FACULTY OF PHYSICAL SCIENCES

OUTLINES OF TESTS, SYLLABI AND COURSES OF READING

NEP- TEMPLATE FOR MULTIDISCIPLINARY UG PROGRAMME TO BE OFFERED BY COLLEGES

B.A. / B.SC. (HONORS)-IIIRD YEAR

EXAMINATIONS BATCH 2026-27, 2027-28, 2028-29



DEPARTMENT OF MATHEMATICS

PUNJABI UNIVERSITY, PATIALA

Semester	Type of Course	Course code	Course title	Credits
V	Discipline Specific Core Course	MATB-3501T / MATBM-3502T	Ordinary and Partial Differential Equations	04
VI	Discipline Specific Core Course	MATB - 3601T / MATBM-3603T	Classical Mechanics	04
	Discipline Specific Core Course	MATB - 3602T	Fundamentals of Geometry	04

MATB-3501T / MATBM 3502T Ordinary and Partial Differential Equations

Course Outcomes:	
CO1	To study and solve differential equations of first order and the equations reducible to these.
CO2	To study first order and higher degree differential equations and their respective solutions.
CO3	To understand the methods of solving linear homogeneous and non-homogeneous differential equations of higher order with constant/variable coefficients.
CO4	To study the methods of solving linear partial differential equations of first order and partial differential equations of first order but of any degree.
CO5	To learn to solve homogeneous and non-homogeneous partial differential equations with constant coefficients.

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Time Allowed: 03 Hours

University Exam: 70
Internal Assessment: 30
Total: 100

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

Section-A

First Order Differential Equations: Differential equations of first order and first degree: Separable differential equations, Homogeneous differential equations, Exact differential equations, Linear differential equations and Differential equations reducible to above mentioned forms. First order and higher degree differential equations solvable for x, y and p, Clairaut's form, Singular solutions. Geometrical meaning of a differential equation, Orthogonal trajectories.

Higher Order Differential Equations: Wronskian, Solution of linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients and with variable coefficients, Cauchy's and Legendre's equations, Method of variation of parameters.

Section - B

First Order Partial Differential Equations: Linear Partial differential equations of first order, Lagrange's solution. Integral surfaces passing through a given curve, Partial differential equations of first order but of any degree, Charpit's general method of solution.

Higher Order Partial Differential Equations: Classification of partial differential equations of second order into hyperbolic, elliptic and parabolic types, Canonical forms. Solution of homogeneous and non-homogeneous partial differential equations with constant coefficients, An introduction to heat, wave and Laplace's equations.

References:

1. H.T.H. Piaggio : An Elementry Treatise on Differential Equations and their Applications: Barman Press.
2. Rai Singhania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi.
3. I.N. Sneddon: Elements of Partial Differential Equations, Mc Graw Hill Book Co.
4. D.A. Murray: Introductory Course in Differential Equations, Orient Blackswan Pvt Ltd., New Delhi, 2012.

MATB-3601T / MATBM-3603T Classical Mechanics

Course Outcomes:	
CO1	To understand the basic concepts of laws of motion.
CO2	To understand the concept of friction and laws of gravity.
CO3	To understand the concept of motion of particle.
CO4	To understand the concepts of velocity and acceleration.
CO5	To understand the concept of projectile motion.

L T P **University Exam: 70**
3 1 0 **Internal Assessment: 30**
Time Allowed: 03 Hours **Total: 100**

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Statics: Basic notation, Newton Laws of motion, parallelogram law of forces, resultant of two collinear forces, resolution of forces, moment of a force, couple, theorem on moments of a couple, coplanar forces, resultant of three coplanar concurrent forces, theorem of resolved parts, resultant of two forces acting on a rigid body. Equilibrium of two concurrent forces, equilibrium condition for any number of coplanar concurrent forces. Lami's λ-μ theorem.

Friction: Definition and nature of friction , laws of friction, Centre of gravity.

SECTION-B

Dynamics: Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upward, motion of two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Simple harmonic motion, elastic string, simple pendulum.

Projectile, Work, Power, conservative fields and potential energy, work done against gravity, potential energy of a gravitational field.

Pedagogy: The instructor should lay emphasis on the importance of the subject in deciding about the stability criteria of everyday structures.

Books recommended:

1) S.L. Loney: The elements of statics and dynamics, 5th edition, Cambridge University Press, 1947.
2) J. L. Synge and B. A. Griffth : Principles of Mechanics, Published by Nabu Press.

MATB-3602T: Fundamentals of Geometry

Course Outcomes:	
CO1	To understand the geometric structures.
CO2	To understand the behavior of conics.
CO3	To understand the concept of tangent and normal.
CO4	To understand the behavior of central and non-central conics.
CO5	To understand the concept of conicoids.

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University Exam: 70
Internal Assessment: 30
Total: 100

Time Allowed: 3 hours

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

Section -A

Conic sections : General equation of a conic section, identification and tracing of various curves based on eccentricity.

Parabola: derivation from the conic section equation, different forms of a parabola (vertex at origin, shifted vertex), concept of tangent and normal, parametric equations of a parabola, polar of a point, pole of a given line, extremities of the focal chord of the parabola, geometrical properties of subtangent and subnormal.

Ellipse: definition and derivation, the standard equation, the basic structure related to axes, foci and the latera recta, tangent and normal, properties of the eccentric angles, equi-conjugate diameters.

Hyperbola : definition and derivation, transverse and conjugate axes, asymptotes of a hyperbola, pair of tangents, equation referred to the asymptotes as axes, conjugate hyperbola, rectangular hyperbola.

Section -B

Introduction to Conicoids : General concept of conicoids as three-dimensional analogs of conic sections, general form of the equation. Types of Conicoids: Ellipsoid, Hyperboloid of one sheet, Hyperboloid of two Sheets, Paraboloid of revolution (elliptic and hyperbolic), origin, symmetry, axis of intersection, traces on coordinate planes.

Central Conicoids: Sphere - the general from, standard form, equation through four non coplanar points. Concentric spheres, intersection of sphere and a straight line, tangent plane to a sphere, orthogonal spheres, radical plane of two spheres, radical axis of three spheres.
Cone - the homogeneous equation, equation with vertex at origin, cone with a given vertex and a given conic for base, enveloping cone to a conicoid , tangent plane of the cone, quadric cone, right circular cone, reciprocal cone.
Non-central Conicoids: Cylinder: quadric cylinder, right circular cylinder, standard form, parabolic cylinder, elliptic cylinder, hyperbolic cylinder, enveloping cylinder to a conicoid.

Recommended Textbooks:

1. Coordinate Geometry by S.L. Loney, A.I.T.B.S. Publishers, India. Reprint, 2009
2. Analytical Solid Geometry by Shanti Narayan and P.K. Mittal , S. Chand Publishing, 2007.
3. Plane and Solid Geometry by J.M. Aarts , Springer-Verlag New York Inc., 2008