SEMESTER – I

Core Paper – I

ALGEBRA

Instructional Hrs: 105 **Sub.Code:15MSPC101**

Max. Marks: CIA-25; ESE -75 **Credits: 4**

Objective:

- To develop the Capability among Students for Handling Abstract Concepts and Provide the Students with Experience in Axiomatic Mathematics while Keeping in Close Touch with the Computational Aspects of the Subject.
- It will help the Students to become Sophisiticated Mathematicians.

UNIT I **21 Hrs.**

Group Theory: Another Counting Principle – Sylow's Theorem - *Direct Products*.

Unit II **21 Hrs.**

Ring Theory: Euclidean Rings –A Particular Euclidean Ring –*Polynomial Rings* – Polynomials Over the Rational Field.

Unit III **21 Hrs.**

Fields: Extension Fields –*Roots of Polynomials* – More About Roots.

Unit IV **21 Hrs.**

Fields: Elements of Galois Theory - *Finite Fields*.

Unit V **21 Hrs.**

Linear Transformations: Canonical Forms: Triangular Form – *Trace and Transpose* – Hermitian, Unitary and Normal Transformations.

TEXT BOOK

Herstein I.N., *Topics In Algebra* **,** John Wiley & Sons , New York, 2nd Edition , 2007.

Unit I	:	Chapter 2 –Section 2.11 to 2.13
Unit II	:	Chapter 3 –Section 3.7 to 3.10
Unit III	:	Chapter 5 –Section 5.1, 5.3 and 5.5
Unit IV	:	Chapter 5 –Section 5.6
		Chapter 7 –Section 7.1
Unit V	:	Chapter 6 –Section 6.4, 6.8 and 6.10

REFERENCE BOOKS

1. **Artin M.,** *Alegbra*, Prentice – Hall , Engleword Cliff, 1991.
2. **Fraleigh J.B.,** *A First Course in Abstract Algebra,* Narosa Publishing House, New Delhi,1988.
3. **Herstein I.N.,** *Abstract Algebra*, Prentice - Hall, New Delhi, 3rd Edition, 1996.

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – I

Core Paper – III

ORDINARY DIFFERENTIAL EQUATIONS

Instructional Hrs: 105 **Sub.Code:15MSPC103**

Max.Marks : CIA-25; ESE -75 **Credits: 4**

Objective: Differential Equations arise for many Problems in Oscillations of Mechanical and Electrical systems, Bending of Beams, Conduction of Heat, Velocity of Chemical Reactions etc., and as such play a Very Important Role in all Modern Scientific and Engineering Studies.

UNIT I 21 Hrs.

Solutions in Power Series: Second Order Linear Equations with Ordinary Points – Legendre Equation and Legendre Polynomials – Second Order Equations with Regular Singular Points- *Properties of Bessel Functions.*

UNIT II 21 Hrs.

Systems of Linear Differential Equations: Systems of First Order Equations- Existence and Uniqueness Theorem –*Fundamental Matrix.*

UNIT III 21 Hrs.

Systems of Linear Differential Equations: Non – Homogeneous Linear Systems – Linear Systems with Constant Co-efficients - *Linear Systems with Periodic Co-efficients.*

UNIT IV 21 Hrs.

Existence and Uniqueness of Solutions: Successive Approximation – Picard's Theorem – *Some Examples* – Continuation and Dependence on Initial Conditions, Existence of Solutions in the Large - Existence and Uniqueness of Solutions of Systems.

UNIT V **21 Hrs.**

Oscillations of Second Order Equations: Fundamental Results – Sturm's Comparison Theorem – *Elementary Linear Oscillations*. Comparison Theorem of Hille-Winter – Oscillations of $x'' + a(t)x = 0$.

Note: *Italics* denotes Self Study Topics

TEXT BOOK

Deo S.G., Lakshmikanthan V., Raghavendra V., *Textbook of Ordinary Differential Equations*, Tata McGraw – Hill Publishing company Limited, New Delhi, 2nd Edition, 2005.

Unit I	:	Chapter – 3	Sections 3.2 - 3.5
Unit II	:	Chapter – 4	Sections 4.2, 4.4, 4.5
Unit III	:	Chapter – 4	Sections 4.6 - 4.8
Unit IV	:	Chapter – 5	Sections 5.3 - 5.8
Unit V	:	Chapter – 8	Sections 8.1 - 8.5

REFERENCE BOOKS

1. **Coddington E.A., Levinson N.,** *Theory of Ordinary Differential Equations*, McGraw Hill, 1st Edition, 1955.
2. **Sanchez D.A.,** *Ordinary Differential Equations and Stability Theory*, W.H.Free man and co, 1968.
3. **Coddington E.A.,** *An Introduction to ordinary Differential Equations*, Prentice-Hall, Englewood Cliff N.J, 1961.

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – II

Core Paper – VI

PARTIAL DIFFERENTIAL EQUATIONS

Instructional Hrs: 90 **Sub.Code:15MSPC206**

Max.Marks : CIA-25;ESE-75 **Credits: 4**

Objective:

- Partial Differential Equations arise in every field of Science and Engineering So the Solutions of the PDEs are of Great interest in Understanding Various Physical Phenomena.
- Text of this Paper is organized to Study the Three Important Fundamental Linear PDEs: Laplace Equation, Wave Equation, and Various Explicit Formulas for Solutions along with their Numerical Solution using Finite Difference Method.
- Non-linear First Order PDEs which arise in Fluid Dynamics is also included in this Paper.

UNIT I **18 Hrs.**

Partial Differential Equations of the First Order: Nonlinear Partial Differential Equations of the First Order – Cauchy's Method of Characteristics - Compatible Systems of First Order Equations – Charpit's Method – *Special Types of First Order Equations* – Jacobi's Method.

UNIT II **18 Hrs.**

Partial Differential Equations of Second Order: The Origin of Second-Order Equations – Linear Partial Differential Equations with Constant Coefficients – Equations with Variable Coefficients – Characteristic Curves of Second-Order Equations – *Characteristics of Equations in Three Variables.*

UNIT III **18 Hrs.**

Partial Differential Equations of the Second Order: The Solution of Linear Hyperbolic Equations – *Separation of Variables* – The Method of Integral Transforms.

UNIT IV **18 Hrs.**

Laplace's Equation: The Occurrence of Laplace's Equation in Physics- Elementary Solutions of Laplace's Equation – Families of Equipotential Surfaces – Boundary Value Problems – *Separation of Variables* – Problems with Axial Symmetry.

UNIT V **18 Hrs.**

The Wave Equation: The Occurrence of Wave Equation in Physics – Elementary Solutions of the One-Dimensional Wave Equation. **The Diffusion Equation**: Elementary Solutions of Diffusion Equation – *Separations of Variables* .

Note: *Italics* denotes Self Study Topics

TEXT BOOK

Iansneddon N., *Elements of Partial Differential Equations*, McGraw - Hill book company, 1st Edition , 1957.

Unit I	:	Chapter 2	Sections 7,8,9,10,11 and 13
Unit II	:	Chapter 3	Sections 1,4,5,6 and 7
Unit III	:	Chapter 3	Sections 8, 9 and 10
Unit IV	:	Chapter 4	Sections 1, 2,3,4,5 and 6
Unit V	:	Chapter 5	Sections 1, 2 and
		Chapter 6	Sections 3 and 4

REFERENCE BOOKS

1. **Raisinghania M.D.,** *Ordinary and Partial differential equations*, S.Chand & company Ltd.
2. **SankaraRao, K.,***Introduction to Partial Differential Equations,* Second Edition, Prentice – Hall of India, New Delhi-2006.
3. **Sharma, Keharsingh J.N.,** *Partial Differential Equations for Engineers and Scientists*, Narosa Publishing house, 1st Edition, 2000.

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – II

Core Paper – VII

MECHANICS

Instructional Hrs: 90 **Sub.Code:15MSPC207**

Max.Marks : CIA-25; ESE- 75 **Credits: 4**

Objective:

- This Course is to Develop the Ability to Determine Lagrangian & Hamiltonian of Mechanical Systems and are these Functions to Obtain the Corresponding Equations of Motions
- Introduce Advanced Theoretical Techniques Including Variational Principles & Hamilton Jacobi Theory to apply these Techniques to Analyze Elementary Mechanical Systems.
- To Give Enough Knowledge to Handle Practical Problems.

UNIT I **18 Hrs.**

Survey of Elementary Principles: Constraints – Generalized Coordinates , Holonomic and Non-Holonomic Systems, Scleronomic and Rheonomic Systems. D'Alembert's Principle and Lagrange's Equations – Velocity – *Dependent Potentials and the Dissipation Function* – Some Applications of the Lagrange Formulation.

Unit II **18 Hrs.**

Variation Principles and Lagrange's Equations: Hamilton's Principle – Some Techniques of Calculus of Variations – Derivation of Lagrange's Equations from Hamilton's Principle – *Extension of Hamilton's Principle to Non Holonomic Systems* – Conservation Theorems and Symmetry Properties.

Unit III **18 Hrs.**

Hamilton Equations of Motion: Legendre Transformations and the Hamilton Equations of Motion - Canonical Equations of Hamilton – Cyclic Coordinates and Conservation Theorems – Routh's Procedure – *Derivation of Hamilton's Equations from a Variational Principle* – The Principle of Least Action.

Unit IV **18 Hrs.**

Canonical Transformations: The Equations of Canonical Transformation – Examples of Canonical Transformations – Poisson Brackets and Other Canonical Invariants – *Integral Invariants of Poincare*, Lagrange Brackets.

Unit V **18 Hrs.**

Hamilton-Jacobi Theory: Hamilton-Jacobi Equations for Hamilton's Principal Function – Harmonic Oscillator Problem – Hamilton-Jacobi Equation for Hamilton's Characteristic Function – *Separation of Variables in the Hamilton-Jacobi Equation*.

Note: *Italics* denotes Self Study Topics

TEXT BOOK

Goldstein H., *Classical Mechanics*, Narosa Publishing house, 2nd Edition, New Delhi, 2001.

Unit I	:	Chapter – 1:	Sections 1.3 - 1.6
Unit II	:	Chapter – 2:	Sections 2.1 - 2.4, 2.6
Unit III	:	Chapter – 8:	Sections 8.1 - 8.3, 8.5, 8.6
Unit IV	:	Chapter – 9:	Sections 9.1, 9.2, 9.4, 9.5
Unit V	:	Chapter – 10:	Sections 10.1 - 10.4

REFERENCE BOOKS

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

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – II

Core Paper – VIII

MATHEMATICAL PROGRAMMING

Instructional Hrs: 90 **Sub.Code:15MSPC208**

Max. Marks : CIA-25; ESE-75 **Credits: 4**

Objective: Problems in Optimization are the Most Common Applications of Mathematics. The Main Aim of this Course is to Present Different Methods of Solving Optimization Problems in the Area of Linear Programming and Non-Linear Programming.

UNIT I **18 Hrs.**

Modeling with Linear Programming: Introduction to L.P- Graphical L.P.Solution- Simplex Method. **The Simplex Method And Sensitive Analysis**: L.P.Solution Space in Equation Form-Transition from Graphical to Algebra Solution-The Simplex Method-Artificial Starting Solution-Special Cases in Simplex Method Applications. **Duality and Post Optimal Analysis:** - *Primal and Dual*-Relationships-Additional Simplex Algorithm for L.P.

UNIT II **18 Hrs.**

Advanced Linear Programming: *Generalized Simplex Table in Matrix Form*–Matrix Definition of Dual Problem- Optimal Dual Solution. **Integer Linear Programming**:-Integer Programming Algorithm- Gomory Cutting Plane Algorithm.

UNIT III **18 Hrs.**

Integer Linear Programming: Branch and Bound Algorithm- Solution of the Traveling Sales Person Problem - **Deterministic Dynamic Programming**: *Recursive Nature of Computation in D.P*.-Forward and Backward Recursion.

UNIT IV **18 Hrs.**

Classical Optimization Theory: Unconstrained Problems-Necessary and Sufficient Conditions-*The Newton-Raphson Method*-Constrained Problems-Equality Constraints (Jacobi Method and Lagrangian Method).

UNIT V **18 Hrs.**

Non-Linear Programming: Unconstrained Algorithms-Direct Search Method-Gradient Method-Constrained Algorithms-*Separable Programming*-Quadratic Programming.

Note: *Italics* denotes Self Study Topics

TEXT BOOK

Hamdy A.Taha, *Operations Research,* Prentice Hall of India Pvt.Ltd. New Delhi 8th Edition, 2006.

Unit I	:	Chapter-2	section 2.2
		Chapter-3	section 3.1 to 3.5, Omit 3.3.3.
		Chapter-4	section 4.2 & 4.4.
Unit II	:	Chapter-7	section 7.1.2, 7.4
		Chapter-9	section 9.2.2.
Unit III	:	Chapter-9	section 9.2.1 & 9.3 Omit 9.3.1 – 9.3.3.
		Chapter-10	section 10.1 & 10.2.
Unit IV	:	Chapter -18	section 18.1, 18.2.1. Omit 18.2.2.
Unit V	:	Chapter -19	section 19.1, 19.2.1, 19.2.2.

REFERENCE BOOKS

1. **Hiller F.S., Lieberman J.,** *Introduction to Operations Research,* Tata – McGraw Hill Publishing Company, New Delhi, 7th Edition, 2001.
2. **Kanti Swarup , Gupta P.K., ManMohan ,** *Operations Research,* Sultan Chand and sons Publishers, New Delhi, 12th Edition, 2005.

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – II

PRACTICAL

MATLAB AND SPSS

Instructional Hrs: 45 **Sub.Code:15MSPCP01**

Max.Marks: CIA-40; ESE-60 **Credits: 3**

LIST OF PRACTICALS

MATLAB

1. Write a program to solve $y' = x + y,\ y(0) = 1$ with $h = 0.2$ using Euler's method.
2. Write a program to solve $y' = 1 - y,\ y(0) = 0$ with $h = 0.1$ using Modified Euler's method.
3. Write a program to solve $y' = \frac{(1+x)y^2}{2},\ y(0) = 1$ with $h = 0.1$ using Runge Kutta second order method.
4. Write a program to evaluate $\int_1^2 \frac{1}{x}\,dx$ by using Simpson's 1/3rd rule with $h = 0.25$.
5. Write a program to evaluate $\int_0^6 \frac{dx}{1+x}$ by using Trapezoidal rule with $h = 1$.
6. Solve the first order linear differential equation $\frac{dx}{dt} = x + t,\ x(0) = 0$.
7. Write a program to create a function that determines the trajectory of the projectile and plot the trajectory.
8. Obtain the linear fit for the following spring experiment given below and find the spring constant where F = mg with g = 9.81 m/s^2.

m(g)	5.00	10.00	20.00	50.00	100.00
δ(mm)	15.5	33.07	53.39	140.24	301.03

9. The following table shows the time versus pressure variation readings from a vacuum pump. We will fit a curve, $P(t) = P_0 e^{-t/\tau}$, through the data and determine the unknown constants P_0 and τ.

t	0	0.5	1.0	5.0	10.0	20.0
P	760	625	528	85	14	0.16

a) Using linear scale

b) Using log scale

SPSS

10. Write a program to apply t – test on data for analysis using SPSS software.
11. Write a program to prepare cross - tabulation and Chi - Square test for the data.
12. Write a program to find the correlation of the variables for the given data.
13. Write a program to prepare the linear regression and curve fit for the data.
14. Write a program to prepare the multiple regression for the data.
15. Write a program to analyze the means of different variables using one - way ANOVA table.
16. Write a program to analyze the influences of independent variable over dependent Variable using two - way ANOVA table in SPSS data editor.

SEMESTER – III

Core Paper – XII

TOPOLOGY

Instructional Hrs: 90 **Sub.Code: 15MSPC312**

Max.Marks : CIA-25; ESE-75 **Credits: 4**

Objective:

- Topology serves to lay the Foundations for Study in Analysis.
- The Course is designed to develop an Understanding of Topological Ideas.
- At the end of the Course, Students should be able to Understand and Appreciate the Central Result of General Topology.

UNIT I **18 Hrs.**

Topological Spaces and Continuous Functions: Topological Spaces –Basis for a Topology – The Order Topology – *The Product Topology On X* x *Y* – The Subspace Topology – Closed Sets and Limit Points – Continuous Functions – The Product Topology.

UNIT II **18 Hrs.**

Connectedness and Compactness: Connected Spaces – Connected Sets in the Real Line – *Components and Path Components* – Local Connectedness- Compact Spaces – Compact Sets in the Real Line.

UNIT III **18 Hrs.**

Countability And Separation Axioms: The Countability Axioms – The Separation Axioms – The Urysohn Lemma-*The Urysohn Metrization Theorem* – The Tiez Extension Theorem.

UNIT IV: **18 Hrs.**

Tychonoff Theorem: The Tychonoff Theorem – Completely Regular Spaces - *The Stone-Cech Compactification.*

UNIT V: **18 Hrs.**

Complete Metric Spaces and Function Spaces: Complete Metric Spaces - Compactness in Metric Spaces – Pointwise and Compact Convergences - The Compact Open Topology - Ascoil's Theorem.

Baire Spaces and Dimension Theory: Baire Spaces – *A Nowhere Differentiable Function.*

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

Munkres R., *Topology* Second Edition Prentice Hall, New Delhi, 2007.

Unit I :	Chapter 2	Sections 12 - 19
Unit II :	Chapter 3	Sections 23 - 27
Unit III:	Chapter 4	Sections 30 - 35
Unit IV:	Chapter 5	Sections 37, 38
Unit V :	Chapter 7	Sections 43, 45 – 47
	Chapter 8	Sections 48, 49

REFERENCE BOOKS

1. **J.Dugundji,** *Topology,* **Allyn and Bacon,** 1966(Reprinted in India by Prentice Hall of India Pvt.Ltd.).
2. **George F. Simmons,** *Introduction to Topology and Modern Analysis,* McGraw –Hill Book Company, 1963.
3. **J.L.Kelley,** *General Topology,* Van Nostrand, Reinhold Co., New York, 1995.
4. **L.Steen and J. Seebach,***counter examples in Topology* , Holt, Rinehart and Winston , New York , 1970

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – IV

Core Paper – XIII

FUNCTIONAL ANALYSIS

Instructional Hrs: 90 **Sub.Code:15MSPC413**

Max.Marks : CIA-25; ESE-75 **Credits: 4**

Objective:

- The Course is designed to Develop an Understanding the ideas of Functional Analysis.
- To Introduce the Concepts and Methods of Elementary Analysis and related Branches of Algebra and Geometry and present an Unified treatment to Problems in different Branches of Analysis.

UNIT I **18 Hrs.**

Banach Spaces: The Definition and Some Examples – Continuous Linear Transformations – The Hahn – Banach Theorem – *The Natural Imbedding of N in N* ** - The Open Mapping Theorem.

UNIT II **18 Hrs.**

Banach Spaces and Hilbert spaces : The Conjugate of an Operator – Hilbert Spaces – The Definition and Some Simple Properties – Orthogonal Complements – *Orthonormal Sets.*

UNIT III **18 Hrs.**

Hilbert spaces : The Conjugate Space H* - *The Adjoint of an Operator* – Self-Adjoint Operators – Normal and Unitary Operators – Projections.

UNIT IV **18 Hrs.**

Finite -Dimentional Spectral Theory: Matrices – Determinants and the Spectrum of an Operator – *The Spectral Theorem.*

UNIT V **18 Hrs.**

Banach algebra: The Definition and Some Examples of Banach Algebras – Regular and Singular Elements – *Topological Divisors of Zero* – The Spectrum – The Formula for the Spectral Radius.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

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

Unit I: Chapter:9 Sections: 46-50

Unit II: Chapter:9 Sections: 51-54

Chapter:10 Sections: 52-54

Unit III: Chapter:10 Sections: 55-59

Unit IV: Chapter:11 Sections: 60-62

Unit V: Chapter:12 Sections: 64-68

REFERENCE BOOKS

1. **Goffman C and Pedrick.G.,** *A First course in Functional Analysis*, Prentice Hall of India, New Delhi, 1987.
2. **Bachman G and Narici L.,** *Functional Analysis*, Academic Press, New York, 1996.
3. **Lustenik L.A and Sobolev V.J.,** *Elements of Functional Analysis*, Hindustan Publishing Corporation, New Delhi, 1971.
4. **Taylor A.E.,** *Introduction to Functional Analysis*, John Wiley and Sons, New York, 1958.

- Question Paper Setters Confine to the above Text Book only.

SEMESTER – IV

Core Paper – XV

FLUID DYNAMICS

Instructional Hrs: 90 **Sub.Code:15MSPC415**

Max.Marks : CIA-25; ESE-75 **Credits: 4**

Objective: To Familiarize the Students with the Concept of Fluid Dynamics as the Subject has got Application in Medical, Astrophysical, Geophysical, Agricultural, Aero dynamical and Other Related Disciplines. Fluid Dynamics is One of the Most Important Parts of the Recent Interdisciplinary Activities Concerning Energy and Technological Development**.**

UNIT I **18 Hrs.**

Bernoulli's Equation: Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. **Equations of Motions:** Differentiation following the Fluid – Equation of continuity – Boundary conditions – Kinematical and physical – *Rate of change of linear momentum* – Equation of motion of an inviscid fluid.

UNIT II **18 Hrs.**

Equations of Motions: Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – energy equation for inviscid fluid – circulation – Kelvin's theorem – *vortex motion* –Helmholtz equation.

UNIT III **18 Hrs.**

Two Dimensional Motion: Two Dimensional Functions – Complex Potential – Basic singularities – source – sink – *Vortex* – *doublet* – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force.

UNIT IV **18 Hrs.**

Dynamics of Real Fluids: Viscous flows – Navier-Stokes equations – *Vorticity* and circulation in a viscous fluid –Steady flow through an arbitrary cylinder under pressure – Steady Couette flow between cylinders in relative motion – Steady flow between parallel planes.

UNIT V **18 Hrs.**

Laminar Boundary Layer in incompressible flow: Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate –Von Miss Transformation – Blasius equation and its solution in series.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Milne Thomson L.M.,** *Theoretical Hydro Dynamics*, McMillan Company, 5th Edition, 1968.

   Unit I : Section 1.0 – 1.3., 3.10-3.41 (omit 3.32)
   Unit II : Section 3.42 – 3.53 (omit 3.44)

2. **Curle N., Davies H.J.,** *Modern Fluid Dynamics*, (Volume I) Dvan Nostrand Company Limited, London 1968.

   Unit III : Section 3.1 – 3.7.5 (omit 3.3.4, 3.4, 3.5.2,3.6)
   Unit IV : Section 5.1 – 5.3.3
   Unit V : Section 6.1 – 6.3.1 (omit 6.2.2.)

REFERENCE BOOKS

Yuan. S.W., *Foundations of Fluid Mechanics***,** Prentice-Hall of India private Limited, Englewood Cliffs, New Jersy, 1969.

Shanti Swarup., Fluid Dynamics,Krishna Prakashan Mandir,Meerut.1987.

- Question Paper Setters Confine to the above Text Book only.