

UNIVERSITY DEPARTMENT OF MATHEMATICS

SYLLABUS OF M. Phil/Ph.D. ENTRANCE EXAMINATION (DEET)

Time : 3 hours

Full Marks: 100

Group A contains 20 multiple choice questions each of marks 2.

Group B contains 18 short answer type questions each of marks 5.

At least **six** questions will be set both in Group A and B from each unit.

Group A is compulsory.

Students are required to answer any **twelve** questions from Group B

UNIT 1

Functions of single variables: Limit and continuity, uniform continuity, differentiability, maxima and minima, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem.

Functions of two variables: Limit and continuity, differentiability, maxima and minima.

Topology of real numbers: Neighbourhood, limit point of a set, open and closed sets, closure of a set, interior, exterior and boundary points, compactness and boundedness, Bolzano Weirstrass theorem and Heine Borel theorem.

Sequence of real numbers and functions: Limit, limit points, convergence, Cauchy general principle of convergence.

Series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy root test and Leibnitz test for the convergence of series.

Riemann Integrals and their properties

Complex analysis: analytic function, C-R equations, singularities, complex integration

UNIT 2

Functions and relations: binary operation, equivalence and partial order relations, equivalence classes and partition of a set.

Groups: properties of groups, subgroups, cyclic groups, abelian and non abelian groups, Cosets, Lagrange's theorem, normal subgroups, quotient groups, permutation groups, homomorphism and isomorphism, Cauchy's theorem and Sylow's theorems.

Ring: Properties, subrings, ideals, integral domain, field, Characteristic, prime ideal, maximal ideal, Euclidean domain, Eisenstein's criterion for irreducibility.

Vector space: subspaces, linear dependence and independence of vectors, basis and dimension, linear transformation, rank and nullity, matrix of linear transformation, Caley-Hamilton theorem, eigen values and eigen vectors of a linear transformation.

Field: finite field, field extension, finite and algebraic extensions.

UNIT 3

Ordinary Differential equation: First order exact differential equations. Integrating factors, rules to find an integrating factor.

First order and higher degree equations solvable for x , y , p . Clairaut's form, singular solutions, general solution. General solution of linear homogeneous and non-homogeneous equations of higher order with constant coefficients, The Cauchy-Euler equation. Second order linear differential equations with variable coefficients.

Partial Differential Equations(PDE): first order first degree by Lagrange's method, first order higher degree by Charpits method, four special forms, Monge's method for the type $Rr + Ss + Tt = V$, Classification of PDE, Homogeneous P.D.E with constant coefficients.