DEPARTMENT OF MATHEMATICS
DHANAMANJURI UNIVERSITY, IMPHAL

Syllabus for Pre Ph.D Entrance Test 2025

Mode of Examination: The Qualifying Entrance Test (QET) has 50 MCQs (Multiple Choice Question) of 2 marks each comprising 50% of research methodology and 50% of subject concern.
Full Mark: 100
Qualifying Mark: 50

Syllabus of the written test:

PART -A (50 marks)

1. **Real Analysis:**
   Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral.

2. **Algebra:**
   Homomorphism, isomorphisms on groups and rings, class equation, p-group, Sylow's p- groups, theorems, subnormal, Normal, composition series with examples, fields, subfields, proposition, Extension fields, Separable, inseparable, algebraic extensions fields, Normal Extension.

3. **Topology:**
   Definition and examples of Metric space, Complete metric space, Homomorphism, definition and examples of Topological space, closure of a set, Separation axioms, Compactness, Connectedness.

4. **Complex Analysis:**
   Analytic function, Complex integration, Cauchy theorem, Cauchy's integral formula, Morera's theorem, Lioville's theorem, fundamental theorem of Algebra, Taylor's and Laurent's series, singularities, Zeros of Analytic function, Argument principle, Rouche's theorem, Residues, Cauchy residue theorem, evaluation of integrals, open mapping theorem, Bilinear transformation.

5. **Differential Equation:**
   Existence, uniqueness and Continuity of the solutions of ordinary differential equation of first order, Picard's method of successive approximation, Lipschitz condition, Picard's theorem of existence and uniqueness, linear dependence and linear independence of solutions of linear differential equation, Wronskian, theorems on linearly independent solutions and linearly dependent set of functions.

PDE of first order, Lagrange's Method, Cauchy's Method of Characteristics, Charpit's Method, PDE of second order with constant coefficients, Classification of PDE of second order, Wave, Heat(Diffusion) and Laplace Equations, Method of separation of variables.

6. Functional Analysis

Normed linear spaces, Banach space, Continuity of Linear maps, Hahn Banach Theorem, Uniform Boundedness Theorem , Banach Fixed point theorems, Closed graph and Open mapping theorems, Inner product space, Hilbert space, Orthogonal and orthonormal sets.

PART –B (50 marks)

Research Methodology

Research Aptitude:

Research: meaning, Types and Characteristics, Positivism and Post- positivistic approach to research.

Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.

Steps of research

Thesis and Article writing: Formate and styles of referencing

Application of ICT in research.

Research ethics

Data Interpretation: Sources, acquisition and classification of data.

Quantitative and Qualitative Data.

Graphical representation(Bar-chart,histograms, pie-chart, Table-Chart and Line-Chart) and mapping of Data.

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