PG – Mathematics

SEMESTER I
CC I – ALGEBRA

Internal : 25 **Subject Code: PMA**
External : 75 **Exam Hour : 3**

Objectives

1. To give foundation in Algebraic structures like Groups ,Rings
2. To train the students in problem solving in Algebra

UNIT – I

Another Counting principle , Sylow's theorem. (Sec 2.11 & 2.12)

UNIT – II

Polynomial rings – Polynomial rings over rational field – Polynomial rings over Commutative rings. (Sec 3,9 , 3.10 & 3.11)

UNIT – III

Dual spaces – Modules. (Sec 4.3 & 4.5)

UNIT – IV

Extension fields – Roots of polynomials – More about Polynomials. (Sec 5.1 , 5.3 & 5.5)

UNIT – V

The Elements of Galois theory- Finite fields. (Sec 5.6 & 7.1)

TEXT BOOK :

I.N. Herstein – Topics in Algebra (Second edition) – John Wiley & Sons.

REFERENCES:

Modern Algebra - Surjith Singh and Quazi Zamarudin.
Modern Algebra - A.R. Vasistha.

SEMESTER I
CC II – REAL ANALYSIS

Internal : 25 **Subject Code: PMB**
External : 75 **Exam Hours : 3**

Objectives:

1. To give the students a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.
2. To train the students in problem-solving as a preparatory for competitive exams

UNIT – I

Basic Topology – Metric spaces – Compact sets – Perfect sets – Connected sets.(Sec 2.15 – 2.47)

UNIT – II

The Reimann Stieltjes integral – Definition and Existence of the integral – Properties of the integral – Integration and Differentitation.Rectifiable Curves. (Sec 6.1 – 6.21)

UNIT – III

Sequences and Series of functions – Uniform convergence – Uniform convergence and continuity – Uniform convergence and integration – Uniform convergence and Differentiation.
(Sec 7.7 – 7.18)

UNIT – IV

Some Special Functions – Power Series – The Exponential and Logarithmic functions – Trigonometric functions – The Algebraic Completeness of the complex field – Fourier Series.
(Sec 8.1 – 8.16)

UNIT – V

The Lebesgue Theory – Set functions – Construction of the Lebesgue **Measure** – Measure spaces – Measurable Functions – Simple functions – Integration . (Sec 11.1 – 11.32)

TEXT BOOK :

" Principles of Mathematical Analysis " by Walter Rudin , Third Edition , McGraw Hill.

REFERENCES :

1.Elements of Real Analysis by K.C. Sharma and G.N.Purohit , Ramesh Book Depot, Jaipur.
2.Tom. M.Apostol , Mathematical Analysis , Second Edition , Narosa Publishing House – 1974.

SEMESTER I

CC III - DIFFERENTIAL GEOMETRY AND TENSORS

Internal : 25 **Subject Code: PMC**

External : 75 **Exam Hours : 3**

Objectives

1. To introduce the notion of surfaces and their properties.
2. To study geodesics and differential geometry of surfaces.

DIFFERENTIAL GEOMETRY

UNIT I

Theory of space curve- Arclength-Tangent and Osculating plane Principal normal and binormal curvature and Torsion-Behaviour of a curve near one of its points-Osculating circle and Osculating sphere. (Section: 1.4 – 1.8, and 1.11)

UNIT II

First fundamental form and Local intrinsic properties of a surface- Introduction –definition of a surface-Nature of points on a surface –Corves on surfaces-Tangent plane and surface normal-The general surfaces of revolution-Helicoids-Metric on a surface-First fundamental form. (Section:2.1 – 2.3 and 2.5-2.9)

UNIT III

The Fundamental Equations of surface theory- Introduction-Tensor notations-Gauss equations-Weingarten equations-Mounardi Codazzi equations.(Section:5.1 – 5.5)

TENSORS :

UNIT IV

Tensor Theory – Scope of Tensor Analysis, Invariance, Transformations of co-ordinates, Properties of Admissible Transformations of Co-ordinates Transformation by invariance, Transformation by Covariance and contravariance, The Tensor concept, contravariant and covariant Tensors, Tensor character of covariant and contravariant laws, Algebra of tensors, Quotient laws, Symmetric and Skew symmetric tensors, Relative Tensors.

UNIT V

Christoffel's Symbols-Transformation of Christoffel's symbols, covariant Differentiation of Tensors, Formulas for Covariant Differentiation, Ricci's Theorem, Riemann Christoffel Tensor, Properties of Riemann – Christoffel Tensors, Ricci Tensor, Bianchi Identities- Eienstein Tensor.

TEXT BOOKS :

For Unit I, II & III **:**Differential Geometry A First Course – D.Somasundaram–Narosa Publishing House Pvt limited.

For Unit IV & V **:** Tensor Analysis – Theory and Applications to Geometry and Mechanics of continuor – I.S. Sokolrikoff (Second Edition) – John Wiley & Sons, Inc.

REFERENCES:

1. Three dimensional Differential geometry – Bansilal & Sanjay Arora, ATMA Ram & Sons, Booksellers and Publishers, New Delhi.
2. Differential Geometry – Nirmala Prakash, Tata McGraw-hill, New Delhi.
3. Mathematical Physics – Satya Prakash, Sultan Chand & Sons, New Delhi.

SEMESTER I

CC IV - ORDINARY DIFFERENTIAL EQUATIONS

Internal : 25 **Subject Code:** PMD
External : 75 **Exam Hours : 3**

Objectives

1. To give an in-depth knowledge of differential equations and their applications.
2. To study the existence, uniqueness, stability behavior of the solutions of the ODE

UNIT I

The general solution of the homogeneous equation– The use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series– Series solutions of first order equations – Second order linear equations; Ordinary points. Chapter 3: Sections 15, 16, 19 and Chapter5: Sections 25 to 27

UNIT II

Regular Singular Points – Gauss's hypergeometric equation – The Point at infinity -
Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions. Chapter 5 : Sections 28 to 31 and Chapter6: Sections 32 to 35

UNIT III

Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.
Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56

UNIT IV

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions
– Sturm Comparison Theorems – Eigenvalues,Eigenfunctions and the Vibrating String.
Chapter 4: Sections 22 to 24

UNIT V

Nonlinear equations: Autonomous Systems; the phase plane and its phenomena – Types of critical points; Stability – critical points and stability for linear systems – Stability by Liapunov's direct method – Simple critical points of nonlinear systems.
Chapter 8: Sections 42 to 44

TEXT BOOKS

G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH,
New Delhi, 1984.

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.

SEMESTER I
EC I – ADVANCED GRAPH THEORY

Internal : 25 **Subject Code: PME1**
External : 75 **Exam Hours : 3**

Objectives
1.To give a rigorous study of the basic concepts of Graph Theory.
2.To study the applications of Graph Theory in other disciplines.
Note: Theorems, Propositions and results which are starred are to be omitted.

Unit I

Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness- Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.
Chapter I & II: 1.1 to 1.4, 1.7, 2.1,2.2

Unit II

Connectivity Vertex Cuts and Edge Cuts - Connectivity and Edge -Connectivity, Trees: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.
Chapter III & IV: 3.1, 3.2, 4.1, 4.3 to 4.4

Unit III

Independent Sets and Matchings Vertex Independent Sets and Vertex Coverings - Edge
Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.
Chapter V & VI: 5.1 to 5.4, 6.1, 6.2

Unit IV

Graph Colourings Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials. Chapter VII: 7.1 to 7.4, 7.7

Unit V

Planarity Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem. Chapter VIII: 8.1 to 8.6

TEXTBOOK

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.

SEMESTER II

CC V - COMPLEX ANALYSIS

Internal : 25 **Subject Code: PME**

External : 75 **Exam Hours : 3**

Objectives

1. To learn the various intrinsic concepts and the theory of Complex Analysis.
2. To study the concept of Analyticity, Complex Integration and Infinite Products in depth.

UNIT – I :

Line integrals –Rectifiable arcs- Line integrals as function of arc- – Cauchy's theorem for a rectangle – Cauchy's theorem in a Disc- Higher derivatives. (Chap – 4 : Sec 1.3– 1.5, 2.3)

UNIT – II :

Removable singularities - Taylor's theorem – Zeros and poles- Chains and cycles- Simple connectivity- Homology - The general statement of Cauchy's theorem – Proof of cauchy's theorem. (Chap – 4 : Sec 3.1,3.2,4.1-4.5)

UNIT – III :

Harmonic functions: Definition and basic property- The mean value property- Poission formula- Schwart's theorem-The Reflection principle. Chap – 4 : Sec 6.1-6.5)

UNIT – IV :

The Weierstrass theorem—The Taylors series-— Partial fractions - Infinite products - Canonical Products. (Chap – 5 : Sec 1.1 -1.2, 2.1-2.3)

UNIT – V :

Gamma function-Stirlings formula-Jensen's formula-Hadamard's theorem. (Chap – 5 : Sec 2.42.5,3.1,3.2)

TEXT BOOK:

Lars.V. Ahlfors By "Complex Analysis", Third Edition-Mc Graw Hill International 1979.

REFERENCES:

1. Complex Analysis by P. Duraipandian
2. Complex Analysis by G.C. Sharma.
3. Complex Analysis by Arumugam, Isaac, Somasundaram

SEMESTER II
CC VI– TOPOLOGY

Internal : 25 **Subject Code: PMF**
External : 75 **Exam Hours : 3**

Objectives

1. To study the concepts concerned with properties that are preserved under continuous deformations of objects.
2. To train the students to develop analytical thinking and the study of continuity and connectivity.

UNIT – I :

Topological spaces – basis for a topology – the order topology – Product topology of XxY – The subspace topology –Closed sets & Limit points – Continuous Functions. (Chapter II: sections 2.1 to 2.7)

UNIT – II :

The product topology – Metric topology - Connected spaces – Connected sets in the real line – Compact spaces. (Chapter II: sections 2.7 to 2.9, Chapter III: sections 3.1, 3.2 and 3.5)

UNIT – III :

The countability axioms – The separation axioms – the Urysohn's lemma – Urysohn's Metrization Theorem. (Chapter IV: sections 4.1 to 4.4)

UNIT – IV

The Tychonoff theorem – Completely Regular Spaces – The Stone – Cech – Compactification. (Chapter V: sections 5.1 – 5.3)

UNIT – V :

Complete Metric spaces – Compactness in Metric spaces (Chapter VII: sections 7.1 & 7.3)

TEXT BOOK:

"Topology , A First course" by James R. Munkress Prentice-Hall of India (P) Ltd. New Delhi, 1988.

REFERENCE:

1. Topology by R.S. Agarwal
2. Introduction to topology by M.L. Khanna.

SEMESTER II
CC VII - PARTIAL DIFFERENTIAL EQUATIONS

Internal : 25 **Subject Code: PMG**
External : 75 **Exam Hours : 3**

Objectives

1. To give an in-depth knowledge of solving partial differential equations and apply them in scientific and engineering problems.
2. To study the other aspects of PDE

UNIT I

Partial differential equations- origins of first or der Partial differential equations- Cauchy's problem for first order equations- Linear equations of the first order- Integral surfaces Passing through a Given curve- surfaces Orthogonal to a given system of surfaces -Non linear Partial differential equations of the first order. (Chapter II Sections 1 to 7)

UNIT II

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. (Chapter II Sections 8 to 13)

UNIT III

Partial differential equations of the second order: The origin of second order equations –second order equations in Physics – Higher order equations in Physics - Linear partial differential equations with constant co-efficient- Equations with variable coefficients- Characteristic curves of second order equations.(Chapter III Sections 1 to 6)

UNIT IV

Characteristics of equations in three variables- The solution of Linear Hyperbolic equations-Separation of variables. The method of Integral Transforms – Non Linear equations of the second order. (Chapter III Sections 7 to 11)

Unit V

Laplace equation : Elementary solutions of Laplace's equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables –Problems with Axial Symmetry. (Chapter IV Sections 2 to 6)

TEXT BOOK

Ian N. Sneddon,Elements of Partial differential equations,Dover Publication – INC, New York, 2006.

REFERENCES

1. M.D.Raisinghania, Advanced Differential Equations , S.Chand and com
pany Ltd., New Delhi,2001.
2.E.T.Copson,Partial Differential Equations, Cambridge University Press

SEMESTER II
CC VIII - FLUID DYNAMICS

Internal : 25 **Subject Code: PMH**
External : 75 **Exam Hours : 3**

Objectives

1. To give the students an introduction to the behaviour of fluids in motion.
2. To give the students a feel of the applications of Complex Analysis in the analysis of the flow of liquids.

UNIT – I:

Real fluids and Ideal Fluids – Velocity of a Fluid at a point – Streamlines and Path lines; Steady and Unsteady Flows – Velocity potential – Vorticity vector – Local and Particle Rates of Change – Equation of continuity – Worked examples – Acceleration of a Fluid (2.1 to 2.9)

UNIT – II:

Pressure at a point in a Fluid at Rest-Pressure at a point in Moving Fluid – Conditions at a Boundary of Two Invisid Immiscible Fluids – Euler's equation of motion – Bernoulli's equation – worked examples (3.1 – 3.6) Introduction – Sources, Sinks and Doublets – Axi-Symmetric Flows: Stokes stream function (4.1, 4.2 & 4.5)

UNIT – III :

Meaning of Two-Dimensional Flow – Use of cylindrical Polar coordinates – stream function – complex potential for Two-Dimensional, Irrotational Incompressible Flow – complex velocity potentials for Standard Two-Dimensional Flows- Some worked examples – Milne-Thomson circle theorem and applications. (5.1-5.6, 5.8)

UNIT – IV :

Theorem of Blasius - Stress components in Real fluid – relation between Cartesian-components of stress – Translational Motion of Fluid Element – Rate of Strain Quadric and Principal Stresses – some further properties of the rate of strain quadric – stress analysis in fluid motion – relations between stress and rate of strain – coefficient of viscosity and laminar flow (5.9 & 8.1-8.8)

UNIT – V :

The Navier – Stokes equations of Motion of a Viscous Fluid - Some solvable problems in viscous flow – steady viscous flow in tubes of uniform cross section – diffusion of vorticity – energy dissipation due to viscosity (8.9 -8.13)

TEXT BOOK :

Content and Treatment as in "Text Book of Fluid Dynamics" by F. Chorlton (CBS Publisher & Distributors, Delhi-110 002).

REFERENCE: "Fluid Dynamics" by Goel and Gupta.

SEMESTER II

EC II – FUZZY SETS AND ITS APPLICATIONS

Internal : 25 **Subject Code: PME2**
External : 75 **Exam Hours : 3**

Objectives:

1. To introduce the concept of fuzzy theory and study its application in real problems
2. To study the uncertainty environment through the fuzzy sets that incorporates imprecision and subjectivity into the model formulation and solution process.

UNIT I

From Classical Sets To Fuzzy Sets, Fuzzy Sets Verses Crisp Sets:

Fuzzy sets: Basic types – Fuzzy sets: Basic Concepts –Additional Properties of α – cuts-

Extension Principle for fuzzy sets.(Chapter 1 Sections 1.3, 1.4, Chapter :2 Sections 2.1 and 2.3)

. **UNIT II**

Operations On Fuzzy Sets: Types of operations– Fuzzy complements- Fuzzy Inter sections: t-Norms – Fuzzy Unions: t-Conorms - Combinations of Operations .(Chapter 3 Sections 3.1, 3.2, 3.3, 3.4, 3.5).

.

UNIT III

Fuzzy Arithmetic: Fuzzy numbers - Linguistic variables -Arithmetic operations on

intervals –Arithmetic operations on Fuzzynumbers.(Chapter 4 Sections 4.1,4.2, 4.3, 4.4.)

UNIT IV

Fuzzy Relations: Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy

Equivalence Relations – Fuzzy Compatibility Relations –Fuzzy Ordering Relations –

Fuzzy Morphisms(.Chapter 5 Sections 5.3 ,5.4, 5.5, 5.6, 5.7, 5.8.)

UNIT V

Fuzzy Decision Making: Individual decision making – Multiperson Decision Making-

Ranking methods – Fuzzy Linear programming.(Chapter15Sections 15.2,15.3, 15.6, 15.7)

TEXT BOOK

George J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic Theory and Applications,
Prentice Hall of India, (2005).

REFERENCES

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited (1991).
2. M. Ganesh, Introduction to Fuzzy sets and Fuzzy logic, Prentice Hall of India, New Delhi (2006).

SEMESTER III
CC IX - MEASURE THEORY

Internal : 25 **Subject Code : PMI**
External : 75 **Exam Hours : 3**

Objectives

1. To generalize the concept of integration using measures.
2. To develop the concept o f analysis in abstract situations.

UNIT I

Measure on Real line - Lebesgue outer measure - Measurable sets - Regularity - Measurable function - Borel and Lebesgue measurability.
UNIT – I Chapter II: Sections 2.1 to 2.5

UNIT II

Integration of non-negative functions - The General integral - Integration of series -
Riemann and Lebesgue integrals.
Chapter III: Sections 3.1 to 3.4

UNIT III

Abstract Measure spaces - Measures and outer measures - Completion of a measure -
Measure spaces - Integration with respect to a measure.
Chapter V: Sections 5.1 to 5.6

UNIT IV

Convergence in Measure- Almost uniform convergence-Signed Measures and Halin
Decomposition –The Jordan Decomposition
Chapter VII: Sections 7.1 and 7.2, Chapter VIII: Sections 8.1 and 8.2

UNIT V

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

TEXT BOOKS

1. G.De Barra, Measure Theory and Integration, New age international (p) Limited.

SEMESTER III
CC X- CLASSICAL DYNAMICS

Internal : 25 **Subject Code : PMJ**
External : 75 **Exam Hours : 3**

Objectives

1. To give a detailed knowledge of the mechanical system of particles.
2. To study the applications of Lagrange's and Hamilton's equations

UNIT – I :

Introductory concepts: The Mechanical System – Generalised Co-ordinates – Constraints – Virtual Work – Energy & Momentum. (Chapter:1 Sec 1.1 to 1.5.)

UNIT – II :

Lagrange's Equations: Derivation of Lagrange's Equations – Examples – Integrals of the Motion. (Chapter:2 Sec 2.1 to 2.3)

UNIT – III :

Special Applications of Lagrange's Equations: Rayleigh's Dissipation function – Impulsive Motion – Gyroscopic Systems – Velocity – Dependent Potentials. (Chapter:3 Sec 3.1 to 3.4)

UNIT – IV :

Hamilton's Equations: Hamilton's Principle – Hamilton's Equations – Other Variational Principles. (Chapter:4 Sec 4.1 to 4.3)

UNIT – V :

Hamilton - Jacobi Theory : Hamilton's Principle function – The Hamilton - Jacobi Equation – Separability. (Chapter:5 Sec 5.1 to 5.3)

Text Book:

Classical Dynamics, Donald T.Greenwood, PHI Pvt Ltd.,New Delhi – 1985.

Reference Books:

Classical Mechanics – Gupta, Kumar & Sharma, Pragathi Prakashan, Meerut.

Classical Mechanics – Herbert Goldstein, Narosa Publishing House,New Delhi.

SEMESTER III

CC XI - INTEGRAL EQUATIONS AND TRANSFORMS

Internal : 25 **Subject Code: PMK**
External : 75 **Exam Hours : 3**

Objectives.

1. To introduce the concept of calculus of variations and integral equations and their applications.
2. To study the different types of transforms and their properties.

UNIT – I

Linear integral Equations – Definition Regularity conditions – Special kind of kernels – Eigen values and Eigen functions – convolution integral – the inner of scalar product of two functions – Notation – Reduction to a system of Algebraic equations – Equations – Fredholm alternative – examples.

(27 hours)

UNIT – II

An approximate method – Method of successive Approximations Iterative scheme - examples – Volterra Integral Equation – examples – Some results about the resolvent kernel.

(27 hours)

UNIT – III

Fourier Transform – Integral formula complex transform – cosine – sine transform – Property – linearity , Change of scale , shifting – modulation theorem – convolution theorem – problems.

(27 hours)

UNIT – IV

Finite fourier transform – operator property – combined property. (27 hours)

UNIT – V

Application of Fourier transform in initial and boundary value problems – applications of infinite Fourier transform – Choice of sine or cosine – Finite Fourier transform of partial derivatives – Choice of finite sine and cosine transforms.

(27 hours)

TEXT BOOK:

1. Ram P. Kanwal – Linear Integral Equations Theory and Practice Academic press 1971. Chapters 1 , 2 , 3.
2. Integral transforms – A.R. Vasista and R.K. Gupta Krishna Pragasam Publications.

SEMESTER III
CC XII - MATHEMATICAL MODELLING

Internal : 25 **Subject Code:PML**
External : 75 **Exam Hours : 3**

Objectives:
1.To study the different mathematical models in ODE and Difference equations.
2.To study graph theoretical models.

UNIT 1 ;

Mathematical modelling through ordinary Differential Equations of first order: Mathematical modelling through differential Equations – Linear growth and Decay models – Non - Linear growth and Decay models – Compartment Models – Mathematical modelling in Dynamics through ordinary differential equations of first order . (Chapter 2 : 2.1 to 2.5)

UNIT 2

Mathematical modelling through systems of ordinary Differential Equations of first order: Mathematical modelling in population Dynamics – Mathematical modelling of epidemics through systems of ordinary Differential Equations – Mathematical modelling in Economics through systems of ordinary Differential Equations of first order - mathematical models in Medicine , Arms Race , Battles and International Trade in Terms of systems of ordinary Differential Equations. (Chapter 3 : 3.1 to 3.5)

UNIT 3 :

Mathematical modelling through ordinary Differential Equations of Second Order: Mathematical modelling of planetary motions – Mathematical modelling of circular motion and motions of satellites – Mathematical modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models Through Ordinary Differential Equations of the second Order; (Chapter 4 : 4.1 to 4.4)

UNIT 4:

Mathematical modelling through Difference Equation: The need For Mathematical Modelling Through Difference Equations : some simple models – Basic Theory of Linear Difference Equations with constant Coefficients – Mathematical Modelling Through Difference Equations in Economics and Finance – Mathematical Modelling through Difference Equations in Population Dynamics and Genetics – Mathematical modelling through Difference Equations in Probability Theory. (Chapter 5 : 5.1 to 5.5)

UNIT 5: Mathematical modelling through Graphs : Situations that can be modelled through Graphs – Mathematical models in terms of directed Graphs – Mathematical Models in terms of signed Graphs – Mathematical modelling in terms of Weighted Digraphs – mathematical modelling in terms of unoriented Graphs. (Chapter 7 : 7.1 to 7.5)

Text Book:

1. **"Mathematical Modelling**" by J.N. Kapur New Age International (P) Limited , Chennai.

SEMESTER III

EC III - OPTIMIZATION TECHNIQUES

Internal : 25 **Subject Code : PME3**

External : 75 **Exam Hours : 3**

Objectives:

1. To enlighten the students in the field of operations research.
2. To help the students to apply OR techniques in business and management problems.

UNIT I :

Integer Linear Programming : Illustrative Applications of Integer Programming – Solution methods of Integer Programming – Branch and Bound Method – Cutting Plane Method – Zero – One Integer Problem.. Chapter 9 : Sections 9.1 to 9.5 (18 Hours)

UNIT II :

Dynamic (Multistage) Programming : Elements of the DP Model: The Capital Budgeting Example – More on the Definition of the State – Examples of DP Models and Computations – Problem of Dimensionality in Dynamic Programming – Solution of Linear Programs by Dynamic Programming. Chapter 10 : Sections 10.1 to 10.5 (18 Hours)

UNIT III :

Inventory Models: The ABC Inventory System – A Generalized Inventory Model – Deterministic Models. Chapter 14 : Sections 14.1 to 14.3 (18 Hours)

UNIT IV :

Queueing Models : Basic Elements of the Queueing Model – Role of the Poisson and Exponential Distributions – Pure Birth and Pure Death Processes – Queues with Combined Arrivals and Departures – Specialized Poisson Queues. Chapter 15 : Sections 15.1 to 15.5.4.

(18 Hours)

UNIT V :

Nonlinear Programming Algorithms : Unconstrained Nonlinear Algorithms. Chapter 20 : Section 20.1 (18 Hours)

Text Book:

"Operations Research" by Hamdy A. Taha , Fifth Edition , Prentice hall of Ind

SEMESTER IV
- CORE COURSE XIII - FUNCTIONAL ANALYSIS

Internal : 25 **Subject CodE: PMM**
External : 75 **Exam Hours: 3**

Objectives

1. To study the three structure theorems of Functional Analysis viz., Hahn-Banach theorem, Open mapping theorem and Uniform boundedness principle.
2. To introduce Hilbert spaces and operator theory leading to the spectral theory of operators on a Hilbert space.

UNIT – I :

The definition and some examples – Continuos linear transformations – The Hahn-Banch theorem – The natural imbedding of N in N**. (Chapter – 9: Sections 46, 47, 48 & 49 only)

UNIT – II:

The definition and some simple properties – Orthogonal complements – Orthonormal sets – The conjugate space H*. (Chapter – 10: Sections 52, 53, 54 &55 only)

UNIT – III :

The open mapping theorem – The conjugate of an operator – The adjoint of an operator – The self-adjoint operators – Normal & unitary operators Projections.

(Chapter – 9: Sections 50 & 51 only; Chapter – 10: Sections 56, 57, 58 & 59 only)

UNIT – IV :

Matrices – Determinants and the spectrum of an operator – The spectral theorem – A survey of the situation. (Chapter – 11)

UNIT – V :

The definition & some examples – Regular and singular elements – Topological divisor of zero – The spectrum – Formula for the spectral radius – The radical & semi-simplicity. **(**Chapter -12)

TEXT BOOK:

SIMMONS, G.F., "Introduction to topology &Modern Analysis" Mc Graw Hill, ISE

REFERENCES:

1. Functional Analysis – Limaye, 2nd edition
2. Functional Analysis – M.L. Khanna.

SEMESTER IV
CC XIV - PROBABILITY THEORY

Internal : 25 **Subject Code: PMN**
External : 75 **Exam Hours : 3**

Objectives:

1. To make the students to understand about fields, σ -fields and random variables.
2. To enable the students to learn about expectations, convergence in random variables and distribution functions.

UNIT-I :

Axioms Of Probability – sample space and events – Axioms of probability – some propositions – equally likely outcomes – probability as a continuous set function – probability as a measure of belief. Chapters II (full)

UNIT-II:

Conditional Probability and Independence – Conditional probabilities – Baye's formula – Independent events – P(.IF) is a probability Chapter III (full)

UNIT – III :

Random variables – Distribution functions – Discrete random variables – Expected value – Expectation of a function of random variable – Variance – Bernoulli and Binomial random variables. Chapter IV: sections 4.1 to 4.6

UNIT IV:

Continuous random variables – Expectation and variance of continuous random variables – The uniform and normal random variables – Exponential random variables – Other Continuous Distribution. Chapter V: section 5.2 to 5.6

UNIT V:

Jointly Distributed Random Variables – Joint distribution functions – Independent random variables – Their sums – Conditional distributions Chapter VI: section 6.1 to 6.5

TEXT BOOK: A first course in probability by Sheldon Ross – Maxwell MacMillan international edition – fifth edition – Newyork (1989).

REFERENCE BOOK:

Probability – An introduction by Geoffery Grimmell and Domenic Welsh – Oxford University Press (1986)

SEMESTER IV

EC IV – ADVANCED NUMERICAL ANALYSIS

Internal : 25 **Subject Code:PME4**
External : 75 **Exam Hours : 3**

Objectives.

1.To know the theory behind various numerical methods.
2.To apply these methods to solve mathematical problems.

UNIT I :

Transcendental And Polynomial Equations : Introduction – Bisection Method – Iteration Methods Based on First Degree Equation – Iteration Methods Based on Second Degree Equation – Rate of Convergence – Polynomial Equations.

UNIT II :

System of Linear Algebraic Equations And Eigenvalue Problems : Successive over Relaxation (SOR) Method – Iterative Method of A^{-1} - Eigenvalues and Eigenvectors : Jacobi Method for Symmetric Matrices – Givens Method for Symmetric Matrices – Power Method .

UNIT III :

Interpolation and Approximation : Higher order Interpolation - Hermite Interpolations – Bivariate Interpolation – Least Squares Approximation .

UNIT IV :

Differentiation And Integration : Methods Based on Interpolation – Methods Based on Finite Differences – Extrapolation Methods – Partial differentiation – Numerical Integration – Methods Based on Interpolation – Newton – Cotes Methods – Methods Based on Undetermined Coefficients – Gauss Legendre Integration Methods – Lobatto Integration Methods – Radau Integration Methods – Gauss – Chebyshev Integration Methods - Composite Integration Methods .

UNIT V :

Ordinary Differential Equations: Numerical Methods – Euler Method – Backward Euler Method – Mid – Point Method – Taylor Series Method – Runge – Kutta Methods – Implicit Runge – Kutta Methods – Multistep Methods – Convergence of Multistep Methods.

TEXT BOOK :

M.K.Jain , S.R.K. Iyengar and R.K. Jain , Numerical Methods for Scientific and Engineering Computation , Third Edition , New Age International (P) Limited , New Delhi.

REFERENCES

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac MilanPress Ltd., 1976.
2. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph,CRC press,2010.
3. F.Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969

SEMESTER – IV
EC V - FINANCIAL MATHEMATICS

Internal : 25 **Subject Code : PME5**
External : 75 **Exam Hours : 3**

UNIT – I

Simple Interest - The Time between Dates - Equations of Value- Partial Payments - Simple Discount -Accumulated Value - Equivalent Rates – Discount Value – Accumulated and Discounted Values for Fractional Interest Periods.(**Chapter – 3, Sections 3.1 – 3.5, Chapter – 4, Sections 4.1 – 4.4)**

UNIT – II

Definitions and Notation – Accumulated Value of an Ordinary Simple Annuity – Discounted Value of an Ordinary Simple Annuity – Other Simple Annuitie.(**Chapter – 5 , Sections 5.1 – 5.4)**

UNIT – III

Amortization of a Debt – Outstanding Principal – Mortgages – Refinancing a Loan – Sinking Funds – Comparison of Amortization and sinking – Fund Methods.(**Chapter – 7 , Sections 7.1 – 7.6)**

UNIT – IV

Introduction and Terminology – Purchase Price to Yield a Given Investment Rate – Callable Bonds – Premium and Discount – Price of a Bond Between Bond Interest Dates – Finding the Yield Rate – Other Types of Bonds.(**Chapter – 8 , Sections 8.1 – 8.7)**

UNIT – V

Net Present Value – Internal Rate of Return – Capitalized Cost and Capital Budgeting – Depreciation (Up to the sum of Digit Method).(**Chapter – 9, Sections 9.1 – 9.4)**

Text Book

"Theory and Problems of Mathematics and Finance" by Peter Zima and Robert L.Brown, Second edition Tata McGraw – Hill Publishing Company Ltd., NewDelhi