

**COURSES OF STUDY FOR MATHEMATICS
SUBSIDIARY
(Approved by Academic Council)**

DEPARTMENT OF MATHEMATICS



MARWARI COLLEGE, RANCHI

(AN AUTONOMOUS & CONSTITUENT UNIT OF RANCHI UNIVERSITY)
COLLEGE WITH POTENTIAL FOR EXCELLENCE SELECTED BY UGC

Website : marwari-college.org

Full Marks: 400

Number of Semesters: 4

Number of Papers: 4

B. Sc. Subsidiary. Part - I: 200 Marks (2 Papers)

B. Sc. Subsidiary. Part - II: 200 Marks (2 Papers)

DISTRIBUTIONS OF MARKS IN MATHEMATICS SUBSIDIARY

Academic year	Semester	Theory paper	Full marks	Pass marks	Duration
First year	I	1 (A) Differential Calculus (B) Set Theory (C) Analytic Geometry of Two Dimensions (D) Real Analysis	100	33	3 Hrs.
	II	2 (A) Integral Calculus (B) Vectors (C) Analytic Geometry of Three Dimensions (D) Advance Real Analysis	100	33	3 Hrs.
Second year	III	3 (A) Abstract Algebra (B) Differential Equations (C) Probability & Statistics (D) Trigonometry	100	33	3 Hrs.
	IV	4 (A) Advance Abstract Algebra (B) Complex Variable (C) Matrix (D) Mechanics	100	33	3 Hrs.

B.Sc. Part – I (Mathematics Subs.)

Semester – I

PAPER – 1

Full Marks: 100

Time: 3 Hrs.

Pass Marks: 33

Instructions :

Answer ten questions selecting atleast one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement, simple problems). It will be of 3 marks. Part (b) is of long answer type questions (e.g. Theorems, Problems etc.). It will be of 7 marks.
[Atleast 50% questions should be theoretical]

Group - A: DIFFERENTIAL CALCULUS [L : 12, Q : 04]

- Successive differentiation, nth derivatives of some standard functions. Leibnitz' theorem. [Q:01]
- Expansion of functions, Taylor's infinite series, Maclaurin's series, Application of Taylor's and Maclaurin's series, Partial Differentiation. [Q:01]
- Tangents and Normal and their equations in Cartesian form, Parametric Form, Tangents at origin, angle of intersection between two curves, length of tangent, sub tangent, Normal, Subnormal. [Q:02]

Group – B: SET THEORY [L : 12, Q : 04]

- Indexed family of sets, Generalised set of operations & De-Morgan's laws, set mapping. [Q:01]
- Relations of the set, equivalence relations & fundamental theorem on equivalence relation. [Q:01]
- Partial order relation, concept of l. u. b. & g. l. b., infimum & supremum of a set, maximal & minimal elements. [Q:01]
- Countable and uncountable sets. [Q:01]

Group - C: ANALYTICAL GEOMETRY OF TWO DIMENSIONS [L : 12, Q : 04]

- Change of rectangular axes, Changing of the origin without changing the direction of the axes, Change of direction of the axes without changing the origin. [Q:02]
- Reduction of the equation of second degree to represent a parabola, ellipse and hyperbola, Equation of the tangent and normal. [Q:02]

Group - D: REAL ANALYSIS [L : 12, Q : 04]

- Fundamental and Algebraic properties of the set of real numbers, Neighbourhoods and limit points of a set, Completeness property, Archimedean Property, density theorem for the set of real numbers, Bounded sets, Open Sets, Closed sets and compact sets, Bolzano-Weirstrass' theorem. Connectedness and Compactness, Heine-Borel theorem. [Q:02]
- Limit and continuity : Limit, Continuity, Uniform Continuity, Properties of continuous functions in closed intervals, Functions of bounded Variation. [Q:02]

REFERENCES:

1. Diff. Calculus – Das & mukherjee / Lalji Pd.
2. Set theory – K. K. Jha / Lalji Pd
3. Analytical geometry of two dimension – Jagdish Jha / Lalji pd.
4. Real Analysis – K. K. Jha / Lalji Pd.

5. Mathematical Analysis – Shanti Narayan.

B.Sc. Part – I (Mathematics Subs.)**Semester – II****PAPER – 2****Full Marks: 100****Time: 3 Hrs.****Pass Marks: 33****Instructions :**

Answer ten questions selecting atleast one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement, simple problems). It will be of 3 marks. Part (b) is of long answer type questions (e.g. Theorems, Problems etc.). It will be of 7 marks.
[Atleast 50% questions should be theoretical]

Group - A : INTEGRAL CALCULUS [L : 12, Q : 04]

- Integration of rational and irrational functions.
[Q:01]
- Evaluation of definite integral, Properties of Definite Integral.
[Q:01]
- Curve tracing, Length and area.
[Q:01]
- Volume and Surface area of solids of revolution. [Q:01]

Group – B: VECTOR ANALYSIS [L : 12, Q : 04]

- Product of three and four vectors.
[Q:01]
- Application to Geometry & mechanics Work done, moment of a vector about a fixed point and about a line.
[Q:01]
- Vector Differentiation : Differentiation of a vector function of a scalar variable, Gradient, Divergence, Curl and Second order operators in Cartesian coordinate system.
[Q:02]

Group – C: ANALYTIC GEOMETRY OF THREE DIMENSIONS [L : 12, Q : 04]

- Rectangular, Spherical-Polar and Cylindrical coordinates. [Q:01]
- Direction cosines, angle between straight lines,
[Q:01]
- Equation of planes. [Q:01]
- Equation of straight lines, shortest distance between straight lines. [Q:01]

Group – D: ADVANCE REAL ANALYSIS [L : 12, Q : 04]

- **SEQUENCE** : Monotonic sequences, bounded sequence, Convergence sequence, limit of sequences, Limit supremum, limit infimum, Cauchy sequence, General Principle of Convergence. [Q:02]
- Convergence and divergence of series of real numbers, Pringsheim's theorem, Comparison tests, Cauchy's root test, D Alembert's ratio test, Rabbe's test, De-Morgan's and Bertrand Test, Logarithmic test.
[Q:01]
- Alternating series, Leibnitz Test, Absolute convergent series.
[Q:01]

REFERENCES:

1. Integral calculus – Das & Mukherjee/ Lalji Pd.
2. Vector Analysis - Lalji Prasad/ Shanti Narayan
3. Mathematical Analysis – Shanti Narayan/ S.C. Mallick
4. Real Analysis – K. K. Jha / Lalji Pd.
5. Analytical Geometry of Three Dimension - J.T. Bell/ J. Jha

B.Sc. Part – II (Mathematics Subs.)**Semester – III****PAPER – 3****Full Marks: 100****Time: 3 Hrs.****Pass Marks: 33****Instructions :**

Answer ten questions selecting atleast one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement, simple problems). It will be of 3 marks. Part (b) is of long answer type questions (e.g. Theorems, Problems etc.). It will be of 7 marks.

[Atleast 50% questions should be theoretical]

Group - A: ABSTRACT ALGEBRA [L : 12, Q : 04]

- Binary operations, Notion of group, Abelian group and non – abelian group with examples. Different ways of defining a group, Concept of subgroup and cyclic group, coset, Lagrange's theorem. [Q:02]
- Homomorphism and Isomorphism, Fundamental theorem of homomorphism, Cayley's theorem [Q:02]

Group - B : DIFFERENTIAL EQUATIONS [L:12, Q : 04]

- First order higher degree, Clairaut's form . Singular Solution, Orthogonal trajectories [Q:02]
- Linear Equations with constant coefficients , Homogeneous linear equations with variable coefficients. [Q:01]
- Simultaneous equation $dx/P = dy/Q = dz/R$ and total d.e. $Pdx+Qdy+Rdz= 0$, together with their geometrical significance. [Q:01]

Group – C: PROBABILITY & STATISTICS [L : 12, Q : 04]

- Notion of Probability : Random experiment, sample space, axiom of probability, elementary properties of probability, equally likely outcome problems, dependent and independent events, conditional and unconditional probability, Baye's theorem. [Q:02]
- Co-efficient of Correlation, Rank, correlation & spearman's formula, [Q:01]
- Curve fitting and method of least squares, Lines of regression, Regression coefficients and their properties. [Q:01]

Group – D: TRIGONOMETRY [L : 12, Q : 04]

- De Moivre's Theorem and its application in expansions. Exponential, and trigonometric functions of complex numbers, Properties of exponential and Trigonometric function of a complex number, Euler's theorem, Periodicity Trigonometric function. Logarithm of complex quantities. Hyperbolic functions: Relations between hyperbolic and circular function, Relation between inverse Hyperbolic and inverse circular functions. [Q:02]
- Gregory's Series, Evaluation of π . [Q:02]

REFERENCES:

1. Abstract Algebra – Surjeet Singh and Quasi Zmeeruddin
2. Modern Algebra – A. R. Vasishtha & A. K. Vasishtha
3. Differential Equation – Lalji Prasad/ M.D. Raisinghania
4. Probability & Statistics - S.C. Gupta & V.K. Kapoor/ J.N. Kapoor
5. Elementary Statistical Methods - Goongupta & Dasgupta
6. Trigonometry – Das & Mukherjee/ Lalji Prasad

B.Sc. Part – II (Mathematics Subs.)

Semester – IV

PAPER – 4

Full Marks: 100

Time: 3 Hrs.

Pass Marks: 33

Instructions :

Answer ten questions selecting atleast one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement, simple problems). It will be of 3 marks. Part (b) is of long answer type questions (e.g. Theorems, Problems etc.). It will be of 7 marks.
[Atleast 50% questions should be theoretical]

Group –A: ADVANCE ABSTRACT ALGEBRA [L : 12, Q : 04]

- Concepts of ring, Sub ring, Ideal, Integral domains and Field, Ring Homomorphism and isomorphism. [Q:04]

Group –B : COMPLEX VARIABLE [L : 12, Q : 04]

- Functions of a Complex variables Limit, Continuity, derivative, Cauchy- Riemann Equations, Analytic function, Harmonic function, Construction of Analytic Function, Milne-Thompson Method. [Q:04]

Group - C : MATRIX [L : 12, Q : 04]

- **Matrices** : Definition, Triangular Matrices, Singular, non singular, symmetric, skew symmetric, Transpose, Conjugate, adjoint of a matrix, inverse of a matrix, Hermitian and skew Hermitian Matrices, Orthogonal, unitary matrices. [Q:02]
- Law of operations, partitioning. [Q:01]
- Elementary transformation, Normal form, elementary matrices, rank of product, equivalence of matrices and criteria for equivalence. Determination of rank of a Matrix, General solution of $AX=B$. [Q:01]

Group –D: MECHANICS [L : 12, Q : 04]

- Conditions for equilibrium of coplanar forces, Astatic Centre. [Q:02]
- Kinematics in two dimensions : Tangential, normal, radial, transverse velocities and acceleration, Angular Velocity and Acceleration, S.H.M. [Q:02]

REFERENCES:

1. Modern Algebra – A. R. Vasishtha & A. K. Vasishtha/ Surjeet Singh & Quasi Zameeruddin
2. Complex Analysis – E. T. Copsion / Lalji Prasad/ J.N. Sharma.
3. Matrix – Shanti Narayan

4. Statics - Das & Mukherjee.
5. Dynamics-Das & Mukherjee.