SYLLABUS FOR Ph.D. PRE-REGISTRATION

COURSE WORK IN MATHEMATICS

PAPER ONE : RESEARCH METHODOLOGY (COMPULSORY)

PAPER TWO : SPECIFIC COURSES (COMPULSORY)

- **UNIT-ONE REAL ANALYSIS**
- **UNIT-TWO COMPLEX ANALYSIS**
- **UNIT-THREE FUNCTIONAL ANALYSIS**
- **UNIT-FOUR RIEMANNIAN MANIFOLD**

PAPER- THREE : OPTIONAL

(ANY ONE OF THE FOLLOWING GROUP TO BE OFFERED BY THE SUPERVISOR CONCERNED)

GROUP A: STRUCTURES ON DIFFERENTIABLE MANIFOLDS

GROUP B: FLUID MECHANICS

(MAXIMUM MARKS FOR EACH PAPERS TO BE 100 AND PASSING MARKS TO BE 40)

COMPULSORY PAPERS

PAPER ONE : RESEARCH METHODOLOGY M.M.100

UNIT ONE : Meaning and objectives of research , Types of research , Research approaches and its significance , History of mathematics , Methodology of mathematical research ,Various methods adopted for doing research in mathematics.

UNIT TWO : Data collection and data analysis ,Elements of probability theory , Binomial , Poisson , and Normal distribution , Expectation , Correlation , Multiple and partial correlation , Regression and its fitting.

UNIT THREE : Organizing a paper , Writing a mathematical statement viz. theorem , corollary , remark , proof etc., How to write abstract and bibliography .

Review of literature. Preparation of Talk and Seminar paper , Preparation of Synopsis / Project , Research grant proposal writing .

UNIT FOUR : Research tools, Searching Google , MathSciNet, ZMATH, Scopus ,Impact factor , h-index , Google scholar, Online and open access Journals,

Library of various countries.

Manuscript preparation using Latex / MS office, Thesis writing , Mathematical software like Mathematica and Matlab.

Reference Books :

1.S.G.Krantz, A primer of Mathematical writings , University Press.

2.J.Stillwell, Mathematics and its History, Springer international Edition,4th Indian Reprint,2005.

3.C.R.kothari,Research methodology, methods and techniques, Vishwa Prakashan.

4.Bhattacharyya, Research methodology, Excel Books,2nd Edition.

5.J.Bell,Doing your research project, Open university Press Berkshire.

6.L.Lamport, Latex a document preparation system, 2nd Edition, Addison Wesly, 1994.

7.E.Krisna, A primer to Latex Tutorials, Trivandrum India,2003.

8.R.Murray, How to write a Thesis? Tata McGraw Hill.

9.S.C.Gupta and Kapoor ,Fundamental mathematical Statistics, S.C.Chand,Delhi.

PAPER TWO: SPECIFIC COURSES (COMPULSORY)M.M.

UNIT-ONE: REAL ANALYSIS

Limit ,Continuity and differentiability of function of several real variables,

Young's Theorem and Schwarz's theorem, Sequence and series of a function

Weierstrass approximation theorem.

UNIT-TWO: COMPLEX ANALYSIS

Conformal Transformation, Contour integration ,Entire function, Infinite products, Meromorphic function, Poission integral, Jenson's Theorem, Riemann mapping theorem,Drichlet's series.

UNIT-THREE: FUNCTIONAL ANALYSIS

Normed linear spaces, Banach spaces, Continuous linear transformation, Hahn-Banach Theorem, Open mapping theorem, Closed graph Theorem Hilbert's spaces,Schwarz's inequality, Reflexivity, Unitary, Self adjoint

Operators. Adjoint of an operator

UNIT-FOUR : RIEMANNIAN MANIFOLD

Riemannian metric , Riemannian connection ,Curvature tensor, Sectional curvature ,Conformal curvature tensor , Projective curvature tensor, Conharmonic curvature tensor and concircular curvature tensor ,Semi – symmetric metric connection.

Reference Books:

1.Walter Ruddin, Principles of mathematical analysis, Vol.1&2,Mc GRAW-Hill, International Edition, 1993.

2.Walter Ruddin, Functional analysis, 2nd Edition Mc GRAW-Hill,1991.

3.S.Ponnusamay, Foundation of complex analysis, Vol.2,Narosa Publishing House, 2013.

4.B.B.Sinha, An introduction to modern Differential Geometry, Kalyani Publication , 1982.

5.R.S.Mishra, A course in tensors with applications to a Riemannian Geometry, 1985.

6.G.F.Simmons, Introduction to Topology and modern Analysis, McGraw Hill, 1963

7. S.Ponnusamay, Foundation of Functional analysis,Narosa Publishing House, 2009.

PAPER- THREE : OPTIONAL M.M.100

(ANY ONE OF THE FOLLOWING GROUP TO BE OFFERED BY THE SUPERVISOR CONCERNED)

GROUP A: STRUCTURES ON DIFFERENTIABLE MANIFOLDS

UNIT-ONE: Almost Hermite Manifolds: Definitions, Almost analytic vector fields, curvature tensor, linear connections, F-connection .

Kahler Manifolds: Definitions, affine connection, curvature tensor, Projective, Conformal, Conharmonic, Concircular and Bochner curvature tensors.

UNIT-TWO: Nearly Kahler Manifold: Definitions, Certain properties, curvature identies, almost analytic vector fields.

Almost Kahler manifold: Definitions, some properties, Conformal transformations, curvature identities.

UNIT-THREE: Almost contact metric manifolds, Basic theorems, Particular affine conections, Sasakian manifolds and its properties.

UNIT-FOUR: Projective, Conformal , Conharmonic , Concircular curvature tensor on Sasakian manifolds .

Reference Books

1. R.S.Mishra, Structures on a differentiable manifold and their applications, Chandrama Publication, Allahabad,1984.

2.K.Yano, Differential Geometry of complex and almost complex Spaces.

3.U.C.De and A.A.Shaikh, Complex manifolds and Contact manifolds, Narosa Publishing House Pvt. Ltd., 2009.

GROUP B: FLUID MECHANICS M.M.100

UNIT-ONE: Basics of general fluid mechanics-Definition: Real fluid, ideal fluid, velocity of fluid, velocity potential, vorticity vector, conservation equation of mass, momentum and energy, vortex Motion.

UNIT-TWO: Stress and strain, Navier- Stokes equation , concept of porous media.

UNIT-THREE: Wave motion in a fluid, speed of sound, supersonic flows, Two phase flow. Normal and oblique shocks. Plano-Poissouille and Coutte flows between parallel plates. Magnetic fluid.

UNIT-FOUR: Curvilinear coordinates, Characteristic method, Similarity methods, Self- similar solution , numerical methods.

Reference Books

1. L.D.Landau and E.M.Lifshitz, Fluid Mechnics, Butterworth –Heinmann 2nd Edition,1987.
2. R.K.Rajput, Text Book of fluid Mechnaics and Hydraulic Mechnacis,S.Chand and company.
3. L.I.Sedov, Similarity and Dimensional method in Mechnacis, Mir Publishers