Mathematics A Course

B.Sc.: Elective

General Features of the proposed course

1. To reflect new trends in mathematics course 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.

Outlines of Tests

Paper	Title of Course	Marks
A	Calculus and Analytic Geometry	100
B	Linear Algebra and Differential Equations	100
	Total	**200**

Syllabi and Courses of Reading

Paper A : Calculus and Analytic Geometry.

Note : Attempt six question by selecting two question 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 function Limits of functions. One-sided limits. Evaluation of limits using limits theorems, Continuity. Properties of continuous functions (without proofs). Derivative and rate of change. Derivative 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 Theorem Increasing and Decreasing functions. Taylor's and Maclaurin's Theorem 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 Dimension (2/12)

Rectangular Coordinate System in space. Direction Angels, Direction Numbers. Equation of Lines and Planes in Scalar and Vector Form. Skew Lines, Shortest Distance between Skew Lines. Cylindrical and Spherical Coordinates, Surfaces. Equation of Spheres, Cylinder, Cone, Ellipsoid, Paraboloid and Hyperboloid.

SECTION III(1/12) (Application 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(1/12) (Integration)

Antiderivative and Indentifinite Integral. Techniques of Evaluating Indentific Integral. Integral as limit of sum. Fundamental 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 :

1. C.H. Edwards and E.D Penney, Calculus and Analytic Geometry (Prentice Hall, Inc. 1982,1986,1988)
2. E.W Swokowski, Calculus with Analytic Geometry (PWS Publishers, Boston, Massachosetts, 1983).
3. G.B Thomas. Jr. and R.L Finncy. Calculus and Analytic Geometry (Addison-Wesley Publishing Company, 9th Edition, 1997)
4. S.M Yusuf and Muhammad Amin, Calculus with Analytic Geometry (Ilmi Kitab Khana, Kabir Street Urdu Bazar Lahore, Latest Edition.

PAPER B:LINEAR ALGEBRA AND DIFFERENTIAL EQUATION

Note:- Attempt six question by selecting two question from section I, one form section II, one from Section III and Two from Section IV.

SECTION I (i) (2/12)

Definition of Matrix. Operation with matrices. Algebra of matrices. Various type of Matrices. Determinant of square matrix. Cofactors and minors, properties of determinants. Laplace expansion of determinants. Elementary row and column. Operation on Matrices. Equivalent and Echelon matrices. Adjoint and inverse of matrix Rank of a Matrix. Solution of Linear algebraic (homogeneous and Non Homogeneous) System of Equation by the Use of Matrices. Network Low 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. Subspace. Spanning sets and linear combination. Linear independence. Bases and Dimension. Existence of bases in terms of 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 orthogonal sets. The Gram Schmidt process. Bigen values and eigenvectors, degenerate elgenvalues, relevant theorems (without proofs) similar matrices. Similarly transformation and their properties, Orthogonal diagonalization of Symmetric matrices (relevant theorem without proof).

SECTION III (2/12)

Genesis (i.e origin) of Differential Equations. Classification of differential equations: Linear and nonlinear Des, homogeneous and inhomogeneous DEs, Ordinary and Partial Differential equations. Various type of solution of differential equations. Families of Curves. Orthogonal trajectories, Initial value and boundary value problems. Existence and uniqueness theorem. Method of Solution of first order ODE (Linear and Non Linear). The Bernoulli, Ricatti and Clairaut equations. Singular Solution. Application of first order ODEs, in problem of decay and growth, population dynamics, logistic equation.

SECTION IV (i) (2/12)

Higher order ODEs, General theory Existence and uniqueness theorems, Linear Independence, Methods for solutions of higher order linear ODE (i) Operator Method (ii) Method of undetermined coefficient. (iii) Variation of Parameters (Wronskin). (iv) 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 transforms, Applications of Laplace transform method to problems associated with ODEs-System of Linear ODEs, and Their solution by operator method.

Recommended Books:-

1. C.H. Edwards, J. and D.E Penney, Elementary Linear Algebra (Prentice Hall, Inc. National Edition.1988)
2. H. Anton, Elementary Linear Algebra (7^{th} edition J.M. Wiley, 1977).
3. G. Hadley, Linear Algebra (Addison-Wesley, 1987).
4. D.G. Zilla A first Course in Differential Equations with Applications (PWS Publishers Second Edition, 1982)
5. C.H. Edwards. Jr. and D.E Penny Differential Equation with application and Boundary Value Problems (Prentice Hall, International Edition, 1996).
6. Mathematical Methods S.M Yusuf and Muhammad Amin (Ilmi Kitab Khana, Kabir Street Urdu Bazar Lahore, Latest Edition.
7. W.E Boyce and Diprima, Elementary Differential Equations and Bound Value Problems (J.Wiley, 5^{th} edition. 1992)
8. N. Fizino and G. Ladas Ordinary Differential Equations with Modern Applications (Wardsworth Third edition 1988.)