkel Transforms in Initial and Boundary value problems.

UNIT -III **18Hrs**

Introduction:

Definition – Regularity conditions – special kinds of Kernels – Eigen values and Eigen functions – Convolution Integral - The inner or scalar product of two functions.

Integral Equations with Separable Kernels:

Reduction to a system of Algebraic equation – Examples – Fredholm Alternative – Examples – An Approximate method.

Method of Successive Approximations:

Iterative Scheme – Examples – Volterra Integral Equation – Examples.

UNIT -IV **18Hrs**

Application Integral Equation to Ordinary Differential Equation:
Initial value problems, Boundary value problems – Examples.

Singular Integral Equation:

Abel integral equation – Examples.

UNIT -V **18Hrs**

Calculus of Variations:
Variation and its properties – Euler's equation – functionals of the form functional dependent on higher order derivatives – functionals dependent on the functions of several independent variables – variational problem in parametric form.

Treatment as in:

1. Integral transforms by Vasistha and Gupta, Krishna Prakasam Mandir meerut, 1993-94. For Unit I & II.
   Unit – I
   Chapter 6: Sections 6.1, 6.4 – 6.12, Examples 1-10.
   Chapter 7: Sections 7.1 – 7.4, Examples 1-9.
   Chapter 8: Sections 8.1, 8.2, Examples 1-5.
   Sections 8.3 – 8.5, Examples 13-17.
   Unit – II
   Chapters: 9,10,11

2. Linear Integral Equations by Ram P. Kanwal, Academic Press, New York, 1971. For Units III & IV.

   Unit – III
   Chapter I : Sections 1.1 – 1.6
   Chapter II : Sections 2.1 – 2.5
   Chapter III : Sections 3.1 – 3.4

   Unit – IV
   Chapter 5 : Sections 5.1 – 5.3
   Chapter 8 : Sections 8.1 – 8.2

3. Differential Equations and Calculus of variations by L. Elsgolts, Mir Publishers, 1970. For Unit-V.

   Unit – V
   Chapter 6 : Sections 6.1 – 6.6

M.Sc. Mathematics
SEMESTER - IV
ADVANCED FUNCTIONAL ANALYSIS

Instructional Hrs: 90

Objectives: 1. To familiarize the students with the basic concept, principles and methods of functional Analysis.

2. To know the applications of Banach Theorem to Linear equations, Differential and integral equation.

3. To Know and understand examples of normed spaces, basic topics on Banach algebras, classic theorems of Functional Analysis.

UNIT - I **18Hrs**

Hahn - Banach theorem and its application to Bounded linear functional. Adjoint operators - uniform bounded theorem - open mapping theorem - closed graph theorem and applications.

UNIT - II **18Hrs**

Banach fixed point theorem - Application of Banach theorem to Linear Equations, Differential and integral equations.

UNIT - III **18Hrs**

Further applications to approximation theory.

UNIT - IV **18Hrs**

Spectral theory of linear operators in Normed spaces

UNIT - V **18Hrs**

Compact linear operators on Normed spaces and their spectrum.

Treatment as in:

Introductory functional analysis with applications By Erwin Kreyszing University of Windser Johnwiley & Sons. 1978 Edn.

Unit - I Chapter 4 - Except 4.6, 4.8, 4.9, 4.10, 4.11

Unit - II Chapter 5 - Except 5.2.2, 5.2.3

Unit - III Chapter 6 - Except 6.6
Unit - IV Chapter 7
Unit - V Chapter 8

M.Sc. (Mathematics)

Question paper pattern

MAX.MARKS:70

SECTION - A

MARKS: 5 x 4 = 20 (Either or Type)

UNIT - I	1 or 2
UNIT - II	3 or 4
UNIT - III	5 or 6
UNIT - IV	7 or 8
UNIT - V	9 or 10

SECTION - B

MARKS: (5 x 10 = 50) (Either or type)

UNIT - I	11 or 12
UNIT - II	13 or 14
UNIT - III	15 or 16
UNIT - IV	17 or 18
UNIT - V	19 or 20

Note: No Subdivisions for Section A & Section B.

SUPPORTIVE PAPER

For students of other than Mathematics Department
QUANTITATIVE TECHNIQUES
17P4MA01

Instructional Hrs: 90

Objectives:
1. To know the basic concepts of probability theory and Binomial, Normal Distributions.
2. To understand the problems in Graphical and Simplex Methods.
3. To study the Transportation and Assignment Problems.

UNIT - I **18 Hrs.**

Theory of Probability

Introduction – Classical Definition – Addition Theorem – Multiplication Theorem – Axiomatic Approach – Axioms of Probability – Conditional Probability – Multiplicative Law of Probability – Examples 1-40. (Theorems statement only).

UNIT - II **18 Hrs.**

Binomial Distribution

Binomial Frequency Distribution – Examples – Mean and Standard Deviation of Binomial Distribution – Mode of the Binomial Distribution (Simple problems only).

Normal Distribution

Characteristics of Normal Distribution – Standard Normal Probability Distribution – Examples (Simple problems only).

UNIT - III **18 Hrs.**

Linear Programming

Graphical Method – Solution to Graphical Method – Steps – Alternative Method _ Examples – Infeasible solution – Unbounded solution – Multiple solution – Simplex Method – Procedure for solving by Simplex method – Table 1 – Table 2 – Examples.

UNIT - IV **18 Hrs.**

Transportation Problem

Mathematical Formulation – Feasible solution – Basic feasible solution – Non-degenerate Basic Feasible solution – Solution to the Transportation Problem – Initial Feasible solution – Methods I to IV – Steps – Test of optimality – Theorem (Statement only) – Steps – Degeneracy in Transportation Problem – Unbalanced Transportation Problem – Maximisation Problem in Transportation – Method of solving Maximisation Problem in T.P. Examples (Simple problems only).

UNIT - V **18 Hrs.**

Assignment Problem

Mathematical formulation of an Assignment Problem – Property I, II (Statement only) – Steps – Unbalanced Assignment Problem – Restricted Assignment Problem – Maximisation Problem in Assignment – Steps – Examples.

Treatment as in:

Quantitative Techniques by Dr. P.R. Vittal – Margam Publications.

Unit – I Part-I – Chapter 1, Page No: 1.1 - 1.9, 1.11 - 1.32.
Unit – II Part-I – Chapters 2, 4.
Unit – III Part-II – Chapters 3, 4.
Unit – IV Part-II – Chapter 7.
Unit – V Part-II – Chapter 8.

QUESTION PAPER PATTERN

MAX.MARKS:70

SECTION – A

MARKS: 5 X 4 = 20 (Either or type)

UNIT – I	1 or 2
UNIT – II	3 or 4
UNIT – III	5 or 6
UNIT – IV	7 or 8
UNIT – V	9 or 10

SECTION – B

MARKS: 5 X 10 = 50 (Either or type)

UNIT – I	11 or 12
UNIT – II	13 or 14
UNIT – III	15 or 16
UNIT – IV	17 or 18
UNIT – V	19 or 20

Note: No Subdivisions for section A & Section B.