Semester	**1**
Course [*1]	**Multi-disciplinary -1**
Paper Code	M1MT230111T
Paper Title	**Demystifying Curves and Surfaces**
No. of Credits [*2]	**3**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**3**
Number of Modules	**Nil**
Syllabus	**Recapitulation of Conic Sections: [10]** Focus-directrix definition of a conic. Classification of conics as parabola, ellipse and hyperbola based on eccentricity. Equations of axis, directrix and focal chords. Standard equations of conics in Cartesian and Parametric form. Reflection properties of parabola, ellipse and hyperbola- Polar equation of conics. **Application of Calculus [14]:** **Tangent –Normal [5]:** Idea of tangents and normal to a plane curve given in explicit, implicit and parametric form. Tangents at the origin of any rational algebraic curve. Angle between the radius vector and tangent at a point of the curve- expression of the differential arc length in Cartesian as well as Polar coordinates. Angle between two intersecting curves. **Rectilinear Asymptotes [4]:** Ideas of vertical, horizontal and oblique asymptotes to a curve given in Cartesian equation, working rule for finding the asymptotes of the most general algebraic curve of certain finite degree. **Concavity, Convexity & Point of inflection [2]:** Criteria based on derivatives with geometric visualization (only Cartesian equations of curves to be dealt) **Envelopes [3]:** Envelope of a one parameter family of curves given in the Cartesian form. Recognizing any curve as the envelope of the family of its tangents. Envelope of a two-parameter family of curves where the parameters themselves are functionally related. **Familiarity with straight lines and planes in 3D [Scalar as well as vector treatment] [15]:** Working knowledge of rank of a matrix and consistency – inconsistency of a system of linear equations in three variables as prerequisites. [2]

	Equation of a plane passing through three non-collinear points, Normal and intercept form of the equation of a plane. Joint equation of a pair of planes passing through the origin (2). Necessary and sufficient conditions for $\vec{r}.\vec{n}_1 = p_1$ and $\vec{r}.\vec{n}_2 = p_2$ to represent a pair of parallel planes (rank method). Distance between two parallel planes (2). How to find the line of intersection of two non-parallel planes. Equation of any plane passing through the line of intersection of two non - parallel planes. Condition for thee given planes meeting in (i) a point (ii) a line (rank method) (3). Scalar and vector approach for derivation of different forms of equations of a straight line in 3D. Idea of direction cosines and direction ratios. (3) Angle b/w two straight lines- Conditions of parallelism and perpendicularity. (1) Shortest distance b/w two skew lines-Equation of the line of shortest distance (vector treatment) (2)
Learning Outcomes *[3]	On successful completion of the course a student will be able to do the following: • Understanding conic-sections and their properties. • Will get acquainted with the concepts of tangent and normal to a given plane curve and use them in different geometrical problems. • Learn to find horizontal, vertical, oblique asymptotes to a given curve. • Will get introduced to the idea of concavity /convexity of curves and understand the points of inflection as well. • Getting introduced to the concept of envelopes and recognizing any curve as the envelope of the family of its tangents. • Getting familiarized with planes and straight lines in three dimensions in both scalar and vector framework through intensive problem solving.
Reading/Reference Lists *[4]	• Maity and Ghosh: An introduction to Analysis: Differential Calculus (Part-1) • Shanti Narayan and Mittal: Differential Calculus • Michael Spivak: Calculus • R.M.Khan: Analytical Geometry of two and three dimensions and Vector Analysis.

	• Robert J.T.Bell: An Elementary Treatise on Co-ordinate Geometry of three dimensions. • Chakraborty and Ghosh: Advanced Analytical Geometry.	
Evaluation	Theory CIA: 10+3+2=15 Semester Exam: 35	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	7 questions each carrying 5 marks out of 11 questions	