MTMAP2 (Credit: 6)
2 dimensional geometry, vector algebra and ordinary differential equation1

Full Marks: 100

Marks and Credit distribution:

Theory: 5 Credits, 85 Marks

End Semester exam: 50Marks, Continuous Assessment: 15 Marks, Midterm: 15 Marks, Attendance: 5 Marks

Tutorial: 1 Credit, 15 Marks

Course Outcome: In 2d geometry, a student will learn the concepts of orthogonal transformation, classification of conics, pair of straight lines, pole, polar, conjugate points and conjugate lines, conjugate diameters; vectors, vector products and solution of vector equations. It is required for differential equation and mechanics courses. In Differential equation 1, a student will learn the classification of ODEs, solution techniques of first order ODE, higher order ODE with constant coefficients, concept of trajectories. It is required for next differential and mechanics courses.

Group-A

2 Dimensional Geometry and Vector Algebra

Unit – I (2 Dimensional Geometry) (20L, Marks assigned for End Semester: 15)

1(a) Orthogonal transformation of co-ordinate axes**:** translation, rotation and their combinations, invariance.

(b) General equation of second degree in two variables, reduction to canonical form, classification of conics, position of axes and their lengths.

2. Pair of straight lines**:** condition that the equation $ax^2 + 2hxy + by^2 = 0$ may represent a pair of straight lines through the origin, angle and angle bisectors of the pair of lines $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, condition that $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ may represent a pair of straight lines, equation of the pair of straight lines joining the origin to the points in which a line meets a conic.

3. Polar equations of straight line, circle and conic, equations of chord, tangent, normal and chord of contact of a conic, reflection properties of conic.

4. Pole, polar, conjugate points and conjugate lines, conjugate diameters.

Unit – II (Vector Algebra) (10L, Marks assigned for End Semester: 10)

1. Section ratio, co-linearity of three points, co-planarity of four points, linear combination of a set of vectors – their dependence and independence, co-ordinates of a vector in two and three dimensions.

2. Scalar triple product, vector triple product, product of four vectors.

3. Applications of vector algebra in

(i) geometrical and trigonometrical problems

(ii) work done by a force, moment of a force about a point and about a line.

4. Vector equations of straight lines and planes, signed distance of a point from a plane, volume of a tetrahedron, shortest distance between two skew lines.

5. Vector equations and their solutions.

References

[1] Co-ordinate Geometry – S. L. Loney.

[2] Co-ordinate Geometry of Three Dimensions – Robert J. T. Bell.

[3] Analytic Geometry ─M. C. Chaki.

[4]Advanced Analytical Geometry ─ J. G. Chakravorty, P. R. Ghosh

[5]Analytical Geometry and Vector Algebra- R. M. Khan

[4] Vector Analysis – Barry Spain.

[5] Vector Analysis – Louis Brand.

[6] Vector & Tensor Analysis – Spiegel (Schaum).
[7] Elementary Vector Analysis – C. E. Weatherburn (Vol. I & II).

Group-B (30L, Marks assigned for End Semester: 25)

Ordinary Differential Equation-1

1. Significance of ordinary differential equation, geometrical and physical consideration, formation of differential equation by elimination of arbitrary constant, meaning of the solution of ordinary differential equation, concept of linear and non-linear differential equations.

2. Equations of first order and first degree: statement of existence and uniqueness theorem, separable, homogeneous and exact equation, condition of exactness, integrating factor, rules of finding integrating factor, (statement of relevant results only).

3. First order linear equations: integrating factor (Statement of relevant results only), equations reducible to first order linear equations (Bernoulli's Equation), method of variation of parameters.

4. Equations of first order but not of first degree. Clairaut's equation, singular solution.

5. Applications: geometric applications, ω-trajectories, orthogonal trajectories.

6. Higher order linear equations with constant co-efficients: complementary function, particular integral, wronskian – its properties and applications, method of undetermined co-efficients, symbolic operator D, method of variation of parameters, exact equation, Euler's homogeneous equation and reduction to an equation of constant coefficients.

References

[1] An Introductory Course on Ordinary Differential Equation – D. A. Murray.
[2] Differential Equations – S. L. Ross.
[3] Differential Equations – H. T. H. Piaggio.
[4] A Text Book of Ordinary Differential Equations – Kiseleyev, Makarenko & Krasnov.
[5] Differential Equations with Application & Programs – S. Balachanda Rao, H. R. Anuradha.
[6] Text Book of Ordinary Differential Equations (2nd Ed.) – S. G. Deo, V. Lakshmikantham & V. Raghavendra (Tata McGraw Hill).
[7] An Introduction to Differential Equations - Ghosh & Maity.
[8] Differential Equations - Chakraborty & Ghosh.

Tutorial: (1 Credit, 15 Marks)

1. Evaluation for the tutorial will be conducted in the following forms (which will be informed to the students at the beginning of the semester):

i) Written test, ii) viva-voce, iii) home-assignment, iv) presentation

2. Tutorial for each core course will comprise of a total of minimum 15 marks and maximum 60 marks for tutorial evaluation which will be converted to 15 marks.

3. Date of written test/viva-voce /home assignment/presentation for tutorial will be informed to the students at least 4days in advance via departmental notice.

4. Evaluated written answer sheets / assignments will be returned back to the students.

5. If any student is absent in the tutorial examination, a re-test may be arranged by the permission of the principal.