

**DEPARTMENT OF MATHEMATICS
DHANAMANJURI UNIVERSITY, IMPHAL**



Syllabus for Pre Ph.D Entrance Test 2022

Mode of Examination: The Qualifying Entrance Test (QET) has 40 MCQs (Multiple Choice Question) of 2 marks each and 20 marks of descriptive type in the research field (Each question may carry 5 or 10 marks).

Full Mark: 100

Qualifying Mark: 50(45 for SC/ST/OBC/Differently-abled category).

Syllabus of the written test:

PART-1(80 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, Liouville's theorem, fundamental theorem of Algebra, Taylor's and Laurent's series, singularities, Zeros of Analytic function, Argument principle, Rouché'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.

6. Partial Differential Equation:

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.

PART-II (20 Marks)

Choose any one topic as per your interested research area: (Each question may carry 5 or 10 marks)

A. Algebra:

Groups: Composition series and Jordan Holder Theorem, Solvable Groups and Nilpotent Groups.

Fields: extension of fields, Normal extensions, Finite fields, Galois Extensions and Galois groups.

Modules: Exact sequences, Simple and semi- simple modules, Free modules, Projective and Injective modules, Fundamental Structure.

B. Operations Research:

Linear programming, Simplex method, Big- M method, Duality, Dual Simplex method, Sensitivity analysis, Linear Goal programming, Integer programming, Nonlinear Programming, Quadratic Programming, QPP by Beale's method and Wolfe's algorithm.

C. Functional Analysis (Operator Theory/Fixed point Theory):

Normed linear spaces, Banach space, Linear operator, Bounded Linear Operator, Compact operator, closed operator, adjoint operator, Inner product space, Hilbert Space Fixed points, Banach Contraction Principle.

D. Topology:

Basis for a Topology, Continuous functions, homeomorphism, Product Topology, Separation Axioms, Compactness, Connectedness, Paths, Path Connected spaces.



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Head (i/c)

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