

## 16HS106 BASIC MATHEMATICS – II

Hours Per Week :

L	T	P	C
3	1	2	5

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	15	30	10	45	-	-	-	-

### Course Description and Objectives:

This course offers basic concepts on matrices, system of equations, differential equations of first and higher order. Further, numerical methods to solve differential equations are introduced.

The objective of the course is to provide the knowledge on the properties of matrices and solving system of equations using matrices. It is also aimed to offer various methods (analytical as well as numerical) to solve first and second order ordinary differential equations.

### Course Outcomes:

The student will be able to :

- understand the basic concepts, properties and operations on matrices.
- determine when a system of equations is consistent or not and solve it whenever possible.
- determine when the matrix has an inverse and find it when it exists.
- identify the method to solve the differential equations.
- find the complete solution of a homogeneous and non homogeneous differential equations with constant coefficients.
- evaluate integrals and solving differential equations using numerical methods.
- compare the solutions of differential equations by numerical methods with exact solution of that equation using MATLAB.

### SKILLS:

- ü Compare the inverse of matrix.
- ü Solve given system of linear equations.
- ü Solve given differential equations.

**UNIT - 1****L-9, T-3**

**MATRICES:** Definition, Types of matrices, Algebra of matrices, Determinant, Minor, Cofactor, Adjoint, and Inverse of a matrix; Elementary row operations, Inverse by row operations, Rank, Determination of rank using Echelon form and normal form.

**UNIT - 2****L-9, T-3**

**SYSTEM OF EQUATIONS:** System of linear equations, Consistency of system of equations, Solution by Cramer's rule, Matrix inversion method, Gauss-Jordan method and Gauss elimination method.

**UNIT - 3****L-9, T-3**

**FIRST ORDER ORDINARY DIFFERENTIAL:** Introduction, Variable separable, Linear equations, Bernoulli equation, Homogenous equations and Non-homogenous equations.

**UNIT - 4****L-9, T-3**

**SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS :** Linear differential equations of second order with constant coefficients with RHS of type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ ,  $x^n$ .

**UNIT - 5****L-9, T-3**

**NUMERICAL METHODS - II:** Numerical integration by trapezoidal rule and Simpson's rules; Numerical solutions to Differential equations - Euler's method and Runge-Kutta method.

**ACTIVITIES:**

- Compute the inverse of matrix and compare with MATLAB output.
- Solve given system of linear equations and compare with MATLAB output.
- Solve given differential equations and compare with MATLAB output.

**LABORATORY EXPERIMENTS****LIST OF EXPERIMENTS**

Total hours: 30

1. Matrix algebra.
2. Rank of a matrix.
3. System of equations (Direct method).
4. System of equations (Cramer's rule).
5. System of equations (Matrix inversion method).
6. Solutions of first order ODE.
7. Trapezoidal rule.
8. Simpson's one-third rule.
9. Simpson's three-eighth rule.
10. Euler's method.
11. RK Method.

**Text BOOKS :**

1. H. K. Dass and Er. R. Verma, "Higher Engineering Mathematics", 3<sup>rd</sup> edition, S. Chand and Co., 2014.
2. B. S. Grawel, "Engineering Mathematics", 44<sup>th</sup> edition, Khanna Publishers, 2014.

**Reference Books :**

1. K. S. Rao, "Numerical Methods", 3<sup>rd</sup> edition, PHI Publishers, 2007.
2. R. Pratap, "Getting started with MatLab", Oxford University Publication, 2009.

