GHS 11

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)

SECTION - A (Algebra - I, 40 marks)

UNIT I : Brief review of sets, subsets and equality of two sets; relation on a set: reflexive, symmetric, anti - symmetric, transitive; examples from geometry and, number systems; equivalence relation and equivalence classes; partitions. Brief review of functions/mappings, inclusion maps, 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 $f : A \to A$ is one one if and only if f is onto"; examples where this assertion does not hold Graph of a function: rea! valued functions such as polynomials, rational functions, logarithmic functions, exponential functions and hyperbolic functions. Limits, $\epsilon - \delta$ definition, standard theorems on limits, standard limits; continuity: Intuitive idea, $\epsilon - \delta$ definition, theorems on sum, differences, product, quotient and composites of continuous functions; continuity of functions.

UNIT II : A brief review of m $\times$ 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 $\times$ 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

SECTION - B (Calculus - I, 60 marks)

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; Leibniz's theorem; L'Hopital'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 these properties; reduction formulas for $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int e^{ax} \sin mx dx$, $\int e^{ax} x^n dx$, $\int e^{ax} (\log x)^n dx$, $\int \sin^n x \cos^m x dx$ and their combinations; improper integrals, convergence and evaluation from definition.

UNIT V : Brief review of first order first degree equations; Bernoulli's equation; exact equations; reduction to exact form by integrating factors; differential equations of first order but higher degrees Clairut's equation and singular solution; geometrical interpretation applications ot first order differential equations to geometric and physical problems (simple case only) including orthogonal trajectories, introduction of second order homogeneous differential equations with constant coefficients.

Text Books:

1. Bhattacharya, P. B., Jain, S. K., and Nagpaul, SR. : *Basic Abstract Algebra*, Cambridge University Press, 2003.
2. Maity, K. C. and Ghosh, R. K. : *An introduction to Analysis. Differential Calculus. Part I*, New Cental Book Agency Pvt Ltd., 2011.
3, Maity, K. C. and Ghosh, R. K. : *An Introduction to Analysis: Integral Calculus*, New Central Book Agency Pvt Ltd., 2013.

Reference Books:

1. Fraleigh, J. B., *A First Course in Abstract Algebra*, Pearson Education India, 2013.
2. Gopala Krishnan, N.S., *University Algebra*, New Age Intet national Pvt, Ltd. Publishers, 2007.
3. Stewart, J., *Essential Calculus: Early Transcendentals*, Cengage India Pvt Ltd, 2017.
4. Saikia, P. K.: *Linear Algebra*, Pearson, Delhi, 2014
5. Das, B.C. and Mukherjee, B.N., *Differential Calculus* , UN Dhar and Sons Pvt Ltd, 52^{nd} edition, 2012.
6. Das, B.C. and Mukherjee, B.N., *Integral Calculus* , UN Dhar and Sons Pvt Ltd, 52^{nd} edition, 2012. 7. Thomas, G. B., and Finney, R. L.: *Calculus and Analytic Geometry* (9 Edition), Pearson Education India, 2010.