Semester	**2**
Course [*1]	**Major**
Paper Code	C1MT230211T
Paper Title	**Vector Algebra and Geometry**
No. of Credits [*2]	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**2**
Syllabus	**Module-1 [Vector Algebra]** **Vector algebra & its applications [16 classes]:** Free and localized vectors, Resultant of two or more co-initial free vectors, Parallelogram law of vector addition; method of resolution [2], linear dependence and independence of vectors and related problems [2], Recapitulation of dot and cross product of two vectors [2], Scalar and Vector triple product, connection of scalar triple product with Cramer's rule of solving system of linear equations, Coplanarity and non-coplanarity of vectors from the viewpoint of scalar triple product. Problems on product of three vectors [5], Volume of a tetrahedron, Moment of a force about a point and that about a line, Resultant of a finite number of forces acting on a rigid body (emphasis on problem solving) [5] **Module-2 [Geometry]** **Two- dimensional Geometry [16 classes]:** Affine transformation of co-ordinates in a plane-rotations and translations. Commutativity of two translations and of two rotations in a plane, non-commutativity of a rotation and a translation in a plane [3], Invariants under affine transformations-(a) distance b/w two points (b) area of a triangle (c) angle between two straight lines in a plane.[2] General second-degree equation in two variables and curves represented by it-non-degenerate and degenerate conic, central and non-central conic: problems on find center when it exists [3]. Reduction of general second- degree equation in two variables to the canonical form by the method of

	invariants. Identification of the nature of curves represented [4]. Tangent and normal to a non-degenerate conic (given in Cartesian and polar form) (emphasis on problem solving) [4] **Three- dimensional Geometry [20 classes]:** Sphere **[8]:** Sphere as a surface generated by revolving a semicircle about its bounding diameter-General form of the equation of a sphere passing through three non-collinear points.[3] Tangent plane to a sphere: condition of tangency [2] . Intersection of two spheres: radical plane and circle of intersection. Equation of any sphere passing through the circle of intersection of two given spheres. [3] Cone & Cylinder **[9]**: Cone & Cylinder as surfaces generated by a variable straight line satisfying some conditions: guiding curve and generator -general equation of a cone & cylinder [2]. Right circular cone and right circular cylinder as special types [2]. Necessary and sufficient condition for a homogeneous second-degree equation in three variables representing a cone with vertex at the origin (statement only). Necessary and sufficient condition for such a cone to have three mutually perpendicular generators (statement only) Illustrative examples [2]. General form of the equation of the tangent plane to a cone & a cylinder (no derivation): (emphasis on problem solving) [3] Conicoid**: [3]** Familiarity with the standard equation of conicoids like ellipsoid, paraboloid and hyperboloids and their geometrical shapes.
Learning Outcomes *[3]	On successful completion of the course a student will be able to do the following: • Understand the concepts of localized and free vectors. • Get acquainted with basic vector operations and laws governing them. • Understand algebraic definitions of dot and cross products and their geometric interpretations. • Application of dot and/ or cross product to determine angle between vectors, orientation of axes, areas of triangles and parallelograms in space, scalar and vector projections, and volume of parallelopipeds. • Understand scalar and vector triple product and its applications. • Getting introduced to affine transformation of co-ordinates in rotations and translations.

	• Getting introduced to general equation of second degree in two variables and the conics represented by it. • Learn to reduce the general equation of second degree to the canonical form by the method of invariants. • Understanding sphere as a surface generated by revolving a semicircle about its bounding diameter and the general form of the equation of a sphere passing through three non-collinear points; tangent plane to a sphere; intersection of two spheres; radical plane and the circle of intersection. • Understanding cone &cylinder as surfaces generated by a variable straight line satisfying some conditions: guiding curve and generators and right circular cone and right circular cylinder as special types. • Getting introduced to some familiar conicoids.	
Reading/Reference Lists *[4]	• S.L Loney: The elements of coordinate geometry. • Shanti Narayan, P.K. Mittal: Vector Algebra. • L. Silberstein: Elements of Vector Algebra. • Ghosh & Maity: Vector Analysis. • Vladimir Lepetic: Classical Vector Algebra. • 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: 20+5+5=30 Semester Exam: 70	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	Module-1 [20] 2 questions each carrying 10 marks out of 4 questions. Module-2 [50] 5 questions each carrying 10 marks out of 9 questions.	