

REVISED SCHEME OF STUDIES FOR B.A / B. SC MATHEMATICS

TWO YEARS PROGRAMME

The syllabi and courses of reading for B.A/ B. Sc (Mathematics) session of 2016 onward are hereby proposed. There shall be three different courses of studies:

(i) A-Course of Mathematics

(ii) B-Course of Mathematics

(iii) General Mathematics

1. Each course mentioned above shall carry 200 marks.
2. There shall be two papers in each course of study.
3. The students who intend to do M. Sc. Mathematics must opt for both the A & B course of Mathematics or general Mathematics with Physics.
4. The practice of setting unseen question in the question paper of the examination is initiated.
5. To avoid selective studies, each question paper may be divided into maximum possible sections.
6. From the scheme of study the paper I of each course should opt in third year and paper II opt in fourth year.
7. For general Mathematics paper I should opt in third year and paper II opt in fourth year.

A-COURSE OF MATHEMATICS:

PAPER-I: CALCULUS AND ANALYTICAL GEOMETRY.

(100 Marks)

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

Section I

(2 questions out of 3 questions)

DIFFERENTIAL CALCULUS

Definition of calculus and its importance, real numbers with their properties, limit, theorems of limit, continuity, differentiability (first and higher order) and their physical significance, Leibnitz's theorem. Rolle's theorem, mean-value theorems (Lagrange's and Cauchy), increasing and decreasing functions, Taylor's and Maclaurin's theorems in finite and infinite forms and their use in expansion of functions in series, Remainder theorem, indeterminate forms and L Hospital's rule, Applications of Rolle's and Mean value theorems and their applications.

Section II

(1 question out of 2 questions)

INTEGRAL CALCULUS

Integral definition and its physical significance, definite and indefinite integrals, Riemann's definition of integral, techniques of integration, properties of definite integrals, fundamental theorem of calculus, proper and improper integrals, and reduction formulae, rectification and quadrature, Simple case of double and triple integrals, surfaces and volumes of revolution.

Section III

(1 question out of 2 questions)

PLANES CURVES

Curves and their Cartesian, polar and parametric representations, asymptotes, maxima, minima, points of inflection and their application, convexity and concavity, Singular point, curvature, center and radius of curvature, functions of several variables and partial derivatives with special reference to the case of two variable, Euler's theorem and implicit functions, maximum and minimum of functions of more than one variable using Lagrange's multiplier method with or without constant, involute and evolute, arc length and intrinsic equations.

Section IV

(2 question out of 3 questions)

ANALYTICAL GEOMETRY

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, properties of circle, parabola, ellipse, and hyperbola, pedal equations, parametric representation of curves.

Rectangular, cylindrical and spherical polar coordinates system in space, direction angles, direction cosines and direction ratios, equation of line and plane, intersection of planes and line, shortest distance, equations of sphere, cylinder, cone, ellipsoid, paraboloid and hyperboloid, symmetry, intercepts and section of a surface, tangent and normal planes, spherical trigonometry and direction of Qibla

Recommended Books:

1. Thomas, (2012). *Calculus*, 12th edition. Addison Wesley Publishing Company.
2. H. Anton, (2013). I. Bevens, S. Davis, *Calculus*, 8th Edition, John Wiley & Sons, Inc.
3. Hughes-Hallett Gleason, McCallum, (2002). *Calculus Single and Multivariable*, 3rd Edition. John Wiley & Sons, Inc.
4. Frank A. Jr, Elliott Mendelson, (1999). *Calculus*, Schaum's outlines series, 4th Edition.
5. C.H. Edward and E.D Penney, (1988). *Calculus and Analytics Geometry*, Prentice Hall, Inc.
6. E. H. Swokowski, (1983). *Calculus and Analytic Geometry*, PWS Publishers, Boston, Massachosetts,.

A-COURSE OF MATHEMATICS:

PAPER-II: MATHEMATICAL METHODS AND NUMBER THEORY. (100 Marks)

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

SECTION I

(2 questions out of 3 questions)

LINEAR ALGEBRA

Algebra of Matrices, determinants and their properties, elementary row and column operations, rank of a matrices, inverse of matrix, solution of homogeneous and non-homogenous systems of equations.

Fields, vector spaces, subspaces, linear dependences and independence, basis and dimension of finitely spanned vector space, linear transformations, matrices of linear transformations, Eigen -values and Eigen- vectors, rank and nullity, inner products and norms, Cauchy Schwarz inequality , triangular inequality, parallelogram identity, orthonormal set and basis and diagonalization of matrices.

SECTION II

DIFFERENTIAL EQUATIONS

(2 question out of 3 questions)

Historical background and motivation, solution of first order differential equations(separable homogenous, exact, non-exact, Bernoulli, Ricatti, Clairaut), formulation (modeling) of first order differential equation arising in problems of population, dynamics and logistics.

Second and higher order linear differential equations and their applications, solution of homogeneous and non-homogeneous differential equations with constant coefficients, method of undetermined coefficients and variation of parameter method.

SECTION III

I (1 question out of 2 questions)

NUMBER THEORY

Divisibility and Euclid's theorem (division algorithm theorem), common divisors, greatest common divisors, least common multiple, prime numbers, congruences, residue systems, Euler's theorem, Fermat's theorem, solution of congruences.

SECTION IV

(1question out of 2 questions)

COMPLEX VARIABLES

Review of complex numbers, polar form and Argand diagram, De Moivre's theorem and its applications, trigonometric, hyperbolic, exponential and logarithmic functions of a complex variable, separation of complex valued functions into real and imaginary parts and summation of series.

Recommended Books:

1. Howard Anton and Chris Rorres, (2005) *Elementary Linear Algebra Applications Version*, John Wiley and Sons Inc. 9th Edition,
2. Bernard Kolman, David R. Hill, (2001) *Introduction Linear Algebra with Applications*, Prentice Hall International, Inc. 7th Edition,
3. Erwin, Kreyszig, (2004) *Advanced Engineering Mathematics*, John Wiley and Sons,
4. Dennis G. Zill & Michael R. Cullen, (2000) *Differential Equation With Boundary Value Problems*, PWS Publishing Company,
5. Burton, D. M. (2000). *Elementary Number Theory*, McGraw Hill.
6. Adler, Andrew, Coury and John E. (1995). *The theory of numbers*, Jones and Bartlett publishers Boston
7. D. G. Zill and P. D. Shanahan, (2003) *Complex Analysis*, (Jones and Bartlett Publishers,)
8. H. S. Kasana, (2005) *Complex Variables: Theory and Applications*, (Prentice Hall,)

B-COURSE OF MATHEMATICS:

PAPER-I: VECTOR ANALYSIS AND MECHANICS

(100 Marks)

Note: Attempt six questions by selecting one question from section I and II, two questions

from section III and IV

SECTION I

(1 question out of 2 questions)

GROUPS

Definition of group, abelian and non-abelian groups, order of a group, subgroups, cosets, Lagrange's theorem and its applications, cyclic groups, permutations, transpositions, even and odd permutations.

SECTION II

(1 question out of 2 questions)

VECTOR ANALYSIS

Vector algebra, three dimensional vectors, coordinate systems and their bases, scalar and vector triple products, differentiation and integration of scalar and vector point functions, concepts of gradient, divergence and curl operators along with their applications, partial derivative of vector point function.

SECTION III

(2 questions out of 3 questions)

STATICS

Basic concepts and principles, inertial and non-inertial frames, Newton's laws, compositions and resolutions of forces, inertial particles in equilibrium, parallel forces, moment of a force about a point, Varignon's theorem, couples, moment of a couple, general conditions of equilibrium of coplanar forces, friction, fluid friction, laws of frictions, principle of virtual work and its applications, centre of mass and gravity, discrete and continuous systems, density of rigid and elastic bodies.

SECTION IV

DYNAMICS

(2 questions out of 3 questions)

Motion in a straight line, rectilinear motion of a particle, curvilinear motion of particle, uniformly accelerated and resisted motion, velocity and acceleration in cartesian and polar coordinates, tangential and normal components, radial and transversal components, relative motion, projectile motion, trajectory, time of flight, vertical motion and motion on an inclined plane, angular velocity, work, power, kinetic energy, conservation of energy, torque, impulse, conservation of linear and angular momentum, conservative and non-conservative forces, simple harmonic oscillator, amplitude, period, frequency, damped and forced vibrations, central forces and orbits, elastic string and springs, Kepler's laws of planetary motion.

Recommended Books:

1. Hwei P. HSU, (1984) *Applied Vector Analysis*, San Diego, New York,.
2. Murray R. Spiegel, (1959) *Vector Analysis*, Schaum's Outline Series, McGrawHill Book Company,
3. Fowles, G.R, Cassiday, G.L. (2005) *Analytical Mechanics*, 7th Edition, Thomson Brook Cole,
4. Jafferson, B. Beasdsworth, T. (2001) *Further Mechanics*, Oxford University press.
5. Joseph F. Shelley, (1999) *Vector Mechanics*, Mc-Graw Hill Company,
6. Murray R. Spiegel, *Theoretical Mechanics*, Schaum's Outline Series, Mc
7. D.K. Anand and P.F. Cunnif, *Statics and Dynamics*, All.
8. . I.N. Herstein, (1964) *Topics in Algebra*, Xerox Publishing Company,.
9. Vivek Sahai and Vikas Bist, (1999) *Algebra*, Narosa Publishing House,
10. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, (1986) *Basic Abstract Algebra*, C.U.P.,

B-COURSE OF MATHEMATICS:

PAPER-II: NUMERICAL ANALYSIS AND METRIC SPACES.

(100 Marks)

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

SECTION I

(2 questions out of 3 questions)

NUMERICAL METHODS

Error analysis, numerical solution of algebraic and transcendental equations, bisection method, iteration method, Newton-Raphson method, secant method, method of false position, difference operators, difference tables, Newton's forward and backward difference formulae for interpolation.

SECTION II

(1 question out of 2 questions)

Any one of the following two parts (i), (ii).

I. INTRODUCTION TO PROGRAMMING

(The Students opting computer sciences as one of their elective subject are not allowed to opt this part)

Introduction to Problem solving. Identification of common problem-solving approaches. Writing simple programs using assignment and sequence. Variables, Simple types, Operators and expressions. Conditional and repetitive statements. Development of solutions using the notions of procedural and data abstraction. Introduction to programming: syntactic constructs, data abstraction, Input and output. Simple functions. Program structure and organization. Program testing and debugging.

II MATHEMATICAL STATISTICS.

(The student opting statistics as one of their elective subject are not allowed to opt this part)

Statistical measures, Statistical description and graphical representation of data, sets, introduction to probability theory, permutations and combinations, random variables, probability distributions, mean, standard deviation, variance and expectation, binomial, poisson, hypergeometric and normal distributions, normal approximation to binomial distribution, distribution of several random variables.

SECTION III

INFINITE AND FOURIES SERIES

(1 questions out of 2 questions)

Sequences and series, infinite series and their convergence, comparison, ratio, root and integral test for convergence, absolute and conditional convergence, Fourier sine and cosine series.

SECTION IV

(2 question out of 3 questions)

METRIC SPACES

Definition and various examples of metric spaces, holder's inequality, Cauchy-schwarz and minkowski's inequality, open and closed balls, neighborhoods, open and closed sets, interior, exterior and boundary points, limit points, closure of a set, convergence in metric spaces, Cauchy sequences, continuity in metric spaces.

Recommended Books:

1. *Dlane Zak, (2006) An Introduction to Programming with C++*,
2. *Gary J. Bronson , (2004) Programming Development and Design Using C++*.
3. *Richard Durrett, (2010) Probability: Theory and Examples*.
4. *F.D.J. Dunstan, (1981) Worked Examples in Probability and Distribution Theory*
5. *Sheldon M. Ross, (2009) A first Course in Probability*,
6. *Faiz Ahmad & M. A. Rana, Elements of Numerical Analysis, National Book Foundation*.
7. *Burden Faires, (2007) Numerical Analysis 5th edition*
8. *Micheal, O. Searcoid, Metric Spaces, Springer*,
9. *W.A. Sutherland, (1975) Introduction to Metric and Topological Spaces, Clarendon Press Oxford*,
10. *E.T. Copson, (1968) Metric Spaces, Cambridge University, Press*,
11. *H. Anton, Calculus, 5th edition, John Willey & Sons, New York*.

GENERAL MATHEMATICS

PAPER-I: CALCULUS AND ANALYTICAL GEOMETRY.

(100 Marks)

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GENERAL MATHEMATICS

PAPER-II: LINEAR ALGEBRA AND DIFFERENTIAL EQUATION.

(100 Marks)

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5. *Problems, PWS Publihing Company,*
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