

Semester IV

Credits Equivalent: 04 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

Attendance Requirements:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

Evaluation Criteria:

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Counselling, Activities and Tutorials (CAT): 25%
 - i. Subjective / Objective Assignment: 10 %
 - ii. Numerical Assignments using programming: 10 %
 - iii. Presentations and Class Tests: 5 %

Course Name: Fluid Dynamics

Course Code: IAM 405

Credits: 04

Course Contents:

Unit I: Basic Concepts, Orthogonal Curvilinear Coordinates, Kinematics of Fluid in Motion, General Theory of Stress and Strain, Equations of Motion of Inviscid Fluids, Bernoulli's Equation and its Applications.

Unit II: The Navier-Stokes Equations and the Energy Equation, Dynamical Similarity, Inspection Analysis and Dynamical Analysis:- Rayleigh's Technique and Buckingham π Theorem.

Unit III: Laminar Flow of Viscous Incompressible Fluids with Temperature Distribution:- Plane Couette Flows, Plane Poiseuille Flows, Generalized Plane Couette Flows, Hagen-Poiseuille Flow, Flow in Tubes of Various Cross-Sections, Jeffery-Hamel Flow, Flow of two Immiscible Fluids, Flow with Constant Fluid Properties and with Variable Viscosity, and Flow in the Neighbourhood of a Stagnation Point.

Unit IV: Boundary Layer Theory:- Velocity and Thermal Boundary Layers; Flow of a Compressible Viscous Fluid and Theory of very Slow Motion.

Prescribed Text Books:

1. Bansal J. L. (2004). Viscous Fluid Dynamics. Second Edition. Oxford and IBH Publishing, Delhi.
2. Raisinghania M.D. (2011). Fluid Dynamics. Tenth Edition. S Chand & Company LTD. New Delhi.

Suggested Additional Readings:

1. Schlichting H. and Gersten K. (2000). Boundary Layer Theory. Eighth Edition. Springer Verlag. Germany.
2. Kundu P.K. and Cohen I.M. (2010). Fluid Mechanics. Fourth Edition. Academic Press.

Course Name: Differential geometry

Course Code: IAM 407

Credits: 04

Course Contents:

Unit I: Curve, Arc-length, Reparametrization, Level curves, Curvature of Plane curve, Frenet-Formulas.

Unit II: Global Properties of Curves: Simple closed curves, The Isoperimetric Inequality, Four vertex Theorem, Surfaces in Euclidean Spaces, Length of curves on surface, Isometries and conformal mappings of surfaces, Surface area.

Unit III: The Second Fundamental Form, Curvature of curves on surface, Normal and Principal Curvatures, Gaussian and Mean curvatures.

Unit IV: The Pseudosphere, Gauss map, Geodesics: Basic Properties, Theorema Egregium and Gauss-Bonnet Theorem.

Prescribed Text Books:

Andrew Pressley, Elementary Differential Geometry, Springer, 2010.

Suggested Additional Readings:

M.P. doCarmo, Differential Geometry of Curves and Surfaces, Prentice Hall, 1976.

B. O'Neill, Elementary Differential Geometry, Academic Press, New York, 1966.

Course Name: OPERATIONAL RESEARCH

Course Code: MTH 502

Credits: 04

Course Contents:**Unit I:**

Linear Programming Problem: Operations research & its scope, Necessity of operations research in industry. Introductions to Linear programming problems, General linear programming problems, Mathematical Formulation of L.P.P. and examples, Feasible, Basic feasible and optimal solutions, Extreme points. Graphical Methods to solve L.P.P., Simplex Method, Big M Method, Two phase Method, Degeneracy, Unrestricted variables, unbounded solutions, Duality in L.P. P., fundamental properties of Dual problems, dual simplex method and Revised Simplex method.

Unit II:

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

Assignment Problem: Formulation, Hungarian method for optimal solution, solving unbalanced problem and travelling salesman problem.

Unit III:

Games and Strategies: Two person zero sum games, maximin and minimax principle, games without saddle points – mixed strategies, Graphic solution of $2 \times n$ and $m \times 2$ games, Dominance property, General solution of $m \times n$ Rectangular games, limitations and extensions.

Unit IV: Queuing theory: Queueing systems, Queueing problem, Transient and steady states, Probability Distributions in Queueing systems. Poisson process (pure birth process), Properties of Poisson arrivals, Exponential process, Markovian property, Pure death process, Service time distribution, Erlang service time distribution, Solution of Queueing Models.

Prescribed Text Books:

1. P. Sankara Iyer(2008), "Operations Research" Tata McGraw-Hill, 2008.
2. Kanti Swarup, P.K. Gupta and Manmohan(2004), Operations Research, Sultan Chand & Sons, 12th Edition.
3. Waynel Winston (2011), Operatios Research, Cenagage Learning India Pvt. Ltd.

Suggested Additional Readings:

1. S.D. Sharma(2004), Operations Research, Kedar Nath Ram Nath & Co. 14th Edition.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi (2005), "Operations Research" Pearson Education.
3. S. Kalavathy (2011), Operations Research, Vikas Publishing House, PVT Ltd. New Delhi.

Course Name: Functional Analysis

Course Code: IAM-501

Credits: 04

Course Contents:

Unit-I:Metric Space , Examples of Metric Spaces, Open set, Closed set, Neighbourhood, convergence, Cauchy sequence, completeness, completion of metric spaces.

Unit-II: Normed Linear Spaces, Banach Spaces, Properties of Normed Linear Spaces, Properties of Banach Spaces, Compactness and Finite Dimensions, Linear Operators, Bounded and Continuous Operators.

Unit-III: Linear Functional, Dual Space, Double Dual Space, Inner Product Spaces, Hilbert Spaces, Properties of Inner Product Spaces, Orthogonal Compliment, Direct Sum, Orthonormal Sets and sequences.

Unit-IV:, Representation of Functional on Hilbert Spaces, Self-Adjointness, Unitary Operators, Normal Operators, Hahn-Banach, Open mapping and closed Graph Theorems.

Prescribed Text Books:

1. E. Kreyszig, □Introductory Functional Analysis with Applications□ Wiley Classic Library.

Suggested Additional Readings:

1. Bollobas, □Linear Analysis□ Second Edition, Cambridge University Press.
2. N. Akhiezer and I. Glazman, □Theory of Linear Operators in Hilbert Spaces□ Dover Books.
3. B. Limaye, □Functional Analysis□ New Age International.
4. I. J. Maddox, □Elements of Functional Analysis□ Cambridge University Press; 2 Edition

Skill Development

Course Name: Vedic Mathematics

Course Code: IAM 412

Credits: 02

Course Objective: The purpose of this course is to acquaint the students with the quicker arithmetic techniques to solve problems.

Course Contents:

Unit I: Number system, binary system, permutation combination, probability.

Unit II: Ratio and proportion, partnership, percentage, average, profit and loss, allegation, time and work, time and distance.

Prescribed Text Book:

M. Tyra, Quicker Maths, BSC Publishing Co. Pvt. Ltd. Delhi, 2017.

Suggested reading:

J. Sankaracarya, Vedic Mathematics, Motilal Banarsidass Publishers Delhi 2015.