Syllabus for Course Work

Total Marks : 200 (160+40*)

Additive Combinatorics

1. Subject upgradation (Full Marks 50):* Basic Group theory, Basic point set topology, Measure and Integration(Algebra of Sets, Measure, Integration, Fubini Theorem, Radon-Nikodym Theorem, Signed measure, Convolution, Haar measure) Functional Analysis (Banach spaces, Hilbert spaces, Operator theory).

* As far as possible in the due course of time.

References:
1. M. A. Armstrong, Basic Topology,
2. J. B. Conway, A Course in Functional Analysis,
3. G. F. Simmons, Mordern Analysis,
4. K. B. Athreya and S. Lahiri, Measure and Integration.

2. Research methodology including computer application (Full Marks 100): Algebra in the Stone-Cech Compactication, Ergodic Theory (Measurable and topological dynamics), Probabilistic methods.

Working knowledge of Latex.

3. Literature Review (Marks-40+10*)

References:
1. N. Hindman and Dona Strauss, Algebra in the Stone-Cech Compactication and its Applications,
2. R. M. Dudley, Real Analysis and Probability,
3. H. Furstenberg, Recurrence in Ergodic Theory and combinatorial Applications,
4. T. Tao and V. H. Vu, Additive Combinatorics,
5. P. Walter, An Introduction to Ergodic Theory.

3. Literature Review (Marks-40+10*): Survey of Relevant Papers.

COMPLEX ANALYSIS AND VALUE DISTRIBUTION THEORY

Research Methodology (Full Marks: 60)

Review of general theory of entire and meromorphic functions, Uniqueness of entire and meromorphic functions sharing values, Growth properties of entire and meromorphic functions, Deficiencies of meromorphic functions and their generalizations, Infinite products and related problems.

References:

1. W. K. Hayman: Meromorphic Functions, The Clarendon Press, Oxford, (1964).
2. C. C. Yang and H. X. Yi: Uniqueness Theory of Meromorphic Functions, Science Press, Beijing (2003).
3. A.S.B. Holland: Introduction to the theory of Entire Functions, Academic Press, New York (1973).

Computer Literacy (Full Marks: 40)

Working knowledge of MSWORD and LaTex.

Literature Survey(Full Marks: 100)

Survey of Relevant Papers.

Mathematical Biology

Literature Review (Marks-40+10*)

Review of discrete and continuous population models, models for interacting populations, chemostat models, models on epidemiology, harvesting models.

Research Methodology including Computer Applications (Marks-80+20*, Credit – 2hrs. per week)

Ordinary differential equations, linearization technique, stability analysis, Poincare` Bendixon theorem.

Laplace transform. Convolution. Inverse transform by the applications of table and contour method. Solution of differential equations by Laplace transform method.

Numerical solution of ordinary differential equations by Runge Kutta method.

Fundamentals of Matlab, MSWORD and LATEX.

Subject Upgradation (On Recent Development) (Marks- 40+10*, Credit- 1hr. per week)

Density dependent and ratio-dependent models, delay models, stochastic models, non-existence of periodic solutions for higher dimensional models, maximum sustainable yield in harvesting.

Survey of relevant papers.

Reference books

1. S.L.Ross: Diffrential Equations.
2. G.Birkhoff and G.C.Rota: Ordinary Differential Equations.
3. I. N. Sneddon : The Use of Integral Transforms.
4. C. E. Froberg : Introduction to Numerical Analysis.
5. F. B. Hilderbrand: Introduction to Numerical Analysis.

6. K. Atkinson and W. Cheney : Numerical Analysis.
7. F. Seheid : Numerical Analysis.
8. Mark Kot : Population Biology.
9. J.D. Murray : Mathematical Biology.
10. H.L. Smith, P. Waltman: The Theory of the Chemostat: Dynamics of Microbial Competition.
11. M.A.Nowak and R.M.May: Virus Dynamics.
12. K.Gopalsamy: Stability and Oscillations in Delay Differential Equations of Population Dynamics.
13. Hall Smith: An Introduction to Delay Differential Equations with Applications to the Life Sciences.
14. Y.Kuang: Delay Differential Equations with Applications in population dynamics.
15. J.Guckenheimer and P.Holmes: Nonlinear Oscillations of Dynamical Systems.

Decision Making in Fuzzy Environment: Theory and Applications

Literature Review

The importance of literature review, obtaining literature sources, searching the literature.
Literature review on: fuzzy Sets, Operation on Fuzzy Sets, Fuzzy Numbers, Fuzzy Logic, Fuzzy Inference, Fuzzy Control and Fuzzy Expert Systems.
Literature review on: Decision making in crisp and fuzzy environment, Goal Programming, Fractional Programming, Dynamic Programming, Nonlinear Programming, Quadratic Programming, Analytic Hierarchy Process, Integer Programming , Duality.

Research Methodology including Computer Applications

Research for development, mode of data collection, qualitative quantitative data analysis.
A brief knowledge on the software: C/C++, Mat lab, Lingo Lindo , Latex, Microsoft Office.

Subject Up Gradation

Recent Updates On: Fuzzy multi attribute decision making, Fuzzy multi objective decision making, Fuzzy multi criteria decision making, Fuzzy bilevel programming, Fuzzy multilevel programming, Fuzzy linear programming, Fuzzy non linear programming, Fuzzy goal programming, Fuzzy chance constrained programming, Fuzzy neural network, Applications of Fuzzy logic/fuzzy decision making in different areas of real life. Introduction to Genetic Algorithm.

References

1.Fuzzy Sets and Fuzzy Logic: J. G. klir and B. Yuan
2.Fuzzy Control: K. Michels, F. Klawonn, R. Kruse, A. Nurnberger
3.Fuzzy Control and Modeling: H. Ying
4. Goal Programming and Extensions: J. P. Ignizio
5.Fuzzy Sets and their Applications: H. J. Zimmermann

Differential Geometry

1. Subject up gradation (full marks 50): Quick review of calculus of R^n. Tensor algebra, covariant and contravariant components of vectors, summation convention, contraction, Kronecker delta, tensor calculus: Riemannian metric, Christoffel symbols of first and second kind, Riemann Christoffel curvature tensor, covariant differentiation, intrinsic differentiation, parallel vector field, Serret-Frenet formula, helix, geometry of surfaces, first, second and third fundamental forms, Gaussian curvature, Meusniers theorem, Eulers Theorem. Basic concepts of topological spaces: base of a topological space, Hausdorff space, compactness, connectedness, homeomorphism, continuous functions in a topological space, product space. matrix groups.

References

1. M. Spivak, Calculus on manifolds.
2. I. S. Sokolnikoff, Tensor calculus and its application to geometry and mechanics.
3. A. Pressley, Elementary differential geometry
4. M. A. Armstrong, Basic Topology
5. A. R. Shastri, Elements of Differential topology.

2. Research methodology including computer applications (full marks 100): Differential manifolds, curves on manifolds, tangent spaces, cotangent spaces, vector fields, integral curves, tensor analysis on manifolds, fiber bundle, Lie Groups, one parameter group of transformations, Lie differentiation, linear connections, covariant differentiation, semi symmetric connection, semi symmetric non-metric connection, quarter symmetric connection, quarter symmetric non-metric connection. Fundamentals of Riemannian geometry, Riemannian curvature tensor, projective curvature tensor, conformal curvature tensor, quasi-conformal curvature tensor, conharmonic curvature tensor m-projective curvature, C-Bochnar curvature tensor, Semi Riemannian metric, pseudo Riemannian metric. Complex structures on a differential manifold, almost complex structure on a differential manifold, contact structures on differential manifolds, almost contact structures on differential manifolds, Normality condition, Nijenhuis tensor, Hermitian manifolds, Kaehlerian manifolds, K-contact manifolds Fundamental concepts of submanifolds, Gauss Weingarten formula, invariant submanifold, anti invariant submanifold, totally geodesic submanifold..

Working knowledge in Latex for article preparation.

References

1. K. Yano and M. Kon, Structures on manifolds.

2. S. Kumeresan, A course in differential geometry and Lie groups.
3. L Lamporte, User guide for Latex.

3. **Literature review (full marks 50):** Sasakian manifolds, locally φ-symmetric Sasakian manifolds, φ-Ricci symmetric Sasakian manifolds, φ-recurrent Sasakian manifolds, invariant submanifolds of Sasakian manifolds, Lorentzian para-Sasakian manifolds, invariant submanifolds of lorentzianpara-Sasakian manifolds, Kenmotsu manifolds, Quasi-Sasakian manifolds, isometric immersion of 3-dimensional quasi-Sasakian manifolds in a Riemannian manifold. Generalized Sasakian space forms, slant submanifolds of generalized Sasakian space forms, generalized Sasakian space form with cyclic parallel Ricci tensor, generalized Sasakian manifold with η-parallel Ricci tensor, projective curvature tensor on generalized Sasakian space forms, trans-Sasakian manifolds, trans-Sasakian manifolds with constant curvature, Legendre curves on 3-dimensional trans-Sasakian manifolds, recurrent 2-recurrent and generalized 2-recurrent submanifolds of transd-Sasakian manifolds,locally φ-symmetric spaces, Einstein and quasi-Einstein spaces, manifolds with quasi-constant curvature, (k,μ)-contact metric manifolds, Ricci Solitons.

References

1. D. E. Blair, Riemannian geometry of contact and symplectic manifolds (Research Monograph).
2. H. Geiges, An introduction to contact topology (Research Monograph).