Course Offered in Spring Semester Department of Mathematics

Batch 2018-20, Semester-IV					
S. N.	**Course Name**	**Course Code**	**Credit**	**Lecture & Tutorial**	**Name of Faculty**
1	Fluid Dynamics	IAM 405	04	4L, 2T	Dr R Kumar
2	Differential Geometry	IAM 407	04	4L, 2T	Dr S K Srivastava
3	Operational Research	MTH 502	04	4L, 2T	Guest Faculty
4	Functional Analysis	IAM-501	04	4L, 2T	Guest Faculty
5	M. Sc. Project	MTH 550	04	4L, 2T	Dr S K Srivastava Group A
					Dr R Kumar Group B

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.

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 (LPP). Formulation and examples, feasible, basic feasible and optimal solutions. Graphical method to solve LPP. Simplex method, Charnes Big M method, two phase method, degeneracy. Duality theory, dual LPP, fundamental properties of dual problems, dual simplex algorithm.

Unit II:

Integer programming; gomory's method, branch and bound method.

Transportation problem: Mathematical formulation, basic feasible solution of T.P. by North West corner method, least cost method, Vogle's approximation method. Unbalanced TP UV method, degeneracy in TP.

Unit III:

Assignment Problem: Mathematical formulation, assignment method, Hungarian method, unbalanced AP.

Network techniques: Shortest path model, dijkastra algorithm, spanning trees, minimum spanning trees, Kruskal's algorithm, Prim's algorithm.

Unit IV:

Game theory: Two person zero sum games, the maxmin-minmax principle, pure strategies, mix strategies, graphical solution of 2xnand mx2 games, dominance property, general solution of mxn rectangular games, LPP of GP

Prescribed Text Book:

1. S.D. Sharma, operations research, kedar nath ram Nath and co. 14th edition 2004.
2. Kanti swarup, PK Gupta and Manmohan operations research, sultan chand and sons 12th edition, 2004.
3. R. paneerselvam , operations research, prentice hall of india pvt ltd, 2004.

Suggested Additional Readings:

1. G. Hadley, linear programming , Narosa pub. House,2002.
2. H.A. Taha operations research , An introduction prentice hall of india pvt ltd, 7th edition 2004.

1. J.K. sharma, operations research, macmillan India pvt ltd 2003

Course Name: Functional Analysis

Course Code:IAM-501

Credits: 04

Course Contents:

Unit I

Banach Spaces: The definition and some examples, continuous linear transformations. The Hahn- Banach Theorem (statement only), the Open Mapping Theorem, the Closed Graph Theorem.

Unit II

The Uniform Boundedness Theorem, The natural embedding of N in N**, reflexivity. Hilbert Spaces: The definition and some simple properties, orthogonal complements, orthonormal sets.

Unit III

The conjugate space H*, the adjoint of an operator, self-adjoint, normal and unitary operators,

Projections.

Unit IV

Spectral Theory: Spectral Theory in Finite Dimensional Normed Spaces. Basic Concepts. Spectral Properties of Bounded Linear Operators. Further Properties of Resolvent and Spectrum.

Text Books

1. G.F. Simmons, Introduction to Topology and Modern Analysis, International Student Edition, McGraw Hill Book Company, Inc. 1963, (Chapter 9: §§ 46-51 and Chapter10: §§ 52-59).

2. E. Kreyszig, Introductory Functional Analysis with Applications, John, Wiley and Sons, Wiley Classics Library Edition Published, 1989 (Chapter 7).