

MATHEMATICS

SCHEME OF STUDIES:

FOR /B.Sc

1. There shall be three different courses of studies in Mathematics.

- i) A-Course of Mathematics
- ii) B-Course of Mathematics
- iii) General Mathematics.

2-Each course will have status of one subject.

3. It is recommended that following division be made. I. A-

1-Course of Mathematics

- (i) Differential and Integral Calculus
- (ii) Complex Numbers and Analytic Geometry.
- (iii) Infinite series, differential equations Laplace transform.
- (iv) (a) Linear Programming and application of the Differential Calculus (b) Application of the Integral Calculus

2. B-Course of Mathematics

- (i) Group Theory and Linear Algebra
- (ii) Vector Analysis and Statics
- (iii) Number Theory, Topology and Inner Product Spaces
- (iv) Numerical Methods and Dynamics

3. General Mathematics

- (i) Complex Number and Linear Algebra
- () Differential and Integral Calculus
- (iii) Applications of Differential and Integral Calculus and Analytic Geometry of these dimensions.
- (iv) (a) Numerical Methods and Infinite Series (b) Linear Programming and Differential Equations

COURSE CONTENTS B.Sc.

A-COURSE OF MATHEMATICS

PAPER-I DIFFERENTIAL AND INTEGRAL CALCULUS

Note: Students have to attempt 5 questions out of 8. Selecting 3 from Part-I and 2 from Part-II

Section-I (5 out of 8)

Differential Calculus

A review of real number system. Absolute values. Upper and lower bounds of variables and functions. Right and left limits of functions. Theorems about limits. Continuous and discontinuous functions and their graphs. Inverse of a function. Inverse hyperbolic functions and their graphs. Definition of derivatives in terms of left and right limits. Geometrical interpretation of derivatives. Relationship between continuity and differentiability. Derivatives, Partial derivatives, Differentials and related rates. Higher derivatives of functions. Leibnitz's theorem. Rolle's theorem. Lagrange's mean value theorem. Increasing and decreasing functions. Cauchy's mean value theorem. Taylor's and Maclaurin's theorems in finite and infinite form and their use in expansion of functions in series. Indeterminate forms and L'Hospital's rule.

Section-II (3 out of 8)

Integral Calculus

Riemann's definition of definite integral as the limit of a sum. Properties of definite integrals. Fundamental theorem of calculus. Techniques of integration and reduction formulae.

Text Book

Recommended Books

1. Zia-ul-Haq, Calculus and analytical Geometry, Carvan Book, 2001.
2. H. Anton, Calculus. edition (1998). John Wiley and Sons, New York.
3. C.H. Edwards and D.E. Penney, Calculus and Analytical Geometry, (Latest Edition).
Prentice Hall, Inc.
4. E.H. Swokowski, Calculus with Analytical Geometry (Latest Edition). PWS Publishers,
Boston, Massachusetts.

5. G.B. Thomas, Jr. and R.L. Finney, Calculus and Analytical Geometry. (Latest Edition).
Addison-Wesley Publishing Company.

(A)

PAPER-II

COMPLEX NUMBERS AND GEOMETRY

Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-I (3 out of 8)

Complex Numbers

Complex numbers and their, polar representation. Euler's formula. De Moivre's theorem and its applications. Trigonometric and hyperbolic functions. Exponential and logarithmic functions. Separation of complex valued functions into real and imaginary parts. Summation of series.

Section-II (5 out of 8) Analytical

Geometry

Two-dimensional Analytical Geometry (2 out of 8)

Translation and rotation of axes. General equation of the second degree and the classification of conic sections. Conic sections in polar coordinates. Tangents and normals. Pedal equation of curves. Tracing of polar curves.

Three dimensional Analytical Geometry (3 out of 8)

Direction cosines and ratios. Angles between two lines Standard forms of equations of planes and lines. Intersection of planes and lines. Distances between points, lines and planes. Spherical, polar and cylindrical coordinate systems. Standard form of the equation of a sphere, cylinder, cone, ellipsoid, parabolic and hyperboloid. Symmetry, intercepts and sections of a surface. Tangent planes and normals.

Recommended Books

1. **Dar, K. H, Mathematical Techniques**, The Carvan Book House, 2001.
2. Zia ul Hach Calculus and Analytic Geometry The Carvan Book House, 2001.
3. C.H. Edwards and D.E. Penney, Calculus and Analytical Geometry, (Latest Edition). Prentice Hall, Inc.

4. E.H. Swokowski, Calculus with Analytical Geometry (Latest Edition). PWS Publishers, Boston, Massachusetts.
5. H. Anton, Calculus. (Latest Edition). John Wiley and Sons, New York.
6. G.B. Thomas, Jr. and R.L. Finney, Calculus and Analytical Geometry. (Latest Edition). Addison-Wesley Publishing Company.

Math- A.Course

PAPER-III

INFINITE SERIES AND DIFFERENTIAL EQUATIONS

Note: There will be 8 questions in all. The candidates would be required to attempt 5 questions. Selecting 2 from section-I and 3 from section-II.

Section-I: (3 out of 8)

Infinite Series

Sequences of numbers and their convergence. Algebra of convergent sequences. Infinite series and their convergence. Convergence tests for infinite series: Comparison, quotient, ratio, root & integral tests. Absolute and conditional convergence. Interval of convergence and radius of convergence.

Section-II (5 out of 8)

Differential Equations

Definition of differential equation & types of differential equations and their formation. Different methods of solving first order ordinary differential equations. The Bernoulli, Riccati and Clairaut equations. Families of curves Orthogonal trajectories. Initial and boundary value problems. Application of first order differential equation in problems of decay & growth of population of dynamics and logistics. Second and higher order linear differential equations with constant coefficients and their methods of solutions. Cauchy Euler equations, system of second order linear differential equations. Method of undetermined coefficient. Method of variation of parameters. Reduction of order. Laplace transform and its applications.

PAPER-IV

- (a) **Linear Programming and application of the Differential Calculus**
- (b) **Application of the Integral Calculus OR**

A Computer Language C / C++

Note: This option is withdraw with effect from session 2006-2007 onwards.

Note: Students have to attempt 5 questions out of 8. Selecting 3 from section-I and 2 from section-II.

Section-I (5 out of 8)

(a) Applications of Differential Calculus 4/5

Curves and their Cartesian, polar and parametric representations. Asymptotes Maxima Minima. Points of inflexion and their applications. Singular points. Curve tracing. Curvature, centre and radius of curvature. Functions of several variables and partial derivatives with special reference to the case of two variables. Eulers theorem and implicit functions. Maximum and minimum of functions of one and two variables with applications. Approximation, Equation of tangent plane and normal line to a surface.

(b) Linear Programming 1/5.

Introduction to Operations Research in general and in particular to linear programming. Simplex method.

Assignment model

Section-II: (3 out of 8)

Application of Integral Calculus:

Rectification and quadrature. Simple cases of double and triple integrals. Volumes and area of surfaces of revolution.

Books Recommended

1. W. A. Spivey Linear Programming, McMillan Co.
2. Hamday A. Taha, Operations Research
3. Hiller, Introduction to Operations Research
4. A. Sultan Linear programming, Academic press.
5. Dar, K. H. Mathematical Techniques, Carvan Book House, 2001.

B-COURSE OF MATHEMATICS

PAPER-I GROUP THEORY AND LINEAR ALGEBRA

Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-1 (3 out of 8)

Group Theory

Definition and examples of groups. Groups of residue classes. Cyclic groups Order of a group and order of an element of a group. Subgroups. Cosets. The Lagrange's theorem (Connection between the order of a group and order of its elements) and its applications.

Introduction to Permutations: even and odd permutations. Cycles; length of cycles, transpositions.

Section-II (5 out of 8) Linear

Algebra:

Fields. Vector spaces and subspaces with their examples. Linear dependence and independence. Bases and dimensions of finitely spanned vector spaces. Linear transformation of vector spaces. Motivation of matrices through a system of linear homogeneous and non-homogeneous equations. Elementary row and column operations on matrices. Algebra of matrices. Determinants of matrices, their properties and evaluation Various kinds of matrices. Matrix of a linear transformation. Rank of a matrix. Evaluation of rank and inverse of matrices Solution of homogeneous and non-homogeneous linear equation. (Gaussian Elimination method, Gauss-Jordan Method)

Books Recommended

1. C.H. Edwards, Jr. and D.E. Penny, Elementary Linear Algebra. (Latest Edition). Prentice-Hall, International Edition
2. H. Anton, Elementary Linear Algebra, (Latest Edition). J. Wiley. G. Hadley, Linear Algebra. (Latest Edition). Addison-Wesley.
J.B. Fraleigh. First Course in Abstract Algebra. (Latest Edition), Addison and Wesley.
K.H. Dar. First step to Abstract Algebra. (2nd edition 1998). Feroz Sons Pvt.
3. A. Majeed. Group Theory

4. K.L. Mir, Linear Algebra, Ilmi Kutab Khana.

PAPER-II

VECTOR ANALYSIS AND STATICS

Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-I: (3 out of 8)

Vector Analysis

Three dimensional vectors, coordinate systems and their bases. Scalar and vector triple products. Differentiation and Integration of vectors. Scalar and vector point functions, concepts of gradient, divergence and curl operators alongwith their applications.

Section-II: (5 out of 8)

Statics

Composition and resolution of forces. Particles in equilibrium. Parallel forces; moments, couples. General conditions of equilibrium of coplanar forces. Principle of virtual work, Friction. Centre of gravity.

Books Recommended

1. A.E. Coulson, An Introduction to Vectors. (Latest Edition). Longmans, Green and Co.
2. G.D. Smith, Vector Analysis. (Latest Edition). Oxford University Press.
3. K. L. Mir, Vector Analysis. (Latest Edition). Ilmi Kitab Khana.
1. M.N. Talpur, Calculus with Analytic Geometry.
2. Collinson. Introductory Mechanics, (Latest Edition). Edward Arnold (Publishers) Ltd., London.

6. L. Syngé and B.A. Griffith, (Latest Edition). Principles of Mechanics. McGraw-Hill.
7. Chester, Mechanics, (Latest Edition). George Allen and Unwin.
8. R. Whitworth and Dyke. Guide to Mechanics, (Latest Edition). Macmillan.
9. Q. K. Otori, Introduction to Mechanics (West Pakistan Publishing Co., Ltd., Lahore).

PAPER-III

NUMBER THEORY, INNER PRODUCT SPACES &

TOPOLOGY

]Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-I (3 out of 8) Number

theory

Divisibility Euclid's theorem (Division Algorithm) Common and greatest common divisors..Least common multiple. Theory of Primes. Linear Equations. Diophantine Equations.

Section-II (5 out of 8)

Topology & Inner Product Spaces:

Definition and Examples of Topology & Topological Spaces. Open and closed sets in topological spaces. Neighbourhood. Limit point, Interior, exterior, boundary and closure of a set in a topological space. Definition and examples of metric spaces, open balls, open sets and neighbourhood in a metric space. Interior Exterior boundary and closure of a set in a metric space. Definition and examples of Inner Product Spaces, Orthogonality, Orthogonal and Orthonormal system, Orthogonal metrics.

PAPER-IV

NUMERICAL METHODS AND DYNAMICS

Note: Students have to attempt 5 questions out of 8. Selecting 3 from section-I and 2 from section-II.

Section-I: (5 out of 8)

Dynamics of a Particle

Motion in a straight line. Uniformly accelerated and resisted motion. Velocity, acceleration and their components in cartesian and polar coordinates; tangential and normal components, radial and transverse components. Relative motion. Angular velocity. Conservative forces. Projectiles. Central forces and orbits. Simple harmonic motion. Damped and forced vibrations.

Section-II: (3 out of 8)

Numerical Methods

Introduction to Numerical Analysis. Numerical Solution of Algebraic and Transcendental

Equations: graphical method, bisection method, iteration method, Newton-Raphson method, secant method and method of false position. System of Linear equations: Gauss-seidel and Jacobi methods. Numerical integration: Trapezoidal and Simpson's rules.

(If possible computer programming may be used for problem solving.)

Books Recommended

1. Robert -W. Horn beck, Numerical Methods, Quantum Publishers.
2. Alestair Wood, Introduction to Numerical Analysis, Addison Wesley.
3. M. Iqbal, Numerical Analysis, National Book Foundation.
4. S.A. Bhatti, N.A. Bhatti, Numerical Methods
5. S.M. Fahfa, Introduction to Point set topology.
6. B. Ahmad, General Topology, 1998.
7. S.Manzur Hussain, Introduction to theory of Numbers.

GENERAL MATHEMATICS

PAPER-I

COMPLEX NUMBER, LINEAR ALGEBRA AND ANALYTIC

GEOMETRY

Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-I: (3 out of 8)

Complex Number System

Complex numbers and Polar form. De-Moivres' Theorem. n th roots of complex numbers. Hyperbolic functions. Sum of trigonometric series.

Section-II (5 out of 8)

Linear Algebra and Analytic Geometry

Matrices: rank and inverse of a matrix. Linear transformations and their matrices. Determinants. System of linear equations. Analytic Geometry of two Dimension. Translation and rotation of axis, Properties of tangents and normals. Polar equation of conic. Pedal equation. Tracing of polar curves.

PAPER-II

DIFFERENTIAL & INTEGRAL CALCULUS

Note: Students have to attempt 5 questions out of 8. Selecting 3 from section-I and 2 from section-II.

Section-I (5 out of 8)

Differential Calculus

Techniques of finding limits. Continuity of a function Differentiability. Indeterminate forms, use of Rolle's theorem, mean value theorems (Lagrange and Cauchy). Taylor and Maclaurin's series. Derivatives, Higher Derivatives and Partial Derivatives. Related rates.

Section-II: (3 out of 8)

Integral Calculus

Techniques of integration, Definite integral as limit of a sum, Evaluation of a definite integral by definition, Improper integrals, reduction formulae.

PAPER-III

APPLICATION OF DIFFERENTIAL, INTEGRAL CALCULUS AND ANALYTIC GEOMETRY OF THREE DIMENSIONS

Note: Students have to attempt 5 questions out of 8. Selecting 3 from section-I and 2 from section-II.

Section-I: (5 out of 8)

Application of differential and Integral Calculus:

Asymptotes, maxima and minima of a function of one and two variables. Curvature and center of curvature, rectification, quadrature, Euler's theorem, Chain Rule, Total derivative, Equation of tangent, Plane and normal lines to surfaces volume and surface area of revolution, Simple cases of double and triple integrals.

Section-II: (3 out of 8)

Analytic Geometry:

Direction cosines and Ratios. Angle between two lines. Standard form of equations of planes and lines. Intersection of planes and lines. Distance between points, lines and planes. Spherical. Polar and cylindrical coordinate systems. Standard form of the equations of a sphere, cylinder, cone, ellipsoid, paraboloid and hyperboloid. Symmetry and intercepts of a surface. Tangent planes and normals.

PAPER-IV

(a) Numerical Methods and Infinite Series

(b) Linear Programming and Differential Equations

Note: Students have to attempt 5 questions out of 8. Selecting 2 from section-I and 3 from section-II.

Section-I: (3 out of 8)

Numerical Methods and Infinite Series:

Introduction to infinite series and tests for their convergence and divergence. Absolute and conditional convergence. Introduction to Numerical Analysis. Numerical Solution of algebraic and transcendental equations: bisection method, Newton-Raphson method.

Section-II (5 out of 8)

Linear, Programming & Differential Equations

Introduction to linear programming. Simplex methods and their examples from real life. Differential equations of first order. Variables, Separable, Homogenous equation, Exact equation, Linear differential equation, Bernoulli's equation, orthogonal trajectories, Diff.

Eq. of 2nd and higher order, Cauchy Euler equation, methods of D-operator and method of variation of parameters. Method of undetermined Coefficient.

Books Recommended for General Mathematics (Papers I to IV)

1. S.T.Tan. Applied Mathematics. For the Managerial, life, and social sciences,
2. H. Anton, Elementary Linear Algebra. (7th edition, 1997). Wiley.
3. Fazzino and G. Ladas, Ordinary, Differential Equations with Modern Applications, (Latest Edition). Wadsworth.
4. E. Kreyszig, Advanced Engineering Mathematics, (Latest Edition). J. Wiley.
5. C.W. Evans, advanced Engineering Mathematics. (Latest Edition). Chapman and Hall.
6. H. Anton, Calculus, (Latest Edition). John Wiley and Sons, New York.
7. E. Kreyszig, Advanced Engineering Mathematics, (Latest Edition), J. Wiley.
8. M. Iqbal Numerical Analysis. (Latest Edition). National Book Foundation.
9. Faiz Ahmad and M.A. Rana Elements of Numerical Analysis, (Latest Edition). National Book Foundation.
10. S.M. Yousaf, Mathematical Methods.
11. Hamday A. Taha, Operations Research.
12. A. Sultan Linear Programming, Academic Press. **Other**

Books

1. Calculus S.M. Yousaf
2. Mathematical Methods S.M. Yousaf

3. Introduction to Mechanics S.M.Yousaf
4. Topology Ch. M. Amin
5. Introduction Set Topology S.M.Yousaf
6. Metric Spaces by Z.R. Bhatti
7. Elementary Theory of Numbers by Sayyad Manzoor Hussain
8. Elementary Numerical Analysis by Dr. M. Iqbal
9. Vector Analysis by Dr. Munawwar Hussain