B.Sc./B.A. Part I Examination 2023
MATHEMATICS

TEACHING AND EXAMINATIION SCHEME

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
	L	**P**			
MATHEMATICS					
Paper I	**3**	**-**	**3**	**75**	81
Paper II	**3**	**-**	**3**	**75**	
Paper III	**3**	**-**	**3**	**75**	

B.Sc./B.A. Part I Examination 2023
Mathematics

Paper I : Algebra and Co-ordinate Geometry of Two Dimensions.
Paper II : Calculus
Paper III: Co-ordinate Geometry of three Dimensions and Vector Calculus.

Total Marks: 75 **Time: 03:00 Hrs.**

Paper I

Algebra and Co-ordinate Geometry of Two Dimensions

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit1: The characteristic equation of a matrix, Eigen values and Eigen vectors, Cayley-Hamilton theorem and its usage in finding the inverse of a matrix. *Rank of Matrix***,** Inequalities. Continued fractions.

Unit 2: Relations between the roots and coefficients of general polynomial equations in one variable, Symmetric functions of roots, Transformation of equations. Descarte's rule of signs. Solution of cubic equations (Cardon's method). Biquadratic equations (Ferrari's Method).

Unit 3: Infinite series. Convergent series, tests for convergence of a series, comparison test, D'Alembert's Ratio test, Cauchy's root test, Logarithmic Ratio Test. Raabe's test, De Morgen and Bertrand's test, Cauchy's condensation test, Gauss's test. Alternating series, Leibnitz test (Derivation of above tests not required).

Unit 4 : Polar equation of a conic, polar equations of tangent, normal, asymptotes, chord of contact, auxiliary circle, director circle of a conic and related problems.
Unit 5 : General equation of second degree. Tracing of conics (Cartesian coordinates).

SUGGESTED BOOKS

M. Ray : A Text Book of Higher Algebra, S.Chand & Co., New Delhi.
J.L. Bansal, S.L. Bhargva, & S.M. Agarwal : Algebra (Hindi Ed.), Jaipur Publishing House, Jaipur.
J.L. Bansal & S.L.Bhargava:2-D Coordinate Geometry (HindiEd)Jaipur Publishing House, Jaipur.
Sharma, C.L.Varshney : Coordinate Geometry, Pragati Prakashan, Meerut.
D.C. Gokhroo, S.R. Saini & J.P.N.Ojha : 2-D Geometry (Hindi Ed.), Navkar Publication, Ajmer.

B.Sc./B.A. Part I Examination 2023
Mathematics

Paper – II
Calculus

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

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Total Marks: 75 **Time: 03:00 Hrs.**

Unit 1: Polar Co-ordinates. Angle between radius vector and the tangent. Angle between curves in polar form. Length of polar substangent and polar subnormal, Pedal equation of a curve, Derivatives of an arc, curvature, various formulae, Centre of curvature and chord of curvature and related problems.

Unit2:Partial differentiation, Euler's theorem on homogeneous functions, chain rule of partial differentiation, Maxima and Minima of functions of two independent variables and of three variables connected by a relation, Lagrange's Method of undetermined multipliers.

Unit 3: Asymptotes, double points, curve tracing, Envelopes and evolutes.

Unit 4: Theory of Beta and Gamma functions. Rectification. Volume and Surfaces of solids of revolution. Differentiation and integration under the sign of integration.

Unit 5: Evaluation of double and triple integrals and their applications in finding areas and volumes. Dirichlet's integral. Change of order of integration and changing into polar co-ordinates.

SUGGESTED BOOKS

Gorakh Prasad: A Text Book of Differential Calculus; Pothishala Pvt..Ltd.Allahabad.
J.L.Bansal, S.L.Bhargava and S.M.Agarwal : A Text Book of Differential Calculus II (Hindi Ed.) and Integral Calculus, Vol. II (Hindi Ed.); Jaipur Publishing House, Jaipur.
D.C. Gokharoo & S.R. Saini : Differential Calculus (Hindi Ed.); Navkar Prakashan, Ajmer.
O.P.Tandon, and Sharma, K.C. : Integral Calculus; Jaipur Publishing House, Jaipur.
Gupta, Juneja and Tandon : Differential Calculus (English Ed.);Ramesh Book Depot, Jaipur.
Gorakh Prasad : Integral Calculus; Pothishala Pvt.Ltd.Allahabad.

B.Sc./B.A. Part I Examination 2023
Mathematics

Paper – III

Co-ordinate Geometry of 3-Dimensions and Vector Calculus.

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

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Total Marks: 75 **Time: 03:00 Hrs.**

Unit 1 : Sphere, Cone and Cylinder (Rectangular Coordinates only)

Unit 2 : The Central Conicoids (referred to principal axes). Tangents and tangent planes, Polar planes and polar lines, Section with a given centre, Enveloping cone, Enveloping cylinder and related problems.

Unit 3 : Equations of the normal to an ellipsoid, number of normals from a given point to an ellipsoid, Cone through six normals, Conjugate diameter and diametral planes and their properties. Cone as a Central surface. Paraboloids.

Unit 4 : Plane Sections of Conicoids, Umbilics, Generating lines of hyperboloid of one sheet and its properties.

Unit 5 : Vector Calculus : Curl, Gradient and Divergence & Identities involving these operators. Theorems of Stoke, Green and Gauss (Statement, application and verification only).

SUGGESTED BOOKS

Gupta, Juneja : Vector Analysis; Ramesh Book Depot, Jaipur.

D.C. Gokhroo, S.R. Saini, S.S.Bhati : Vector Calculus (Hindi Ed.); Navkar Prakashan, Ajmer.
S.L.Bhargava, Banwari Lal : Vector Calculus (Hindi Ed.); Jaipur Publishing House, Jaipur.
R.J.T.Bell,: Coordinate Geometry of Three dimensions;Macmillan India Ltd., New Delhi.
Vasistha, Agarwal : Analytical Solid Geometry; Pragati Prakashn, Meerut.
Gokhroo, Saini & Rathi : Analytical 3-D Geometry (HindiEd);Jaipur Pub. House, Jaipur.
J.L.Bansal, S.L. Bhargva & S.M. Agarwal : 3-D Coordinate Geometry II; Jaipur Pub. House, Jaipur.

B.Sc./B.A. Part II Examination 2023
MATHEMATICS

TEACHING AND EXAMINATIION SCHEME

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
MATHEMATICS	L	P			
Paper I	3	-	3	75	81
Paper II	3	-	3	75	
Paper III	3	-	3	75	

B.Sc./B.A. Part II Examination – 2023
MATHEMATICS

Paper I : **Numerical Analysis and Linear Programming.**
Paper II : **Differential Equations.**
Paper III : **Mechanics I (Statics and Dynamics of particle)**

Total Marks: 75 **Time: 03:00 Hrs.**

Paper I
Numerical Analysis and Linear Programming

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1: Difference operators and factorial notation, Differences of polynomial, Newton's formulae for forward and backward interpolations. Divided differences, relation between divided differences and Simple difference. Newton's general interpolation formulae, Lagrange interpolation formula.

Unit 2: Central differences, Gauss, Stirling and Bessel interpolation formulae. Numerical Differentiation. Numerical integration, Trapezoidal, Simpson's and Weddle's rules.

Unit 3: Solution of linear difference equations with constant and variable coefficients. Solution of Algebraic and Transcendental equations, Iterative, Regula Falsi and Newton Raphson methods.

Unit 4: Convex sets and their properties. The simplex technique and its application to simple L.P. problems. The Big M-Method.

Unit 5: Two Phase Method, Revised Simplex Method. Concepts of duality in linear programming. Framing of dual programming. Elementary theorems of duality. Integer Programming Problem (IPP).

SUGGESTED BOOKS

D.C. Gokhroo & S.R. Saini : Linear Programming (Hindi Ed.), Navkar Prakashan, Ajmer.
Mittal, Sethi : Linear Programming, Pragati Prakashan, Meerut
Goyal, Mittal : Numerical Analysis, Prograti Prakashan, Meerut
J.L.Bansal,S.L. Bhargava & S.M. Agarwal : Numerical Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur
H.C. Saxena : Numerical Analysis; S.Chand & Co., New Delhi
D.C. Gokhroo : Numerical Analysis (Hindi Ed.);Navkar Prakashan, Ajmer
S.L. Bhargava, K.C. Sharma & S.S. Bhati : Linear programming (Hindi Ed.); Jaipur Publishing House, Jaipur.

B.Sc./B.A. Part II Examination 2023
MATHEMATICS

Total Marks: 75 **Time: 03:00 Hrs.**

Paper II
Differential Equations

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1: Exact and reducible to exact differential equations of first order and first degree. First order higher degree differential equations solvable for x,y,p. Clairaut's form and singular solutions.

Unit 2: Linear differential equations with constant coefficients, Homogeneous linear differential equations with variable coefficients. Simultaneous differential equations, Total differential equations of the form Pdx + Qdy + Rdz = 0, by method of inspection and method for homogeneous equations.

Unit 3: Linear differential equations of second order of the form $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R.$

Exact Linear differential equations of n^{th} order. Exact Non-Linear differential equations. Differential equations of the various forms e.g., (i) $\frac{d^2y}{dx^2} = f(y)$ (ii) Equations not containing y directly (iii) Equations not containing x directly and other forms. Method of variation of parameters to the solution of second order linear differential equations.

Unit 4: Series solutions of Second Order Linear differential equations, Power series method, Bessel and Legendre equations. Partial differential equations of the first order. Lagrange's solution. Some special types of equations which can be solved easily by methods other than the general method. Charpit (general) method of solution.

Unit 5: Partial differential equations of second and higher order. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients. Monge's method of integrating Rr + Ss + Tt = V.

SUGGESTED BOOKS

Sharma, Gupta : Differential Equations; Krishna Prakashan, Meerut
Ray, Chaturvedi : Differential equations; Kedar Nath, Ram Nath & co., Agra.
J.L.Bansal, H.S.Dhami : Differential equations (Vol. II); Jaipur Publishing House, Jaipur
D.C.Gokhroo, S.R. Saini & R.K.Kumbhat : Differential equations (Hindi Ed.);Navkar Prakashan, Ajmer
Gokhroo, Saini, Oza : Partial differential equations; Jaipur Publishing House, Jaipur.

B.Sc./B.A. Part II Examination 2023
MATHEMATICS

Total Marks: 75 **Time: 03:00 Hrs.**

Paper III
Mechanics – I
(Statics and Dynamics of a Particle)

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1: Resultant and equilibrium of coplanar forces acting on a rigid body. Friction.

Unit 2: Stable and Unstable equilibrium. Forces in three dimensions, Poinsot's central axis, Wrenches.

Unit 3: Virtual work and common catenary.

Unit 4: Velocities and accelerations along radial and transverse directions and along tangential and normal directions. Simple harmonic motion and motion under inverse square law.

Unit 5: Motion on smooth and rough plane curves, circular and cycloidal motions. Central forces and central orbits (excluding planetary motion).

SUGGESTED BOOKS

S.L. Ioney : Statics

R.S. Verma : A Text Book on Statics; S. Chand & Co., New Delhi.

S.L. Loney : Dynamics of a particle & Rigid bodies.

M.Ray : A Text book on Dynamics; S. Chand & Co., New Delhi

D.C.Gokhroo, S.R. Saini & G.R.Yadav : Higher Dynamics II (Hindi Ed.); Navkar Prakashan, Ajmer

S.L. Bhargava & S.M.Agarwal : Dynamics (Hindi Ed.);Jaipur Publishing House, Jaipur

S.L. Bhargava, S.M.Agarwal & V.G. Gupta : Statics (Hindi Ed.); Jaipur Publishing House, Jaipur

Gokhroo : Statics (Hindi Ed.); Navkar Prakashan, Ajmer.

B.Sc./B.A. Part III Examination 2023
MATHEMATICS

TEACHING AND EXAMINATIION SCHEME

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
	L	P			
MATHEMATICS					
Paper I	3	-	3	75	81
Paper II	3	-	3	75	
Paper III	3	-	3	75	

B.Sc./B.A. Part III Examination 2023
MATHEMATICS

Paper I : Abstract Algebra
Paper II : Analysis and Laplace Transforms
Paper III : Mechanics II (Dynamics of Rigid Bodies and Hydrostatics)

Total Marks: 75 **Time: 03:00 Hrs.**

Paper I
Abstract Algebra

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1: Definition and example of groups. General properties of groups, Order of an element of a group. Permutations : Even and Odd permutations. Groups of permutations. Cyclic group, Isomorphism, Isomorphism of cyclic groups, Cayley's theorem.

Unit 2: Subgroups, Cosets, Lagrange's theorem, Product Theorem of subgroups, Conjugate elements, conjugate complexes, Centre of a group, Normaliser of an element and of a complex. Normal subgroups, quotient Groups, Commutator subgroup of a group. Homomorphism, Fundamental theorem of homomorphism.

Unit 3: Definition and kinds of rings, Integral domain, Division ring, Field, Subring of a ring, Subfield of a field. Characteristic of a ring and field.

Unit 4: Ideals of a ring, Quotient rings, Prime fields, Prime ideals, Field of quotients of an integral domain, Definition and examples of a vector space, subspace of a vector space, Linear combination and linear space, Linear dependence and independence of vectors. Direct product of vector spaces and internal direct sums of subspaces.

Unit 5: Bases and dimension of a finitely generated spaces, Quotient space, Isomorphism, Linear transformation (Homomorphism), Rank and nullity of linear transformation.

SUGGESTED BOOKS

G.C. Sharma: Modern Algebra; Ram Prasad & Sons, Agra.
J.L. Bansal & S.L. Bhargava : Abstract Algebra (Hindi Ed.); Jaipur Publishing House, Jaipur.
R.S. Agarwal. : Text Book on Modern Algebra; S. Chand & Co., New Delhi.
D.C. Gokhroo & S.R.Saini : Abstract Algebra (Hindi Ed.); Jaipur Publishing House, Jaipur.

B.Sc./B.A. Part III Examination 2023
MATHEMATICS

Total Marks: 75 **Time: 03:00 Hrs.**

Paper – II

Analysis and Laplace Transforms

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.

Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.

Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1 : Dedekinds theory of real numbers. Linear sets. Upper and Lower bounds, Limiting points, Weierstrass's theorem. Derived sets, Enumerable Sets, Open and Closed sets.

Unit 2 : Theory of Riemann integration, Darboux theorem. Fundamental theorem of integral calculus, Mean value theorem of integral calculus.

Unit 3 : Functions, Limits, and continuity. Differentiability, Concept of an analytic function, Cartesian and Polar form of Cauchy-Riemann equations. Harmonic function, Conjugate function, Laplace's differential equations, Construction of analytic functions. Power Series: Absolute convergence of power series, circle and radius of convergence of power series, sum function of a power series.

Unit 4: Basic definition and Properties of complex integration Complex integration as the sum of two line integrals, Inequality for complex integrals. Curves in complex plane, Cauchy-Goursat theorem, Connected regions, Indefinite integral (or Anti Derivative). Derivative of Single-valued functions F(z). Cauchy's integral formula, Extension of Cauchy's integral formula to multiconnected, regions, Cauchy's integral formula for the derivative of an analytic function, Successive derivative of an analytic function, Morera's Theorem. Liouville's Theorem, Poisson's integral formula.

Unit 5: Laplace Transforms and Inverse Laplace Transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Convolution theorem. Applications of Laplace Transform to the solution of differential equations.

SUGGESTED BOOKS

Shanti Narayan: Real Analysis; S.Chand & Co., New Delhi.
G.N.Purohit: Real Analysis; Jaipur Publishing House, Jaipur.
S.L. Bhargava, S.P. Goyal: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.
D.C. Gokhroo, S.R. Saini, J.P.N. Ojha: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.
Shanti Narayan: Theory of Functions of a Complex Variable; S.Chand & Co., New Delhi.
K.P.Gupta : Complex Analysis; Pragati Prakashan; Meerut
D.C. Gokhroo, S.R. Saini & G.R. Yadav: Complex Analysis (Hindi Ed.); Navkar Publication, Ajmer
G.N. Purohit: Complex Analysis; Jaipur Publishing House, Jaipur.
S. Ponnusamy: Foundations of Complex Analysis, Narosa Publishing House, Bombay, New Delhi.
V. Karunakaran: Complex Analysis, Narosa Publishing House. Bombay, New Delhi (2002).
N.Levinson and R.M. Redheffer: Complex Variables, Tata McGraw-Hill Publ. Co. Ltd., New Delhi (1980).

B.Sc./B.A. Part III Examination 2023
MATHEMATICS

Total Marks: 75 **Time: 03:00 Hrs.**

Paper III
Mechanics – II
(Dynamics of Rigid Bodies and Hydrostatics)

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

Unit 1: Moments and Products of inertia. D'Alembert's principle, the general equations of motion of a rigid body, Motion of the center of inertia and motion relative to the center of inertia. Motion about a fixed axis under finite forces.

Unit 2: The compound Pendulum. Reaction of the Axis of rotation. Motion of a rigid body in two dimension under finite forces.

Unit 3: Fluids and Fluid Pressure, homogeneous and heterogeneous fluids, Surface of equal pressure, fluid at rest under action of gravity, Fluid pressure on Plane surfaces.

Unit 4: Centre of pressure, resultant pressure on curved surfaces.

Unit 5: Equilibrium of floating bodies, Centre of buoyancy, Surface of buoyancy. Stability of equilibrium of floating bodies, Meta Centre.

SUGGESTED BOOKS

S.L. Loney : Rigid Body Dynamics; Cambridge Univ. Press.

P.P.Gupta : Rigid Body Dynamics, Vol.I; Krishna Prakashan, Mandir; Meerut

J.L.Bansal: Rigid Body Dynamics; Jaipur Publishing House, Jaipur.

B.N.Prasad: Hydrostatics; Krishna Prakashan, Mandir; Meerut

S.M. Mathur : A Text Book of Hydrostatics; Ramesh Book Depot, jaipur.

Sharma, D.C. Gokhroo, S.R. Saini, S.M.Agarwal.: Elements of Hydrostatics; Jaipur Publishing House, Jaipur.