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Annexure

SYLLABUS FOR B.A./B. Sc. (MATHEMATICS), September,2012

Course Structure: Semester-wise distribution.

First Semester (Total marks: General –100)
GHS 11 : Algebra-I, & Calculus – I, (100 marks, 80 lectures)

Second Semester (Total marks: General – 100)
GHS 21 : Geometry & Vector Calculus (100 marks, 80 lectures)

Third Semester (Total marks: General – 100)
GHS 31: Algebra II, & Calculus – II (100 marks, 80 lectures)

Fourth Semester (Total marks: General – 100) (100 marks, 80 lectures)

GHS 41: Statics & Dynamics. (100 marks, 80 lectures)

Fifth Semester (Total marks: Honours - 200)
H 51 : Elementary Number Theory & Advanced Algebra (100 marks, 80 lectures)

H 52: Differential Equations & Advanced Dynamics . (100 marks, 80 lectures)

Sixth Semester (Total marks: Honours - 200)

H 61 : Advanced Calculus (100 marks, 80 lectures)

HOPT62: Optional paper (100 marks, 80 lectures)

Optional Papers : Any one of the followings (100 marks, 80 lectures)
OP 1 : Computer programming in C & Computer Oriented Numerical Analysis
OP 2 : Operations Research
OP 3 Hydro Mechanics
OP4 : Financial Mathematics
OP5 : Discrete Mathematics
OP6 : Mathematical Modeling

(Abbreviation: G = general, H = honours, GH = general and honours)

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ALGEBRA-I & CALCULUS – I

(Number of Teaching hours: 80; Time:3 hrs; Marks: 100)

(To answer five questions, choosing one out of two questions from each unit)

UNIT I : Brief review of basics in set theory such as ways of describing a set, set operations, empty set, disjoint sets, De Morgan's laws, Venn diagrams; power sets, cartesian products, cardinality results; relation as a subset of cartesian product (notation xRy if (x,y) ∈ R); relation on a set: reflexive, symmetric, anti-symmetric, transitive; examples from geometry and number systems; equivalence relation and equivalence classes; partitions.

Functions and graphs: real valued functions such as polynomials, rational functions, logarithmic functions, exponential functions, hyperbolic functions; limits, ε - δ definition, standard theorems on limits, standard limits; continuity : Intuitive idea, ε - δ definition, theorems on sum, difference, product, quotient and composite of continuous functions; discussion of continuity of the functions mentioned earlier and their composites.

UNIT II : Brief review of functions/mappings, inclusion map; restriction of a map; composition of maps; associativity; onto, one-one, bijective maps; inverse images of sets, inverse of a bijective map; finite and infinite sets; Proof of " if A is a finite set then f : A → A is one-one if and only if f is onto"; examples where this assertion does not hold. A brief review of m x n matrix over R/C as a rectangular array of numbers (motivation through systems of linear equations); transpose, conjugate transpose; definition of inverse of a matrix; special type of matrices: diagonal, scalar, upper/lower triangular, nilpotent, idempotent, symmetric, skew symmetric, hermitian, skew hermitian matrices; trace of a square matrix; row vectors and column vectors of a matrix; row rank/column rank of an m x n matrix (in terms of linear independence of row/column vectors of the matrix); Adjoint of a matrix; inverse in terms of adjoints; determinantal rank of matrix; equality of rank and determinantal rank; Elementary operations; elementary matrices; row/column reduced echelon form of a matrix; determination of the inverse of a matrix by elementary operations; theorem on the equality of row-rank and column-rank; rank of a matrix; determination of the rank by elementary operations;); systems of linear equations: homogeneous and non-homogeneous;

UNIT III : Properties of continuous functions defined on closed and bounded intervals : (statements with illustrations only for the following) boundedness, intermediate value theorem, uniform continuity . Derivatives of real valued functions on intervals : definition; Derivative as a rate measurer, derivative as the gradient of tangent (geometrical interpretation only); Theorems on sum, difference, product, quotient and composite of differentiable functions.

Review of methods of differentiation; successive differentiation; Liebnitz's theorem; L'Hospital's Rule (statements only with applications).

UNIT IV. Anti-derivative : review of the standard methods: integration by parts and by partial fractions; integral of a continuous function as the limit of Riemann sum (including sums arising out of unequal distribution of interval); examples of evaluation of integrals from the definition. Definite Integrals, fundamental theorem of integral calculus and differentiability of integrals of continuous functions(statements with illustrations only) properties of definite integral, evaluation of integrals using properties; reduction formulas for $\int sin^n x dx$, $\int cos^n x dx$, $\int tan^n x dx$, $\int e^{ax} sin(mx) dx$, $\int e^{ax} x^n dx$, $\int e^{ax} (log x)^n dx$, ...dx and their combinations; improper integrals, convergence and evaluation from definition.