Syllabus of M.A/M.Sc (Mathematics) Semester III

PAPER XI (MAT CC-11)

Functional Analysis

Functional Analysis

Unit 1 : Normed linear spaces, Banach spaces and examples, Quotient space of normed linear Spaces and its completeness, equivalent norms, Riesz Lemma, Basic properties of finite dimensional normed linear spaces and compactness.

Unit 2 : Weak convergence and bounded linear transformation, normed linear spaces of bounded linear transformations, dual spaces with examples, uniform boundness theorem and some of its consequences.

Unit 3 : Open mapping theorem and closed graph theorem, Hahn- Banach Theorem on real linear spaces, complex linear spaces and normed linear spaces, Reflexive spaces.

Unit 4: Inner product spaces, Riesz lemma on Hilbert space, orthonormals sets and Parseval's identity, structure of Hilbert spaces, Projection theorem Riesz Representation Theorem.

Unit 5 : Adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces, Self-adjoint Operators, positive operator, Projection, Normal and unitary operators.

References

1. G.F.Simmons:- Introduction to Topology and Modern Analysis
2. K.K.Jha :– Functional Analysis, Advanced General Topology

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PAPER XII (MAT CC-12)

Fluid Dynamics

Fluid Mechanics :

Unit 1 : Lagrangian and Eulerian methods, Equation of Continuity, Boundary Surfaces, Stream lines, Path lines and Streak lines, velocity potential, irrotational and rotational motions, vortex lines.

Unit 2 : Lagrange's and Euler's equations of motion, Bernoulli's theorem, equation ofmotion by flux method, equation referred to moving axis, implusive actions.

Unit 3: Irrotational Motion in two dimension, stream function, complex velocity potential, sources, sinks, doublets and their images, conformal mapping, Milne-Thompson circle theorem.

Unit 4 : Two dimensional irrotational motion produced by motion of a circular, coaxial and elliptic cylinders in an infinite mass of liquid, kinetic energy of a liquid, Theorem of Blasius, motion of a sphere through a liquid at rest at infinity, liquid streaming past a fixed sphere, Equation of motion of a sphere, Stoke's stream function

Unit 5 : Vortex motion and its elementary properties, Kelvin's proof of permanence, Motion due to circular and rectilinear vertices.

References

1. F.Chorlton :- A text Book of Fluid Dynamics.
2. M.D. Raisinghania:- Fluid Dynamics

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PAPER XIII (MAT CC-13)

Classical Mechanics (Rigid Dynamics)

Unit 1 : Generalised Co-ordinates, Holonomic and Non Holonomic systems, Lagrange'sequations of motion, energy equations for conservative fields.

Unit 2 : Hamilton's canonical equations, Rouths equations, Hamilton'Principle, Principle of Least Action.

Unit 3 : Small Oscillations, normal Co-ordinates, normal mode of vibration.

Unit 4 : Contact transformations, Lagrange brackets and Poisson brackets, the most general infinitesimal contact transformation, Hamilton- Jacobi equation.

Unit 5 : Motivating problem of Calculus of variation, Euler- Lagrange equation shortest distance, minimum surfaces of revolution, Brachistochrone problem.

References

1. A.S. Ramsey :- Dynamics Part II
2. S.L. Loney :- Dynamics of particle and rigid bodies

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PAPER XIV (MAT CC-14)

Optimization Techniques

Linear Programming

Unit 1 : Simplex method for unrestricted variable, Two phase method, Dual simplex method, Parametric Linear programming, Upper Bound technique, Interior point algorithm, Linear Goal programming.

Unit 2 : Integer programing, Branch and bound technique, Gomory's algorithm.

Non- Linear programming :

Unit 3 : One and multi-variable unconstrained optimization, Kuhn- Tucker condition for constrained optimization, Wolfe's and Beale's methods.

Unit 4 : Game theory, Two person- Zero sum games with mixed strategies, Graphical solution by expressing as a linear programming problem.

Unit 5 : Inventory theory, Different costs of inventory model, Deterministic Economic lot size model, EOQ with uniform demand and several productions of unequal length / production runs of equal length EOQ models- Shortages not allowed, shortages allowed.

References:

1. H.A.Taha :- Operations Research- An Introduction
2. Kanti Swarup, P.K.Gupta and Man Mohan: Operations Research
3. P.K.Gupta and D.S. Hira :- Operations Research

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PAPER XV (MAT CC-15)

Differential Geometry

Unit 1: Curves in spaces, parameters other than arc lengths, tangent principal normal, binormal and three fundamental planes, Curvature and torsion of space curves, Serret- Frenet formulae, Fundamental theorem on spaces curves, Helices, spherical. indicatrix, Involutes and Evolutes, Bertrand curves.

Unit 2 : Representation of surfaces, Curves on surfaces in R^3 spaces, tangent plane and Normal, Envelope, characteristic and edge of regression, developable surface of revolution, directions on a surface.

Unit 3 : Parametric curves, angle between them, first order and second order magnitudes, principal directions and lines of curvature, Normal Curvature, Euler's theorem and Meunier's theorem. Theorem of Beltrami and Enneper, Gauss Characteristic equation, Mainardi- Codazzi equations.

Unit 4 : Conjugate directions, Isometric lines, asymptotic lines and Geodesics- their equations and properties, curvatrure and torsion, their structures on surfaces of revolution, Bonnet's theorem, Clairaut's theorem and Dupin's indicatrix.

References:

1. C.E. Weatherburn:- Differential Geometry In Three Dimension
2. J.A. Thorpe :- Elementary Topics in Differential Geometry
3. A. Gray : Differential Geometry of three dimensions, Cambridge University Press