With effect from the session from 2015 - 2016

Paper I: Algebra, Differential Geometry and Modeling

Time: 03 hrs **Subject Code: Phd-062** **3+1+0**

Max. Marks: 100

Module I

Algebra: Number theory, Division algorithm, Euclidean algorithm, Euler's phi function, farmat's theorem, willson's theorem, linear congruences, Chinese remainder theorem,
Group Theory: Sub group, permutation group, cyclic group, quotient group, normal subgroup, Finite group: lagrange theorem, sylows therems, Ring, Field, reducible and irreducible polynomial,
Linear Algebra: Vector Spaces, Sub spaces, basis and dimension, linear transformation, rank-nullity theorem, matrix of a linear transformation, transition matrix, inner-product space, norm space, gramme-schmidt orthogonalization process.

Recommended Books

1. Kenneth M Hoffman & Ray Kunze, *Linear Algebra* (2nd Edition), Prentice Hall publications
2. Joseph A. Gallian, *Contemporary Abstract Algebra* (4th Edition), Narosa Publishing House, New Delhi, 1999.
3. I. N. Herstein, Topics in Algebra, Wiley Eastern, 1975.

Module-II

Differential Geometry: Tensor calculus, Curves in space R^3, curvature and torsion of smooth curves, Frenet-Serret formulae, osculating circle, osculating sphere, spherical indicatrices, involutes and evolutes, fundamental theorem of space curves, second and third fundamental forms, surfaces in $R3$, regular surfaces, level sets of smooth functions on $R3$, surfaces of revolution, tangent vectors, tangent plane. geodesics, geodesics on a surface of revolution, geodesic curvature of a curve, Gauss-Bonnet Theorem (statement only).

Mathematical Modeling Simple situations requiring mathematical modeling, Characteristics and limitations of mathematical models, linear growth and decay models, Non linear growth and decay models, Compartment models, Mathematical models through difference equations Basic theory of linear difference equations with constant coefficients, economic and finance, population dynamic and genetics. Situations that can be modeled through graphs, Directed graphs, signed graphs, and weighted digraphs.
Mathematical modeling through linear programming, Transportation and assignment models, Game Theory, Network Model, Goal Programming, Non linear programming problems, Kuhn- Tucker conditions.

Recommended Books

1. C. E. Weatherburn, *An Introduction to Riemannian Geometry and the Tensor Calculus*, Cambridge University Press, 2008.
2. P.K. Nayak, *A Book on Tensor Calculus and Riemannian Geometry*, Narosa publication
3. J. N. Kapur, *Mathematical Modeling*, Wiley Eastern.
4. D. N. Burghes, *Mathematical Modeling in the Social Management and Life Science*, Ellie Herwood and John Wiley.
5. H. A. Taha, *Operations Research –An Introduction*, Macmillan.
6. G. Hadley, *Nonlinear and Dynamic Programming*, Addison Wesley

Approved 6.2.16

06/02/16

With effect from the session from 2015 - 2016

Time: 03 hrs **3+1+0**
Max. Marks: 100

Paper II: Analysis and Differential Equations
Subject Code: Phd-063
Module I:

Real Analysis: Real number system and its order completeness, sequences and various tests of convergence and divergence of series of real numbers. Continuity and differentiability (single and several variables)

Complex Analysis: - Analyticity, Cauchy's residue theorem, evaluation of definite and improper integrals using contour integration, meromorphic functions, argument principle, Rouche's theorem, open mapping theorem, singularity and residue at ∞. Conformality, Möbius transformations, the group of Möbius transformations, Cauchy's therems on Integrabilty and differentialbilty of complex functions,

Metric spaces: completeness, connectedness, compactness, Basic topology.
Functional Analysis Inner product Spaces, Normed Spaces, Banach Spaces, Linear operators Linear Functionals and Hilbert Spaces.

Recommended Books:

1. Walter Rudin, *Principle of Mathematical Analysis*, Mcgraw Hill, Third Edition
2. Erwin Kreyszig, *Introduction to Functional Analysis with Applications*, John Wiley & Sons.
3. H.S. Kasana, *Complex Variables: Theory and Applications*, PHI Learning Pvt. Ltd.

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Module II

Differential Equations
ODE:- Initial value problems, Existence and Uniqueness theorem, Series solution around an ordinary point and a regular singular point, Method of Frobenius, Bessel, Legendre and Hypergeometric equations, Confluent Hyper geometric equation, Self adjoint eigen value problems, Green's functions, Second order boundary value problems, Sturm Liouville problems.

PDE:- Linear and quasi linear equations, Partial Differential Equations of second order with constant and variable coefficients, Classification and reduction of second order equations to canonical form, Cauchy's, Neumann and Dirichlet's problems, Solution of Laplace and Poisson's equations in two- and three-dimensions by variable separable method, Solutions of homogeneous and non-homogeneous wave and heat equations.

Recommended Books

1. B.Rai, D.P.Choudhary, H.I.Freedman, *A Course in Ordinary Differential Equations*, Narosa Publishing House, New Delhi
2. K.Sankara Rao, *Introduction to Partial Differential Equations*, Prentice – Hall of India, New Delhi - 110001