25. MATHEMATICS-A COURSE

APPENID 'A'

(Outlines of Tests)

		Marks
Paper A :	Calculus and Analytic Geometry.	100
Paper B :	Linear Algebra and Differential Equations.	100
	Total Marks	200

General Features of the proposed course

1. To reflect new trends in mathematics courses at the corresponding level in the well reputed International Universities

2. To ensure that a student securing a first class in B.A./B.Sc. examination has prepared and understood at least 75% of the material of certain course.

3. To achieve the objective stated in 2 above, each paper will be divided into four sections and students will be required to answer at least one question from each section.

APPENDIX 'B'

(Syllabi and Courses of Reading)

Paper A : Calculus and analytic Geometry.

Note : Attempt six questions by selecting two questions from Section I, two from Section II, one from Section III and one from Section IV.

SECTION I (i) (2/12)

Real number system, Absolute value and inequalities, solution for equations containing absolute values, solution of inequalities, Function, Bounded sets and functions Limits of functions. One-sided limits. Evaluations of limits using limits theorems. Continuity. Properties of continuos functions (without proofs). Derivative and rate of change. Derivatives of algebraic and transcendental functions. Implicit differentiation. Applications to Business and Economics (cost, revenue and profit function, marginal cost, marginal revenue and marginal profit). Newton-Raphson formula.

(ii) (Further differentiation) (2/12)

Higher Derivatives, Lebniz Theorem. Rolle's Theorem. Mean value Theorems. Increasing and Decreasing Functions. Taylor's and Maclaurin's Theorems with Remainders. Taylor and Maclaurin Series. Indeterminate Forms. L'Hospital Rule.

SECTION II (i) Plane Analytic Geometry (2/12)

Transition and rotation of Axes. General Equation of Second Degree. Polar Coordinates. Polar Equations of Conics. Properties of Parabola, Ellipse and Hyperbola. Tangents and Normals. Parametric Representation of Curves.

(ii) Analytic Geometry of Three Dimensions (2/12)

Rectangular Coordinate System in Space. Direction Angles, Direction Numbers. Equation of Lines and Planes in Scalar and Vector Form. Skew Lines Shortest Distance Between Skew Lines. Cylindrical and Spherical Co-ordinates, Surfaces. Equation of Spheres, Cylinder, Cone, Ellipsoid, Paraboloid and Hyperboloid.

SECTION III (2/12) (Applications of Differentiation)

Differentials. Related Rates. Extrema. Concavity. Applied Problems of Extrema. Singular Points. Tangents at the Origin. Asymptotes. Graphing of Cartesian and Polar Curves. Arc Length Intrinsic Equation and Pedal Equation. Curvature. Evolute and Envelope.

SECTION IV (2/12) (Integration)

Antiderivative and Indefinite Integral. Techniques of Evaluating Indefinite Integral. Integral as Limit of Sum. Fundamentel Theorem of Integral Calculus. Properties of the Definite Integral, Reduction Formulas. Application of Integral Calculus to Find Length of Plane Curves and Areas. Numerical Integration. Trapezoidal Rule and Simpson's Rule.

Recommended Books :

C.H. Edwards and E.D. Penney, Calculus and Analytic Geometry (Prentice Hall, Inc 1982, 1986, 1988).

E.W. Swokowski, Calculus with Analytic Geometry (PWS Publishers, Boston, Massachosetts, 1983).

G.B. Thomas. Jr. and R.L. Finney. Calculus and Analytic Geometry (Addison - Wesley Publishing Company, 9th Edition, 1997).

Paper B : (Linear Algebra and Differential Equation)

Note :- Attempt six questions by selecting two questions from Section I, one from Section II, one from Section III and two from Section IV.

SECTION I (i) (2/12)

Definition of Matrix. Operations with matrices. Algebra of matrices. Various types of matrices. Determinant of square matrix. Cofactors and minors, properties of determinants. Laplace expansion of determinants. Elementary row and column operations on matrices. Equivalent and Echelon matrices. Adjoint and inverse of a matrix, Rank of a matrix. Solutions of linear algebraic (homogeneous and non-homogeneous) systems of equations by the use of matrics. Network flow problems.

(ii) (2/12)

Definition of a field and examples, Vector spaces, real and complex vector spaces. (This course will be mainly concerned with real vector spaces). Examples of vector spaces). Subspaces. Spanning sets and linear combinations. Linear independence. Bases and dimension. Existence of bases in terms of a basis, uniqueness of representation relative to a given basis. Linear transformations. Dimension theorem. Vector space of linear transformations. Matrix of a linear transformation.

SECTION II (2/12)

Inner product spaces. Inner product and norm. Cauchy-Schwarz and triangle inequalities. Orthogonal and orthonormal sets. The Gram-Schmidt process. Eigen values and eigenvectors, degenerate eigenvalues, linearly independent eigenvectors corresponding to distinct and repeated eigenvalues, relevant theorems (without proofs) similar matrices. Similarity transformations and their properties, Orthogonal diagonalization of symmetric matrices (relevant theorems without proof).

SECTION III (2/12)

Genesis of differential equations. Classification of differential equations : linear and nonlinear DEs, homogeneous and inhomogeneous DEs, ordinary and partial differential equations. Various types of solutions of differential equations. Families of curves. Orthogonal trajectories, Initial value and boundary value problems. Existence and uniqueness theorem. Methods of solutions of first order ODEs (linear and non-linear). The Bernoulli, Ricatti and Clairaut equations. Singular Solutions. Applications of first order ODEs in problems of decay and growth, population dynamics, logistic equation.

SECTION IV (i) (2/12)

Higher order ODEs, General theory, Existence and uniqueness theorems. Linear independence of solutions. Wonskian Methods of solutions of higher order linear ODE (1) Operator method (2) Method of undetermined coefficients. (3) Variation of parameters (1) Reduction of order. The Euler-Cauchy equation. Application of 2nd order ODEs to mechanical and electrical systems.

(ii) (2/12)

Power series solutions of first order and second order equations, (only simple cases involving ordinary points are to be considered). Laplace transform, Applications of Laplace transform method to problems associated with ODEs—Systems of linear ODEs and their solution by operator method

Recommended Books :-

C.H. Edwards, J. and D.B. Penny, Elementary Linear Algebra (Prentice Hall International Edition, 1988).

H. Anton, Elementary Linear Algebra (7th edition, J.M. Wiley, 1977)

G. Hadley, Linear Algebra, (Addison-Wesley, 1987).

D.G. Zill, A first Course in Differential Equations with Applications (PWS Publishers Second edition, 1982).

C.H. Edwards. Jr. and D.E. Penny, Differential Equations with applications and Boundary Value Problems (Prentice-Hall, International Edition, 1996).

W.E. Boyce and Diprima, Elementary Differential Equations and Boundary value problems. (J. Wiley, 8th edition, 1992).

N. Fizino and G. Ladas Ordinary Differential Equations with Modern Applications (Wardsworth Third edition 1988).