

## BSc. (Prog.) with Mathematics as Major

### Category II

#### DISCIPLINE SPECIFIC CORE COURSE (DSC-2): ANALYTIC GEOMETRY CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Analytic Geometry	4	3	1	0	XII pass with Mathematics	NIL

**Learning Objectives:** The course aims at identifying and sketching curves, studying three dimensional objects, their geometric properties and applications. Use of vector approach to three-dimensional geometry makes the study simple and elegant.

**Learning Outcomes:** This course will enable the students to:

- Learn concepts in two-dimensional geometry.
- Identify and sketch conics namely, ellipse, parabola and hyperbola.
- Learn about three-dimensional objects such as straight lines and planes using vectors, spheres, cones and cylinders.

#### SYLLABUS OF DSC-2

##### UNIT – I: Conic Sections

(5 Weeks)

Techniques for sketching parabola, ellipse and hyperbola; Reflection properties of parabola, ellipse, hyperbola, and their applications to signals; Classification of quadratic equation representing lines, parabola, ellipse and hyperbola; Rotation of axes; Second degree equations.

##### UNIT – II: Vectors, Lines and Planes

(6 Weeks)

Rectangular coordinates in 3-dimensional space, vectors viewed geometrically, vectors in coordinate systems and vectors determined by length and angle; Dot product; Projections; Cross product, scalar triple product, vector triple product and their geometrical properties; Parametric equations of lines, direction cosines and direction ratios of a line, vector and symmetric equations of lines, angle between two lines; Planes in 3-dimensional space, coplanarity of two lines, angle between two planes, distance of a point from a plane, angle between a line and a plane, distance between parallel planes; Shortest distance between two skew lines.

##### UNIT – III: Sphere, Cone and Cylinder

(4 Weeks)

Equation of a sphere, plane section of sphere, tangents and tangent plane to a sphere; Equation of a cone, enveloping cone of a sphere, Reciprocal cones and right circular cone; Equation of a cylinder, enveloping cylinder and right circular cylinder.

**Recommended Readings:**

1. Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). *Calculus* (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Indian reprint (2016) by Wiley India Pvt. Ltd. Delhi.
2. Narayan, Shanti & Mittal, P. K. (2007). *Analytical Solid Geometry*. S. Chand & Company Pvt Ltd. India.

**Suggestive Readings:**

- i. Bell, Robert J.T. (1972). *An Elementary Treatise on Coordinate Geometry of Three Dimensions*. Macmillan & Co. Ltd. London.
- ii. George B. Thomas, Jr., & Ross L. Finney (2012). *Calculus and Analytic Geometry* (9th ed.). Pearson Indian Education Services Pvt Ltd. India.

**DISCIPLINE SPECIFIC CORE COURSE – 2 (Discipline A-2): Elementary Linear Algebra****CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Elementary Linear Algebra	4	3	1	0	XII pass with Mathematics	NIL

**Learning Objectives:** The objective of the course is to introduce the concept of vectors in  $\mathbb{R}^n$ , understanding the nature of solution of system of linear equations, and to view the  $m \times n$  matrices as a linear function from  $\mathbb{R}^n$  to  $\mathbb{R}^m$  and vice versa. The concepts of linear independence and dependence, rank and linear transformations has been explained through matrices.

**Learning Outcomes:** This course will enable the students to:

- Visualize the space  $\mathbb{R}^n$  in terms of vectors and the interrelation of vectors with matrices.
- Familiarize with concepts of bases, dimension and minimal spanning sets in vector spaces.
- Learn about linear transformation and its corresponding matrix.

**SYLLABUS OF DSC-2****UNIT – I: Euclidean Space  $\mathbb{R}^n$  and Matrices (6 Weeks)**

Fundamental operations with vectors in Euclidean space  $\mathbb{R}^n$ , Linear combinations of vectors, Dot product and their properties, Cauchy-Schwarz inequality, Triangle inequality, Solving system of linear equations using Gaussian elimination, Application: Curve Fitting, Gauss-Jordan row reduction, Reduced row echelon form, Application: Solving several

systems simultaneously, Equivalent systems, Rank and row space of a matrix, Eigenvalues, Eigenvectors, Eigenspace, Diagonalization, Characteristic polynomial of a matrix.

**UNIT – II: Introduction to Vector Spaces**

**(4 Weeks)**

Definition, Examples and some elementary properties of vector spaces, Subspaces, Span, Linear independence and linear dependence of vectors, Basis and dimension of a vector space, Maximal linearly independent sets, Minimal spanning sets.

**UNIT – II: Linear Transformations**

**(5 Weeks)**

Linear transformations: Definition, Examples and elementary properties, The matrix of a linear transformation, Kernel and range of a linear transformation, The dimension theorem, one-to-one and onto linear transformations, Invertible linear transformations, Isomorphic vector spaces.

**Recommended Reading:**

1. Andrilli, S., & Hecker, D. (2016). *Elementary Linear Algebra* (5th ed.). Elsevier India.

**Suggestive Readings:**

- i. Lay, David C., Lay, Steven R., & McDonald, Judi J. (2016). *Linear Algebra and its Applications* (5th ed.). Pearson Education.
- ii. Kolman, Bernard, & Hill, David R. (2001). *Introductory Linear Algebra with Applications* (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.