CORE COURSE: 1 M.SC MATHEMATICS SEM – I

ALGEBRA - I

OBJECTIVES:

- *To educate the advanced level of Groups.*
- *To impart emphasis on concepts on technology of the Groups and Rings as these algebraic structures having application in Mathematical Physics, Mathematical Chemistry and Computer Science.*
- *The sequential development of concepts and skills by using materials to access students in making the transition from the arithmetic to the symbolic.*
- *To study the algebraic structure of Vector spaces.*

UNIT I: GROUP THEORY

Permutation Groups – Another counting Principle – Sylow's theorem.

UNIT II: ABELIAN GROUP

Direct Product – Finite abelian groups.

UNIT III: RING THEORY

The field of Quotients of an Integral domain – Euclidean Rings – A Particular Euclidean Rings.

UNIT IV: POLYNOMIAL RINGS

Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over commutative rings.

UNIT – V FINITE FIELDS

Finite Fields – Wedderburn's theorem on finite division rings – A theorem of Frobenius.

TEXT BOOK:

[1] I.N.Herstein, 'Topics in Algebra', Second Edition, Wiley Eastern Limited 2014.

UNIT I - Chapter 2 (Section 2.10 – 2.12)

UNIT II - Chapter 2 (Section 2.13 – 2.14)

UNIT II I- Chapter 3 (Section 3.6 – 3.8)

UNIT IV - Chapter 3 (Section 3.9 – 3.11)

UNIT V - Chapter 7 (Section 7.1 – 7.3)

REFERENCES:

(1) Surjeet Singh, Quazizameeudui, 'Moderrn Algebra', Vikas Publishing House Pvt. Ltd.

(2) J. Gallian, 'Contemporary Abstract Algebra', Narosa Publishing House, Fourth Edition, 1999.

CORE COURSE: 2 **M.Sc., MATHS** **SEM: I**

REAL ANALYSIS

Objective:

- The main goal of the course is to familiarize the fundamentals of Real Analysis.
- To give geometry behind the definition of metric spaces
- To give a systematic study ofRiemannStieltjesintegral and calculus on $R^{n.}$
- A brief study of convergence of sequences and series and Functions of several variables.
- Expose the students to the basics of Real Analysis and PDE required for the subsequent course work.

Unit I: Metric Spaces

Metric Spaces- Open sets, Closed sets and Convergent sequences- Continuous mappings between metric spaces- Complete metric spaces – Compact metric spaces- Separable metric Spaces.

Unit II: Differentiation

The derivative of a real function – Mean value theorems – The continuity of the derivative- L' Hospital's rule – Derivatives of higher order – Taylor's theorem – Differentiation of vectors valued function.

Unit III: Reimann- Steiltjes integral

Definition and existence of the Integral – Properties of the Integral – Integration and Differentiation.

Unit IV: 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- Stone-Wierstrass theorem.

Unit V: Functions of several variables

Linear Transformations – Differentiations – The contraction Principle- The inverse function theorem.

Text Books:

[1] " Principles of Mathematical Analysis", Walter Rudin, McGraw Hill, Third Edition, 1976.
[2] " Real Analysis", H.L. Royden, P.M. Fitzpatrick, PHI Learning Pvt. Ltd, 2010.

Unit I :Chapter 9 – 9.1 to 9.6 [2]
Unit II: Chapter 5- Sec 5.1 to 5.19 [1]
Unit III: Chapter 6- Sec 6.1 to 6.22 [1]
Unit IV: Chapter 7 – Sec 7.1 to 7.27 [1]
Unit V: Chapter 9 – Sec 9.1 to 9.25 [1]

Reference Books:

1. "Mathematical Analysis", Tom P. Apostal, Narosa Publishing House, Delhi.
2. "Analysis I and II", Serge Lang, Addison – Wesley Publishing Company, 1969.

CORE COURSE:3 M.SC MATHEMATICS SEM: I

ORDINARY DIFFERENTIAL EQUATIONS

OBJECTIVES

- *To identify an ordinary differential equation and its order.*
- *To verify whether a given function is a solution of a given ordinary differential equation (as well as verifying initial conditions when applicable) .*
- *To find solutions of separable differential equations.*
- *To find the general solution of second order linear homogeneous equations with constant co-efficients .*
- *To understand the notion of linear independence and the notion of a fundamental set of solutions.*

Unit I: SECOND ORDER LINEAR EQUATIONS

Introduction - The General Solution of Homogeneous Equation - The use of a Known Solution to find another - Homogeneous equation with constant coefficients -The method of Variation of parameters.

Unit II: POWER SERIES SOLUTIONS AND SPECIAL FUNCTIONS

Introduction-Series solutions of First order equations-Second order Linear equations - Ordinary points - Regular singular points - Regular singular points (continued).

Unit III: SOME SPECIAL FUNCTIONS

Legendre Polynomials - Properties of Legendre polynomials - Bessel Function, The Gamma Function - Properties of Bessel Functions.

Unit IV: LAPLACE TRANSFORMS

Introduction- A few remarks on the theory – Applications to Differential Equations - Derivatives and Integrals of Laplace Transforms – Convolutions and Abels Mechanical Problem.

Unit V:THE EXISTENCE AND UNIQUENESS OF SOLUTIONS

The method of successive Approximations – Picard’s Theorem – the second order linear Equations.

TEXT BOOK

[1]"**Differential Equations with Applications and Historical notes**" by *George F.Simmons*,TataMcGrawHill,Second Edition 2003, 22nd Reprint 2012.

Unit I : Chapter 3 - Sec 15 to 19
Unit II : Chapter 5 - Sec 26 to 30
Unit III : Chapter 8 - Sec 44 to 47
Unit IV : Chapter 9 - Sec 48 to 52
Unit V : Chapter 13 – Sec 68 to 70

REFERENCES

[1] W.T. Reid, "**Ordinary Differential Equations"**, John Wiley & Sons, New York,1971.
[2] E.A. Coddington and N. Levinson, "**Theory of Ordinary Differential Equaitons**,McGraw Hill Publishing Company, New York, 1955.

CORE COURSE:4 M.SC MATHEMATICS SEM : I

CLASICAL MECHANICS

OBJECTIVES:

- To understand and deals with some of the key ideas of classical mechanics.
- To understand the concepts covered in the paper include generalized coordinates, Lagrange's equations, Hamilton's equations and Hamilton - Jacobi theory.
- To develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics.
- To develop skills in formulating and solving physics problems.
- To useconservation of energy and linear and angular momentum to solve dynamics problems.

Unit I: ELEMENTRARY PRINCIPLES

Mechanics of a particle – Mechanics of a system of particles – constraints – D'Alembert's principle and Lagrange's equation – velocity – Dependent potentials and the dissipation function – Simple Application of the Lagrangian formulation.

Unit II: CENTRAL FORCE PROBLEM

Reduction to the equivalent one-body problem – The equation of motion and first integrals –The equivalent of one- dimensional problem and Classification of Orbits – The Virtual theorem – The Differential equations for the Orbit and Integrable power- Law Potentials.

Unit III: THE KEPLER PROBLEM

Inverse square law of forces – The motion in time in the Kepler Problem – the Laplace – Runge – Lenz vector – Scattering in a Central Force Field.

Unit IV: THE KINEMATICS OF RIGID BODY MOTION

The indipent coordinates of ε rigid body – Orthogonal Transformation – Formal Properties of the transformation Matricx – The Euler Angles – The cayley –klein parameters and related quantities – Euler;s theorem on the motion of a rigid body.

Unit V: THE HAMILTON EQUATION OF MOTION

Legendre Transformation and the Hamilton equations of motion – Cyclic Coordinates and conservation Theorems – Routh'sProcedure – The Hamiltonian Formulationof Relativistic Mechanics – Derivation of Hamilton's Equations from aVariational Principle.

TEXT BOOKS:

[1] "**Classical Mchanics**", by Herbert Goldstein and others, Pearson Publiction, Third Edition 2013, New Delhi.

Unit I: Chapter :1 Sec: 1.1 to 1.6
Unit II: Chapter: 3 Sec:3.1 to 3.5
Unit III: Chapter: 3 Sec: 3.7 and 3.10
Unit IV: Chapter: 4 Sec: 4.1 and 4.6
Unit V: Chapter: 8 Sec: 8.1 and 8.5

REFERENCES:

1)."**Classical Dynamics**" by DonaldT.Greenwood, PHI Pvt Ltd., New Delhi-1985.
2). Narayanan Chandra Rana and PromodJoag, "**Classical Mchanics**" Tata McGaw Hill.1990.

ELECTIVE COURSE:1 M.Sc MATHEMATICS SEM: I

CALCULUS OF VARIATION AND INTEGRAL EQUATIONS

Objectives:

- To Analyze the maximum or minimum of functionals.
- To find the external functions that make the functional attain a maximum or minimum value.
- To teach how to save boundary value problems involving certain types of differential equations.
- To use deductive reasoning and critical thinking to solve problems.
- To use technology when appropriate and know the limitations of the technology.

Unit I: Calculus of Variations

Maxima and Minima - The Simplest Case - Illustrative Examples – Natural boundary conditions and Transition conditions – The Variational notation – The more general case.

Unit II: Applications of Calculus of Variations

Constraints and Lagrange multipliers – Variable end points – Storum – Liouville problems – Hamilton's principle – Lagrange's equations.

Unit III: Integral Equations

Introduction – Relaitons between Differential and Integral Equations – The Green's function – Alternative definition of the Green's function.

Unit IV: Linear Equation in Cause and Effect

The influence function – Fredholm equations with seperable kernels – Illustrative examples.

Unit V: Applications of Integral Equations

Hilbert – Schmidt theory – Iterative methods for solving equations of the second kind – The Fredholm theory – Neumann series.

Text Book:

[1] "Methods of applied Mathematics" – Francis B.Hilderbrand , second edition – Prentice - Hall of India pvt, New Delhi, 1968.

Unit – I : Chapter 2 Sec: 2.1 – 2.6 [1]

Unit – II : Chapter 2 Sec: 2.7 – 2.11 [1]

Unit – III : Chapter 3 Sec: 3.1 – 3.4[1]

Unit – IV : Chapter 3 Sec: 3.5 – 3.7 [1]

Unit – V : Chapter 3 Sec: 3.8 – 3.10 [1]

Reference Book:

[1] "Linear integral Equations, Theory and Techniques" – R.P.Kanwal, Academic press, Newyork, 1971.

CORE COURSE :5 M.SC MATHEMATICS SEM:II CODE:P2RMTCC5

PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:

- *To identify Partial differential equation and its order.*
- *To classify Partial differential equations into linear and nonlinear equation.To solve first order linear differential equations .*
- *To understand the notion of linear independence and the notion of a fundamental set of solutions.*
- *To use the Laplace transform to compute solutions of equations involving impulse functions.*
- *To find solutions of the heat equation, wave equation, and the Laplace*

equation subject to boundary conditions.

Unit I: INTRODUCTION – FIRST ORDER PDE

First order PDE - Curves and surface - Genesis of first order PDE - Classification of Integrals - Linear equation of the first order - Pfaffin Differential equations - Compatible systems - Charpits method – Jacobi's method.

Unit II:FIRST ORDER PDE

Integral surfaces through a given curve - Quasi-Linear equations - Non linear First order PDE.

Unit III: SECOND ORDER PDE

Genesis of second order PDE - Classification of Second order PDE: One - Dimensional wave equation - Vibrations of an Infinite string - Vibrations of semi - infinite string – Vibrations of a string of finite length(Method of separation of variables).

Unit IV: LAPLACE'S EQUATION

Boundary value problems - Maximum and Minimum Principles - The Cauchy problem - The Dirichlet problem for the upper half plane - The Neumann problem for the upper half plane - The Dirichlet interior problem for a circle - The Dirichlet exterior problem for a circle - The Neumann problem for a circle - The Dirichlet problem for a Rectangle - Harnack's theorem - Laplace's equation - Green's function.

Unit V: HEAT CONDUCTION

Heat Conduction problem - Heat conduction - Infinite Rod case - Heat conduction finite rod case - Duhamel's principle - Wave equation - Heat conduction equation.

TEXT BOOK

[1] **"An Elementary Course in Partial Differential equations"** by *T.Amarnath*, Narosa, 1997.

Unit I: Chapter 1:Sec 1.1 to 1.8

Unit II: Chapter 1: Sec 1.9 to 1.11

Unit III: Chapter 2: Sec 2.1 to 2.3.5(except 2.3.4)

Unit IV: Chapter 2: Sec 2.4.1 to 2.4.11

Unit V: Chapter 2:Sec 2.5.1, 2.5.2, 2.6.1 and 2.6.2

REFERENCES

1. Sneddon, "Elements **of Partial Differential Equations"**, McGraw Hill, New York, 1984.
2. P. Prasad and R. Ravindran, "**Partial Differential Equations**", Wiley Eastern, New Delhi, 1987.

CORE COURSE:6 M.Sc MATHEMATICS SEM:II CODE:P2RMTCC6

MEASURE THEORY AND INTEGRATION

Objectives:

- To understand the concept of Measure Theory, Definitions and Main Properties of the Integral.
- To construct Lebegsue's Measure on a Real line and in n – dimension Euclidean Space.
- To overcome the limitation using more abstract space.
- To provide a concise introduction to Measure Theory in the context of Abstract Algebra.
- To Focus on the Development of Measure and Integration Theory.

Unit I : Measure on Real Line

Lebesgue outer measure – Measurable sets – Regularity – Measurable Functions – Borel and Lebesgue Measurability.

Unit II : Integration of Functions of a Real Variable

Integration of non – negative functions – The General Integral - Integration of Series – Riemann and Lebesgue Integrals.

Unit III : Convergence and their Derivatives

Convergence in Measure – Almost Uniform Convergence – Applications – Simple Problems only.

Unit IV : Signed Measures

Hahn Decomposition Theorem – The Jordan Decomposition Theorem – The Radon Nikodym Theorem.

Unit V : Measure & Integration in a Product Space

Measurability in a product space – The Product Measure and Fubini's Theorem.

Text Book:

[1] "Measure Theory and Integration" – G. De. Barra – New Age International Private Ltd.

Unit – I	: Chapter 2	Sec: 2.1 – 2.5 [1]
Unit – II	: Chapter 3	Sec: 3.1 – 3.4[1]

Unit – III	: Chapter 7	Sec: 7.1 – 7.2[1]
Unit – IV	: Chapter 8	Sec: 8.1 – 8.3 [1]
Unit – V	: Chapter 10	Sec: 10.1 – 10.2 [1]

Reference Book:

[1] "An Introduction to Measure and Integration" – Inder, K. Ranna – Narosa Publishing House – New Delhi - 1997.

[2] "Lebesgue Measure and Integration" – P.K.Jain, V.P.Gupta – New Age International Pvt. Ltd – 2000

[3] " Real Analysis", H.L. Royden, P.M. Fitzpatrick, PHI Learning Pvt. Ltd, 2010.

CORE COURSE:7 M.Sc., MATHEMATICS SEM:II CODE:P2RMTCC7

COMPLEX ANALYSIS

Objectives:

- In this course, students will learn algebra and geometry of complex numbers, mappings in the complex plane.
- To introduce the concepts multi – valued functions, the calculus of functions of single complex variable and Fourier transform.
- Be able to find the powers and the roots of a complex number complex exponential and to apply the De moivre's formula.
- Use the Cauchy – Riemann equations to determine whether/where a function is differential & find the derivative of a function. Use the two dimension Laplace's equation in Cartesian or polar co-ordinates to determine whether a real valued is harmonic or not.
- Be able to recognize and apply the Liouville's theorem, the mean-value property of a function & the maximum modulus principle.

Unit I: Complex Functions

Introduction to the concept of Analytic Function- Elementary theory of Power series – The exponenetial and Trigonometric Functions.

Unit II: Fundamental Theorems And Cauchy's Integral Formula

Line Integrals-Rectifiable Arc's-Linear Integrals as Functions of Arcs-Cauchy's Theorem for a Rectangle- Cauchy's Theorem in a Disk-The Index of a point with respect to a closed curve-The Integrals Formula –Higher Derivatives.

Unit III: Local Properties of Analytic Functions

Removable singularities, Taylor's Theorem- Zeros and Poles - The Local Mapping- The Maximum Principle.

Unit IV: General Form of Cauchy's Theorem And The Calculus Of Residues

Chains and Cycles-Simple Connectivity-Locally Exact Differentials-Multiply Connected Regions-The Residue Theorems-The Argument Principle-Evaluation of Definite Integrals.

Unit V: Harmonic Function

Definition and Basic Properties –The Mean Value Property-Poisson's Formula-Schwarz's Theorem-The Reflection Principle.

TEXT BOOK

[1]"Complex and Analysis", Lars V.Ahlfors, III edition McGraw Hill Book Company,Tokyo,1979.

Unit I: Chapter 2- All sections.

Unit II: Chapter 4: Sec 1(1.1 to 1.5), Sec2 (2.1 to 2.3)

Unit III: Chapter 4: Sec 3(3.1 to 3.4)

Unit IV: Chapter 4: Sec 4(4.1, 4.2, 4.6 and 4.7) and Sec 5(5.1 to 5.3)

Unit V: Chapter 4: Sec 6(6.1 to 6.5)

REFERENCES

[1] "Complex Analysis",Sarge Lang, AddisionWeslay, 1977.

[2] "Foundations of Complex Analysis", S.Ponnusamy, ,Narasa Publishing Hourse,New Delhi,1977

[3] "Complex Analysis", V.Karunakaran,.

CORE COURSE:8 M.Sc., MATHEMATICS SEM:II CODE:P2RMTCC8

TOPOLOGY

Objectives:

- The course will develop and understanding of Topological spaces including connectedness and compacteness.
- To study the continuous functions on the topological spaces and study their homeomorphisms.
- Compactness is a topological invariant. Tychonoff theorem states that the product of any collection of compact spaces.
- Uryshonmetrization theorem states that regular second countable spaces are metrizable.
- Using the Bitopological spaces to develop clear thinking and analyzing capacity for research.

Unit I: Topological Spaces

Topological Spaces – Basis for a Topology – The Order Topology – The Product Topology – The Subspace topology – Closed sets and Limit points.

Unit II: Continuous Functions

Continuous functions – The Product topology – The metric Topology – The metric Topology continued.

Unit III: Connectedness and Compactness

Connected Spaces – connected subspaces of the Real line – Compact spaces – Compact Subspaces of the Real line – Limit Point Compactness.The Tychonoff theorem.

Unit IV: Countability and Separation Axioms

The Countability axioms – The Separation axioms – Normal Spaces – The uryshon lemma- The Uryshonmetrization theorem.

Unit V: Bitopological Separation

Pairwise T_1 and T_2 spaces – Pairwise Regular- Quasi-MetrizableBitopological Spaces- Pairwise normal – Pairwise Completely normal in Bitopological spaces.

Text Books:

[1] " Topology", James R. Munkres, Pearson Education Pvt. Ltd. II Edition. (2002)

[2] "Topology", K. ChandrasekharaRao, Narosa Publishing House, New Delhi (2009).

Unit I: Chapter 2, Sec 12 to 17 [1]

Unit II: Chapter 2, Sec 18 to 21 [1]

Unit III: Chapter 3, Sec 23,24, 26 to 28, Chapter 5, Sec 37 [1]

Unit IV: Chapter 3, Sec 30 to 34 [1]

Unit V: Chapter 11, Sec 11.1 to 11.5 [2]

Reference Books:

1) "Topology", J. Dugunji, Prentice Hall of India, 1966.
2) " Introduction to Topology and Modern Analysis", George F. Simmons, McGraw Hill Book co.,1963.
3) "General Topology" J. L. Kelly, Van Nostrand, Reinhold Co., Newyork, 1955.

ELECTIVE COURSE: EC2 M.SC MATHEMATICS SEM:II CODE:P2RMTEC2

NUMERICAL ANALYSIS

OBJECTIVES

- To understand the concept of transcendental and polynomial equations.
- To know how to use numerical methods to solve ordinary differential equations first and second order.
- To know the techniques of Numerical Differentiation and Numerical Integration.
- To know how to use iterative methods to solve systems of linear equations.
- To understand how to find solution of difference equations, Algebraic and Transcendental equations and Numerical solution of Ordinary differential equations of first order and second order.

Unit I:TRANSCENDENTAL AND POLYNOMIAL EQUATIONS

Iteration Methods Based on Second degree equation - Rate of convergence - Iteration Methods-Methods for Complex Roots-Polynomial equations.

Unit II: EIGEN VALUES AND EIGEN VECTORS

Jacobi Method for Symmetric Matrices - Givens Method for Symmetric Matrices - Rutishauser Method for Arbitrary Matrices - Power Method - Inverse Power Method.

Unit III: INTERPOLATION AND APPROXIMATION

Interpolating Polynomials using Finite Differences -Hermite Interpolations - Piecewise and Spline Interpolation - Bivariate Interpolation-Approximation-least Squares Approximation.

Unit IV: DIFFERENTIATION AND INTEGRATION

Numerical Differentiation - Optimum Choice of Step - Length-Extrapolation methods-Numerical Integration Methods based on interpolation - Methods based on undetermined coefficients-composite Integration Methods-Romberg Integration.

Unit V: O.D.E -- BOUNDARY VALUE PROBLEMS:-

Introduction – Initial Value Problem Method (Shooting Method) - Finite Difference Methods – Finite Difference Methods – Finite Elementary Methods.

TEXT BOOKS:

[1]”Numerical **Methods Scientific and Engineering Computation**”, sixth Edition by *M.K.Jain, Iyengar and R.K.jain*, New Age International (P) Ltd. Reprint- 2012.

Unit I: Chapter :2 Sec:2.4 to 2.8

Unit II: Chapter :3 Sec:3.5 except Pages 128 and 129

Unit III: Chapter:4 Sec:4.4 to 4.9

Unit IV: Chapter:5 Sec:5.2 to 5.4 and 5.6 to 5.10

Unit V: Chapter: 7 Sec:7.1 to 7.4

REFERENCES:

1) S.S.Sastry: “**Introduction methods of Numerical Analysis”**, Prentice Hall of India, New Delhi,(1998).

2) R.L.Burden and J.DouglasFairis: “**Numerical Analysis”**,P.W.S.Kent Publishing company, Bostan(1989),Fourth Edition.

CORE COURSE:9 M.SC MATHEMATICS SEM:III CODE:P3RMTCC9

FLUID DYNAMICS

OBJECTIVES

- To introduce the fundamentals of fluid Dynamics such as kinematics of fluid, incompressible flow and boundary layer flows.
- To discuss of the case of steady motion under conservative body forces and Some Potential Theorems.
- To show where fluid mechanics concepts are common with those of solid Dynamics and indicate some fundamental areas of difference.
- To develop skills in formulating and solving physics problems.
- To introduce viscosity and show what are Newtonian and non-Newtonian fluids.

Unit 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 - Velocity Vector – Local and Particle rates of change – Equations of Continuity – Worked Examples.

Unit II: EQUATIONS OF MOTIONS OF A FLUID

Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary at Two in viscid immiscible fluids – Euler's Equation of a Motion – Bernoulli's Equation – Worked Examples – Discussion of the case of steady motion under conservative body forces – Some Potential Theorems – Some flows involving Axial Symmetry.

Unit III: SOME THREE DIMENSIONAL FLOWS

Introduction – Source, Sinks and Doublets, Images in a rigid infinite plane – Images in Solid spheres – Axi-Symmetric Flows:Stoke's stream function – Some special forms of the stream function for Axi-Symetric irrational motion.

Unit IV: SOME TWO DIMENSIONAL FLOWS

Complex Velocity Potentials For Standard Two – Dimensional Flows – Uniform Stream – Line Sources and Line Sinks – Line Doublets – Line Vortices – Some Worked Examples – Two Dimensional Image System – Milne-Thomson Circle Theorem – Theorem Of Blasius.

Unit V: VISCOUS FLOW

Viscous flow – Some solvable problems in viscous flow – Steady viscous flow in Tubes – Steady viscous flow in Tubes of Uniform cross-section.

TEXT BOOKS

[1] "**Text Book of fluid Dynamics**", by Charlton, CBS Publications, New Delhi.,1985.

Unit I: Chapter :2 Sec: 2.1 to 2.8

Unit II: Chapter: 3 Sec: 3.1 to 3.9

Unit III: Chapter:4 Sec:4.1 to 4.5

Unit IV: Chapter: 5 Sec: 5.5 and 5.9

Unit V: Chapter: 8 Sec: 8.10 and 8.11

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.

3. B.S.Massey, J.W.Smith and A.J.W.Smith, "**Mechanics of Fluids**", Taylor and Francis, New York, 2005

4. P.Orlandi, "**Fluid Flow Phenomena"**, Kluwer, New Yor, 2002.

CORE CORSE :10 M.SC., MATHEMATICS SEM :III CODE: P3RMTCC10

FUNCTIONAL ANALYSIS

Objectives:

- Students will have a firm knowledge of real and complex normal vector spaces, with their geometric and topological properties.
- To understand the definition and fundamental properties of metric spaces, including the ideas of convergence, continuity, completeness, compactness and connectedness;
- To understand the definition and fundamental properties of Hilbert spaces, and bounded linear maps between them;
- How basic concepts of geometry and linear algebra can be generalized to infinite dimensional spaces.
- Successful students will understand the basic principles and techniques of fixed point theory, and will be able to apply these principles in modeling concrete problems from other scientific areas.

Unit I :BANACH SPACES

The definition and some examples – continuation linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N** -The open mapping theorem – The conjugate of an operator. []

Unit II: HILBERT SPACES

The definition and some simples properties - orthogonal complements-orthogonal sets – the conjugate space H*- The adjoint of an operator – self –adjoint operator - normal and unitary operators – projections.

Unit III:FINITE DIMENSIONAL SPECTRAL THEORY

Matrices – Determinants and the spectrum of an operator – The spectral – A survey of the situation.

Unit IV:GENERAL PRELIMINARIES ON BANCH ALGEBRAS

The definition and some examples – Regular and singular elements – Topological divisors of zero – the spectrum – the formula for the spectral radius - the radical and semi – simplicity.

Unit V: THE FIXED POINT THEROMES AND BOOLEAN ALGEBRAS(APPENDICES)

Fixed point theorem – Brouwer's fixed point theorem schauder's fixed point theorem – Picard's theorem – Boolean algebra – Boolean rings – stone's theorem.

TEXT BOOK

[1] "Introduction to topology and modern analysis " by G.F. simmons , McGraw Hill International Edition 1963.

Unit I: Chapter: 9

Unit II: Chapter:10

Unit III: Chapter:11

Unit IV: Chapter: 12

Unit V: Appendices 1 and 3

REFERENCES

1) Walter Rudin, functional analysis, TMH Edition 1974.
2) B.V Linaye, Functional Analysis, Wiley Eastern limited , Bombay , second Edition 1985

CORE COURSE:11 M.SC MATHEMATICS SEM:III CODE:P3RMTCC11

FUZZY MATHEMATICS AND ITS APPLICATIONS

OBJECTIVES:

- *To provide the knowledge of operations on fuzzy sets.*
- *To introduce student in a mathematical field based on the concept of a fuzzy numbers.*
- *To enable the students in developing fuzzy relations.*
- *To study fuzzy models that is applicable to natural science and technical fields.*
- *To know the applications of fuzzy methodology.*

UNIT I: OPERATIONS ON FUZZY SETS

Fuzzy Intersections: t-norms – Fuzzy Unions: t-conorms – Combinations of Operations – Aggregate Operations.

UNIT II: FUZZY ARITHMETIC

Fuzzy Numbers – Linguistic Variables – Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers – Lattice of Fuzzy Numbers – Fuzzy Equations.

UNIT III: FUZZY RELATIONS

Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Ordering Relations – Fuzzy Morphisms – sup-i Compositions of Fuzzy Relations – Inf-ω_I Compositions of Fuzzy Relations.

UNIT IV: CONSTRUCTING FUZZY SETS AND OPERATIONS ON FUZZY SETS

General Discussion – Methods of Construction: An Overview – Direct Methods with One Expert – Direct Methods with Multiple Experts – Indirect Methods with one Expert – Indirect Methods with Multiple Experts - Constructions from Sample Data.

UNIT V: APPLICATIONS

Introduction – Medicine – Economics – Fuzzy Systems and Genetic Algorithms – Fuzzy Regression – Interpersonal Communication – Other Applications.

TEXT BOOK

[1] 'Fuzzy sets and Fuzzy logic', George J.Klir and Bo Yuan, Prentice Hall of India, New Delhi, 1995.

UNIT I : Chapter 3 (Section 3.3 – 3.6)

UNIT II : Chapter 4

UNIT III : Chapter 5 (Section 5.5 – 5.10)

UNIT IV : Chapter 10

UNIT V : Chapter 17

REFERENCES:

(1) 'Fuzzy set theory and its applicationns', Second Edition – H.J.Zimmermann 2013.

(2) 'Fuzzy Logic with Engineering Applications' Timothy J. Ross, McGraw Hill International Editions-1997.

CORE COURSE:12 M.SC MATHEMATICS SEM: III CODE: P3RMTCC12

ADVANCED GRAPH THEORY

Objectives:

- To learn about how Graph Theory and Combinactories developed via a creative organic historical process.
- To understand some applications of Graph Theory to Practical Problems and Branches of Mathematics.
- To practice creative problem solving and improve skills in this area.
- To see the simplicity of Graph Theory and combinactories @ make them ubiquitous.
- To make Graph Theory easier and to be creative in Research fields .

Unit I :Matchings

Matchings – Definitions – examples - Matchings and Coverings in Bipartite Graphs – Perfect Matchings.

Unit II : Edge Colourings, Independent Sets and Cliques

Edge Chromatic Number – Vizing's Theorem – Independent sets – Ramsey's Theorem.

Unit III : Vertex Colourings

Chromatic Number – Brook’s Theorem – Hajo’s Conjecture – Chromatic Polynomials.

Unit IV : Planar Grpahs

Plane and Planar Grpahs – Dual Graphs – Euler’s Formulae – Bridges – Kuratowski’sTheorem – The Five - Colour Theorem – The Four - Colour conjuncture.

Unit V : Directed Graphs

Directed Graphs - Directed Paths - Directed Cycles – Definitions – Examples – Simple Applications.

Text Book:

[1] “Graph Theory with Applications” – J.A. Bondy –U.S.R Murty – The Macmillan Press Ltd.

Unit – I	: Chapter 5	Sec: 5.1 – 5.3 [1]
Unit – II	: Chapter 6	Sec: 6.1 – 6.2 & Chapter 7 Sec: 7.1 – 7.2[1]
Unit – III	: Chapter 8	Sec: 8.1 – 8.4[1]
Unit – IV	: Chapter 9	Sec: 9.1 – 9.6 [1]
Unit – V	: Chapter 10	Sec: 10.1 – 10.3 [1]

Reference Book:

[1] “Graph Theory ” – Harray . F – Addison - Wesley - 1969.

[2] “Graph Theory with Applications to Engineering and Computer” – NarasingaDeo – Prientice Hall of India Pvt. Ltd. – New Delhi - 2000.

ELECTIVE COURES:3 M.SC., MATHEMATICSSEM :III CODE:P3RMTEC3

APPLIED MATHAMATICAL STATISTICS

Objectives:

- To Compute and interpret a correlation coefficient and linear regression analysis

- To understand the relationship between point estimate and interval estimation
- Distinguish the reasons why researchers choose to use either parametric or non-parametric statistics.
- Understand the purpose of analysis of variance
- Compute analysis data generated by functional experiments by using analysis of variance.

Unit I: CORRELATIO AND REGRESSION

Multiple and partial correlation – Yule's Notation – Plane of Regression – Generalization – properties of residuals – variance of the residuals – coefficient of multiple correlation – properties of multiple correlation coefficient of partial correlation.

Unit II: THEORY OF ESTIMATION

Method of estimation – Method of maximum likelihood Estimation - Method of minimum variance – Method of moments – confidence intervals and confidence limits – confidence intervals of large sample.

Unit III: NON-PARAMETRIC METHODS

Introductions - advantages and disadvantages of Non-parametric methods over parametric methods – basic definition – Wald - Wolfowitz Run test – test for randomness – median test – sign test – Mann-Whitney – Wilcoxon U Test.(Related simple problems)

Unit IV: ANALYSIS OF VARIAVCE

Introduction – One way classification – Mathematical Analysis of the model – Two Way classification – Mathematical Analysis of the Model – Analysis of Two-Way classified data with K- Observation per cell.(Related simple problems)

Unit V : FACTORIAL EXPERIMENTS

Factorial experiments – advantage - 2^2 –Factorial Design – Statistical Analysis – Yate's Method - 2^3Factorial Experiment – Statistical Analysis - 2^n Factorial experiment.(Related simple problems)

TEXT BOOKS

[1] " Fundamentals of Mathematical Statistics" by S.C Gupta and V.K Kapoor.

[2]"Fundamentals of Applied Mathematical Statistics" by S.C. Gupta and V.K. Kapoor.

Unit I: Chapter : 10 sec:10.11 to 10.15 [1]

Unit II: Chapter: 15 sec : 15.1 to 15.3, 15.5 and 15.5.1 [1]

Unit III: Chapter:16 sec: 16.8 to 16.8.7 [1]

Unit IV: Chapter: 5 sec: 5.1 to 5.4 [2]

Unit V: Chapter: 16 sec:16.9.1 to 16.9.4 [2]

REFERENCE BOOKS:

1. "Statistics for Management" K. Subramani and A. Santha, Scitech Publications Pvt. Ltd., second edition.
2. " Mathematical Statistics", J.N. Kapur, H.C. Saxena, Chand and co. Publications.

CORE COURSE :13M.SC MATHEMATICS SEM:IVCODE:P4RMTCC13

STOCHASTIC PROCESSES

***OBJECTIVES*:**

- *To understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete-time Markov chains;*
- *To develop skills in building stochastic models using Markov chains and to better understand inventory/production control in light of stochastic models.*
- *To develop an understanding of queuing systems under different configurations and understand notions of long-time behaviour including transience, recurrence, and equilibrium;*
- *To apply these ideas to answer basic questions in several applied situations including genetics, branching processes and random walks.*
- *To develop skills in analyzing and interpreting the results.*

Unit:I:STOCHASTIC PROCESSES

Some notions – Specification of Stochastic processes – Stationary Processes – Markov Chains – Definitions and Examples – Higher Transition Probabilities – Generalization of Independent Bernoulli trails – Sequence of Chain – Dependent trails.

Unit:II:MARKOV CHAINS

Classification of states and chains – Determination of Higher Transition Probabilities – Stability of a Markov system – Reducible Chains – Markov Chains with Continuous state space.

Unit:III:MARKOV PROCESSES WITH DISCRETE STATESPACE

Poisson Processes and their Extensions – Poisson Process and related distribution – Generalization of Poisson Process – Birth and Death process.

Unit:IV: RENEWAL PROCESSES AND THEORY

Renewal Process – Renewal Processes in continuous time – Renewal equation – Stopping time – Wald's equation – Renewal theorem.

Unit:V:**STOCHASTIC PROCESSES IN QUEUING**

Stochastic processes in Queuing - Queuing system – General concepts – The queuing model M/M/1 – Steady state Behaviour – Transient behavior of M/M/1 model.

TEXT BOOK:

[1] J.Medhi, "**Stochastic Processes**", Howard M.Taylor – Second edition, 1994.

Unit I: Chapter 2 – Sec 2.1 to 2.3, Chapter 3 - Sec 3.1 to 3.3

Unit II: Chapter 3 – Sec 3.4 to 3.6, 3.8, 3.9 and 3.11

Unit III: Chapter 4 – Sec 4.1 to 4.4

Unit IV: Chapter 6- Sec 6.1 to 6.5

Unit V: chapter 6 - Sec10.1 to 10.3, omit Sec 10.2.3 and 10.2.3.1

REFERENCES:

1. Samuel Kolri ,howardM.Taylor ,"**A First course in Stochastic Processes"**,Second Edition.
2. Srinivasan and Medha, "**Stochastic Processes"**, N.V Prabhu , Macmillan(NY),

CORE COURSE:14 M.SC MATHEMATICS SEM: IV CODE:P4RMTCC14

ALGEBRA - II

OBJECTIVES:

- *To develop mathematical maturity and ability on fields.*
- *To study algebraic structure of a linear transformation.*
- *To be better diagonalization equipped in Canonical forms of various transformations.*
- *To educate advanced level of finite fields.*

UNIT I - MODULES AND FIELDS

Modules – Extension Fields – The Transcendence of e – Roots of Polynomials.

UNIT II -LINEAR TRANSFORMATIONS

The Algebra of Linear transformations – Characteristic Roots – Matrices.

UNIT III -CANONICAL FORMS

Canonical Forms: Triangular Form – Nilpotent Transformations – A Decomposition of V: Jordan Form.

UNIT IV-LINEAR TRANSFORMATIONS OVER THE FIELD OF COMPLEX NUMBERS

Determinants – Hermitian, Unitary and Normal Transformations.

UNIT V - VECTOR SPACES

Elementary Basic Concepts – Linear Independence and Bases – Dual space – Inner product spaces.

TEXT BOOK:

[1] I.N.Herstein, 'Topics in Algebra', Second Edition, Wiley Eastern Limited-2011.

UNIT I – Chapter 4 (Section 4.5) and Chapter 5 (Section 5.1 – 5.3)

UNIT II –Chapter 6 (Section 6.1 – 6.3)

UNIT III- Chapter 6 (Section 6.4, 6.5 and 6.6)

UNIT IV – Chapter 6 (Section 6.9 and 6.10)

UNIT V – Chapter 4 (Section 4.1 – 4.4)

REFERENCES:

(1) David S.Dummit and Richard M.Foote, 'Abstract Algebra', Wiley and sons, Third edition, 2004.

(2) Serge Lang, 'Algebra' – Revised Third Edition – Springer – Verlag – 2002.

ELECTIVE COURSE: EC4 M. Sc., MATHEMATICS SEM: IV

CODE:P4RMTEC4P

MATLAB

Objectives: To enable the students to

- Apply Computer theory and algorithmic aspects in various situations.
- Design and debug the programs.

- Develop program skills independently themselves.

LIST OF PRACTICALS

1. MATLAB program involving matrix manipulation.

   Sec: 3.7 - 3.10.3 [1], Page: 48 – 68
2. MATLAB program to find Eigen Values and Eigen Vectors

   Sec: 8.1 [2], Page: 371 – 373
3. MATLAB program to solve a system of linear equations using Gauss Jordan method.

   Sec: 2.2.3 [2], Page: 89 – 92
4. MATLAB program to solve a system of linear equations using matrix inversion method.

   Sec: 2.3 [2], Page: 92
5. MATLAB program to solve polynomial equation.

   Sec: 4.1 – 4.4 [1], Page: 81 – 83
6. MATLAB program to draw 2D graphs

   Sec: 6.1 – 6.2.1 [1], Page: 120 – 124
7. MATLAB program to draw 3D graphs

   Sec: 6.8.1 – 6.8.8 [1], Page: 146 – 151
8. MATLAB program to solve an algebraic equation using bisection method.

   Sec: 4.2 [2], Page: 183 – 185
9. MATLAB program to solve an algebraic equation using Newton – Raphson method

   Sec: 4.4[2], Page: 186 – 189
10. MATLAB program to evaluate an integral using trapezoidal rule and Simpson's 1/3 rule.

    Sec: 5.6[2], Page: 226 – 227
11. MATLAB program to solve Euler's Method

    Sec: 6.1[2], Page: 263 – 265
12. MATLAB program to solve RungeKutta Method – Fourth order

    Sec: 6.3[2], Page: 267 – 269
13. MATLAB program to solve Constrained optimization

    Sec: 7.3.2[2], Page: 352 – 355
14. MATLAB program to solve Graphical LPP

Sec: 7.3.3[2], Page: 355 – 357

TEXT BOOKS:

[1] **"MATLAB and Its Applications in Engineering"**

By Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma.

Dorling Kindersely(India) Pvt. Ltd.,

[2] **"APPLIED NUMERICAL METHODS USING MATLAB"**

By Won Young Yang, Wenwu Cao, Tae – Sang Chung, John Morris,

A John Wiley and sons Inc Publications