SEMESTER – I ALGEBRA – I - PMT701

Objectives

To introduce the concepts and to develop working knowledge on class equation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms

Unit-I   **[18 HRS]**

Another counting principle [Chapters: 2.5, 2.8, and 2.11].

Chapter 2: Sections 2.11 [Omit Lemma 2.1,2.5]

 Unit-II   **[18 HRS]**

Sylow's Theorem

Chapter 2:12

Unit-III   **[18 HRS]**

Direct Products, Finite Abelian groups, Modules.

Chapters: 2.13, 2.14,   4.5

Unit-IV

Canonical Forms: Triangular forms, Nilpotent Transformations, A Decomposition of V, Jordan form

Chapter: 6.4, 6.5, 6.6   **[18 HRS]**

Unit-V

Rational Canonical Form, Trace and Transpose, **Chapter: 6.7, 6.8,**

Text Book

1. I.N. Herstein. Topics in *Algebra* [II Edition] Wiley Eastern Limited; New Delhi; 1975.

Reference Books

1. MArtin, *Algebra*, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.NagpauI, *Basic Abstract Algebra [II Edition]* Cambridge University Press, 1997. [Indian Edition]
3. I.SIuther and I.B.S.Passi, *Algebra,* Vol. 1 -Groups[1996]; Vol. II Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.MaIik7 J.N. Mordeson and M.K.Sen, *Fundamental of Abstract Aigebra,* McGraw Hill [International Edition], New York. 3997.
5. N.Jacobson, *Basic Algebra*, Vol. I & II W.H.Freeman; also published by Hindustan Publishing Company, New Delhi, 1980.

SEMESTER – I   REAL ANALYSIS   - PMT702S

Unit-I : Functions Of Bounded Variation: Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. **Chapter - 6: Sections 6.1 to 6.8**   [18 HRS]

Unit-II : The Riemann - Stieltjes Integral: Introduction - Notation - The definition of the Riemann - Stieltjes integral -Linear Properties - Integration by parts- Change of variable in a Riemann -Stieftjes integral - Reduction to a Riemann Integral - Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals -Additive and linearity properties of upper and lower integrals - Riemann's condition - Comparison theorems. **Chapter - 7; Sections 7.1 to 7.14**   [18 HRS]

Unit-III: The Riemann-Stieltjes Integral: Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of Riemann-Stieitjes integrals- Mean value theorems for Riemann - Stieltjes integrals - The integrals as a function of the interval - Second fundamental theorem of integral calculus-Change of variable in a Riemann integral-Second Mean Value Theorem for Riemann integral. **Chapter - 7: 7.15 to 7.22**   [18 HRS]

Unit -IV : Infinite Series : Infinite Series : Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series.

Double sequences - Double'series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series - Cesaro summability.

Chapter - 8 Sections 8.8, 8.15, 8.17, 8.18, 8.20, 8.21 to 8.26   [18 HRS]

Unit-V: Sequences of Functions: Point-wise convergence of sequences of functions - Examples of sequences of real - valued functions - Definition of uniform convergence - Uniform convergence and continuity - The Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions -Uniform convergence and Riemann - Stieltjes integration - Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series -Mean convergence. **Chapter - 9 Sec 9.1 to 96, 9.8,99, 910,911, 9.13**[18 HRS]

Text Book

Tom M.ApostoI *: Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974.

Reference Books

1.   Bartle, R.G. *Real Analysis*, John Wiley and Sons Inc./1976.

2.   Rudin,W, Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 1976.

SEMESTER – I ORDINARY DIFFERENTIAL EQUATIONS - PMT703

Unit-I:

Linear differential equations of higher order: Linear independence-Equations with constant coefficients-Equations with variable coefficients.   **Chapter-2[2.4,2.5,2.6]**   [18 HRS]

Unit-II: Linear differential equations of higher order: Wronskian-Method of variation of parameters- Method of Laplace Transforms.   **Chapter-2[2.7,2.8,2.10]**   [18 HRS]

Unit-III: **System of Linear Differential Equations :** System of first order equations-existence and uniqueness theorem- Fundamental matrix.   **Chapter-4[4.2, 4.4,4.5]**   [18 HRS]

Unit-IV: System of Linear Differential Equations: Non-Homogeneous Linear Systems-Linear systems with constant coefficients. **Chapter-4[4.6, 4.7,]**   [18 HRS]

 Unit-V: **Existence and Uniqueness of solutions :** Lipschit condition and Gronwall inequality-Successive approximations-Picard's theorem-Fixed point Method. **Chapter-5[5.2, 5.3,5.4,5.9]**

[18 HRS]

Text Book:

Contents and Treatment as in "Ordinary Differential Equation" by   S.G.Deo ,

V.Lakshmikantham and V.Raghavendra, Tata McGraw Hill , Second Edition Publishing

company limited.

Books   for Reference:

1. Ordinary Differential Equation by D.Somasundaram,   Narosa Publishing House

2. Advanced Differential Equations by M.D. Raisinghania , S.Chand & Company Ltd.

3. A course in Ordinary Differential Equations by B.Rai, D.P.Choudhury aand

    H.I.Freedman,   Narosa Publishing House, New Dehi,2002.

4. Differential Equations with applications and Historical notes by George F.Simmons, Tata

    McGraw Hill, New Delhi,1974.

5. Ordinary Differential Equations by W.T.Reid , John Wiley and Sons, New York, 1971.

SEMESTER – I CLASSICAL MECHANICS - PMT704S

Objectives

To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Langrange, Hamilton Jacobi and Theory of Relativity due to Einstein.

Unit-I: Mechanical Systems

The Mechanical system - Generalised coordinates - Constraints - Virtual work - Energy and Momentum

Chapter 1: Sections 1.1 to 1.5   [18 HRS]

Unit-II: Lagrange's Equations

Derivation of Lagrange's equations- Examples - Integrals of motion.

Chapter 2: Sections 21 to 23[Omit Section 24]   [18 HRS]

Un1t-III; Hamilton's Equations

Hamilton's Principle - Hamilton's Equation - Other variational principle.

Chapter 4: Sections 4.1 to 43[Omit section 4.4]   [18 HRS]

Unit-IV: Hamilton-Jacobi Theory

Hamilton Principle function - Hamilton-Jacobi Equation – Separability

Chapter 5: Sections 51 to 5.3   [18 HRS]

Unit-V: Canonical Transformation

Differential forms and generating functions - Special Transformations -Lagrange and Poisson brackets.

Chapter 6: Sections 6.1, 6.2 and 63 [omit sections 6.4, 6.5 and 6.6]   [18 HRS]

Text Book

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

Reference Books

1.H.Goldstein, Classical Mechanics, [2nd Edition] Narosa Publishing House; New Delhi.

2.N.CRane and P.S.C.Joag, Classical Mechanics, Tata McGraw Hill, 1991.

3. J.L.Synge and B.A.Griffth, Principies of Mechanics [3rd Edition] McGraw Hill Book Co., New York, 1970.

SEMESTER – I   MATHEMATICAL PROGRAMMING - EPMT705T

Unit-I: Integer Linear Programming: Types of Integer Linear Programming Problems - Concept of Cutting Plane -Gomory's AN Integer Cutting Plane Method - Gomory's mixed Integer Cutting Plane method - Branch and Bound Method. - Zero-One Integer Programming.

Unit-II: Classical Optimization Methods: Dynamic Programming: Characteristics of Dynamic Programming Problem -Developing Optimal Decision Policy - Dynamic Programming Under Certainty - DP approach to solve LPP.

Unit-III: Non-linear Programming Methods: Examples of NLPP - General NLPP - Graphical solution - Quadratic Programming - Wolfe's modified Simplex Methods - Beale's Method.

Unit-IV : Theory Of Simplex Method
Canonical and Standard form of LP - Slack and Surplus Variables -Reduction of any Feasible solution to a Basic Feasible solution - Alternative Optimal solution - Unbounded solution - Optimaiity conditions - Some complications and their resolutions - Degeneracy and its resolution.

Unit-V: Revised Simplex Method
Standard forms for Revised simplex Method - Computational procedure for Standard form I - comparison of simplex method and Revised simplex Method.

Text Book:
J.K.Sharma, Operations Research , Macmillan [India] New Delhi 2001
Unit 1 – Chapte 7 - Sec:7.1 to 7.7
Unit 2 – Chapter 22- Sec: 22.1 to 22.5
Unit 3 - chapter 24 Sec: 24.1 to 24.4
Unit 4- chapter 25 Sec: 25.1 to 25.8
Unit 5 – chapter 26 Sec: 26.1 to 26.4

Reference Books:
1. Hamdy A. Tana, *Operations Research*, [seventh edition] Prentice - Hall of India Private Limited, New Delhi, 1997.
2. F.S. Hillier & J.Lieberman I*ntroduction to Operation Research* [7th Edition] Tata- McGraw Hill company, New Delhi, 2001.
3. 3. Beightler. C, D.Phillips, B. Wilde *foundations of Optimization* [2nd Edition] Prentice Hall Pvt Ltd., New York, 1979
4.S.S. Rao - *Optimization Theory and Applications,* Wiley Eastern Ltd. New Delhi. 1990

SEMESTER – II   ALGEBRA –II - PMT806S

Unit-I

Extension fields (Finite extension, algebraic extension and algebraic number).

Chapter 5: Section 5.1   [18 HRS]

Unit-II

Roots of Polynomials (Reminder theorem, Factor theorem and isomorphism

between F[x] and F'[t]).**Chapter 5: Sections 5.3**   [18 HRS]

Unit-III

More about roots-Elements of Galois theory,

Chapter 5: Section 5.5 and 5.6.[Omit theorem5.6.3]   [18 HRS]

Unit-IV

Solvability by radicals - Wedderburn's theorem on finite division rings.

Section 5.7 [omit Lemma 5.7.1, Lemma 5.7.2 and Theorem 5.7.1]

Chapter 7: Sections 7.2 [Only Theorem 7.2.1]   [18 HRS]

Unit-V

Integral Quaternions and the Four - Square theorem-Division Algebra

Chapter 7: Section 7.3 (omit theorem 7.3.1)[Lemma 7.4.1, 7.4.2&7.4.5 only].

[18 HRS]

Text Book

I.N. Herstein. Topics in Aigebra [II Edition] Wiley Eastern Limited, New Delhi, 1975.

Reference Books.

1.   MArtin, Aigebra, Prentice Hall of India, 1991.

2.   B.Bhattacharya, S.KJain, and S.R.NagpauI, Basic Abstract Aigebra [11 Edition] Cambridge University Press, 1997. [Indian Edition]

3.   I.S.Luther and LB.S.Passi, Aigebra, Vol. 1 - Groups [1996]; Vol. II Rings, Narosa Publishing House , New Delhi, 1999

4.   D.S.Malik,   J.N.   Mordeson   and   M.K.Sen,   Fundamental of Abstract Aigebrar McGraw Hill [International Edition], New York. 1997.

5.   N.Jacobson, Basic Algebra, Vol. 1 SE II Hindustan Publishing Company,New Delhi.

SEMESTER – II   MEASURE THEORY   - PMT807

Objective.

1.To generalize the concept of integration using measures.

2.To develop the concept of analysis in abstract situations.

Unit 1-Lebesgue Measure

Outer measure –Definition &properties –Lebesgue measure-measurable sets-properties-non-measurable-set-measurable functions-Little wood's three principle.

(chapter 3 sec.1-6)   [18 HRS]

Unit 2-Lebesgue Integral

Lebesgue Integral of simple function bounded measurable function –of a non negative function-Fatou's lemma-monotone convergence therorem-General Lebesgue integral –Lebesgue convergence in measure.

(chapter 4 sec 1-5)   [18 HRS]

Unit 3-Differentiation and Integration

Differetiation of monotone functions Vitali's lemma-Integral of derivative-Functions of bounded variation Differentiation of an integral –absolute continuity –convex functions-Jensen's inequality.

(chapter 5 sec 1-5)   [18 HRS]

Unit 4-General measure and Integration

Measure spaces –Measurable functions –Integration-Signed measure –Hahn decomposition theorem.

(chapter 11 sec 1-6)   [18 HRS]

Unit 5-Measure and outer measure

Outer measure Measurability –extension theorem-product measures Fubini's theorem-Tonnelli's theorem.

(chapter 12 sec 1,2 and 4)   [18 HRS]

Text Book

1. Real Analysis –H.L.Royden –Prentice Hall of India 2001 edition.

Reference Books

1. De Barra.G.Measure and Integration –Wiley Eastern Limited 1991 edition

2.Walter Rudin-Real and Complex analysis.

SEMESTER – II NUMERICAL ANALYSIS - PMT808S

Objectives

This courses introduces a numerical methods for hands-on experience on computers.

Unit –I

Nonlinear equation: Fixed –point iteration method and its convergence- Bisection method-regular – Falsi method – secant method – convergence of secant/Regular-Falsi method – Newton- Raphson method and its convergence- convergence when roots are repeated.

Unit-II

Numerical differentiation: Differentiation by Newton's FD formula and BD formula.

Numerical integration: Methodology for numerical integration –Rectangular rule – Trapezoidal rule – Simpson's rule – Weddle rule.

Unit-III:

Splines and their applications: A piece – wise polynomial – spline approximation – uniqueness of cubic spline – construction of cubic spline.

Unit-IV :

Minimal property of splines –Application to differential equation – Cubic spline parametric form – Chebyshev approximation by principles of least squares .

Unit-V :

Partial differential equation:

Some standard forms – Boundary conditions – Finite difference approximations for derivatives – Methods for solving parabolic equation – Explicit method – fully implicit scheme – Crank – Nicolson's (C-N) scheme – derivative boundary.

TEXT BOOKS:

Elements of Numerical Analysis by Radhey S. Gupta

Macmillan India Ltd.

REFERENCE BOOK:

1.Elementary Numerical Analysis by Samuel D. Conte and Carl de Boor, McGraw Hill.1981

2.Introductory Methods of Numerical Methods by S. S. Sastry, Prentice – Hall India , 1994.

SEMESTER – II   FLUID DYNAMICS - PMT809T

UNIT –I KINEMATICS OF FLUIDS IN MOTION: Real fluids and Ideal fluids- Velocity of a fluid at a point, Stream lines, path lines, steady and unsteady flows- Velocity potential – The vorticity vector – Local and particle rates of changes – Equations of continuity- Worked examples- Acceleration of a fluid – Conditions at a rigid boundary. Chapter 2. Sections 2.1 to 2.10

UNIT – II: EQUATIONS OF MOTION OF A FLUID: Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two inviscid immiscible fluids – Euler's equation of motion – Discussion of the case of steady motion under conservative body forces.   Chapter 3 Sections 3.1 to 3.7

UNIT –III SOME THREE DIMENSIONAL FLOWS: Introduction – Sources, Sinks, and doublets rigid infinite plane – Axis symmetric flows.

Chapter 4 Sections 4.1, 4.2, 4.3,

UNIT – IV: SOME TWO DIMENSIONAL FLOWS: Meaning of two dimensional flow – Use of Cyclindrical polar coordinate – The stream function – The complex potential for two dimensional, irrotational incompressible flow- Complex velocity potentials for standard two dimensional flows- Some worked examples- Two dimensional Image systems- The Milne Thompson circle Theorem.   Chapter 5 Sections 5.1 to 5.8

UNIT – V : VISCOUS FLOWS: Stress components in a real fluid – Relations between Cartesian components of stress – Translational motion of fluid elements- The rate of strain quadric and principal stresses- some further properties of the rate of strain quadric – Stress analysis in fluid motion- Relation between stress and rate of strain – The coefficient of viscosity and Laminar flow – The Navier – Stokes equations of motion of a Viscous fluid.

Chapter 8 Sections 8.1 to 8.9

Recommended Text

F. Chorlton, Text Book of Fluid dynamics, CBS publications. Delhi, 1985.

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 York, 2002
5. T. Petrila, Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics, Springer, Berlin , 2004.

SEMESTER – II   OPERATION RESEARCH - EPMT810T

UNIT-I: PROJECT MANAGEMENT : PERT AND CPM
Basic Difference between PERT and CPM – Steps in PERT/CPM Techniques-PERT/CPM Network Components and Precedence Relationships – Critical Path Analysis – Probability in PERT Analysis – Project time-cost Trade Off – Updating the Project – Resource Allocation.

UNIT - II : DETERMINISTIC INVENTORY CONTROL MODELS
Meaning of inventory Control – Functional Classification – Advantage of Carrying Inventory – Features of Inventory System – Inventory Model building – Deterministic Inventory Model with no Shortage – Deterministic Inventory with Shortages.

UNIT-III: QUEUES THEORY
Essential Features of Queueing System – Operating Characteristic of Queueing System – Probabilistic Distribution in Queueing Systems – Classification of Queueing Models – Solution of Queuing Models – Probability Distribution of Arrivals and Departures

UNIT-IV: REPLACEMENT AND MAINTANANCE MODELS
Failure Mechanism of Items – Replacement of Items Deteriorates with Time – Replacement of Items that fail completely – other Replacement Problems.

UNIT- V: SIMULATION
Introduction – Steps of Simulation Process – Advantages and Disadvantages of Simulation – Monte Carlo Simulation – Random Number Generation – Simulation Inventory Problems – Queuing Problems – PERT Problems.

TEXT BOOK: JK. Sharma, Operations Research, MacMillan India, New Delhi, 2001.
 Unit 1- Chapter 13 : Sec. 13.1 to 13.9
 Unit 2 - Chapter 14: Sec. 14.1 to 14.8
 Unit 3 -.Chapter 16: Sec. 16.1 to 16.7
 Unit 4 - Chapter 17: Sec. 17.1 to 17.5
 Unit 5 - Chapter 19: 19.1to 19.11, 19.13

REFERENCE BOOKS
1. Kanti Swarup, P.K. Gupta, Man Mohan - *Operations Research*, Sultan Chand & Sons, New Delhi.
2. F.S. Hillier and J.Lieberman - *Introduction to Operations Research* [8th Edition], Tata McGraw Hill Publishing Company, New Delhi,2006.
3. Beightler. C, D.Phillips, B. Wilde, *Foundations of Optimization* [2nd Edition] Prentice Hall Pvt Ltd., New York, 1979.

Gross, D and C.M.Harris, *Fundamentals of Qeueing Theory*, [3rd Edition], Wiley and Sons, New York, 1998.