DEPARTMENT OF MATHEMATICAL SCIENCES

KARAKORAM INTERNATIONAL UNIVERSITY GILGIT

Course contents

1st intra-university undergraduate mathematics contest-2022

CALCULUS

Functions, Limits of functions, Continuous functions, Role of limits in the definition of derivatives and integrals, Mean value theorems, Bounded sets, Convergence of sequences and series, Computations and applications of definite integrals to compute areas and volumes.

COMPLEX ANALYSIS

Complex numbers, Analytic and harmonic functions, Cauchy's fundamental and integral theorems, Singularities and residues.

LINEAR ALGEBRA

Matrix algebra, System of linear equations, Vector spaces, Spanning sets, Linear dependence and basis, Linear transformations and matrices, Rank and nullity of linear transformations.

GROUP THEORY

Groups, Sub-group, Modulus Group, Permutation Group, Symmetric Group, Alternating Group, Cyclic Sub-Group and Cyclic Group. Cosets, Lagrange's theorem, Conjugacy classes, Normal Sub-groups and quotient groups Homomorphisms of a group, Ring, Sub-ring, Commutative Ring, Division Ring integral Domain, Fields. Sub-Field, Ideals of ring. Necessary and sufficient condition of sub-ring and sub-ring and sub-field.

TOPOLOGY

Basic definition of topology, Examples of topology, Standard topology on R, Cofinite topology on R, Relative topology, Interior, Closure and limit point of a subset of topological space, Basis and sub-basis of topology.

ORDINARY DIFFERENTIAL EQUATIONS

Familiarity with different techniques for solution of first and second order differential equations, Linear and non-linear differential equations, Exact equations, Integrating factors, Homogeneous and non-homogeneous differential equations, Wronskian and singular points.

VECTOR ANALYSIS

Vector algebra, Limit, Continuity and differentiability of scalar and vector point functions, Vector operators and related identities, Applications to geometry, Line integrals, Surface and volume integrals, Integral theorems.

REAL ANALYSIS

Real number and Real Number system, supremum and infimum, completeness properties of the real numbers, Archimedean property of Real Number, Function and Types, Topology of Real numbers, Sequence and Series and its convergence, Sub-sequence and convergent sequence, limits of numerical sequences; limits and continuity of function , properties of continuous functions on closed bounded intervals, Derivatives of Real Valued function, the mean value theorem, L'Hopital Rule, Riemann Integral and its Properties, Sequences and Series of functions, , point-wise and uniform convergence. Relations of uniform convergence with continuity, Derivatives and Integration, Power series, The Exponentials and logarithmic Functions.