## 22MT103 LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

Hours Per Week :

| $L$ | $T$ | $P$ | $C$ |
| :---: | :---: | :---: | :---: |
| 3 | 2 | 0 | 4 |

PREREQUISITE KNOWLEDGE: Basics of matrices, Differentiation and Integration.

## COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the principles of mathematics through matrices, differential equations and applications that serves as an essential tool in several engineering applications.

## MODULE-1

UNIT-1
12L+8T+0P=20 Hours

## MATRICES

Definition of matrix; Types of matrices; Algebra of matrices, adjoint of a matrix, inverse of a matrix through adjoint and elementary row operations, Rank of a matrix, Echelon form, Normal form. Eigen values and Eigen vectors (up to $3 \times 3$ matrices only) and properties (without proofs).

UNIT-2
12L+8T+0P=20 Hours

## APPLICATIONS OF MATRICES

Consistency of system of linear equations, Solution of system of linear equations having unique solution and involving not more than three variables by Gauss elimination method and Gauss Jordan method. Cayley-Hamilton theorem (without proof), Power of a matrix, Inverse of a matrix. Strength of materials and strength of beams using Eigen value and Eigen vectors.

## PRACTICES:

- Compute inverse of a matrix if exists.
- Explain with suitable examples how rank of matrix is independent of the elementary operations.
- Explain with suitable examples how rank of matrix is unique.
- Discuss with suitable examples when eigen values and eigen vectors are possible for a matrix.
- Discuss the possibility of solution of a system of equations.
- Discuss when inverse and power of a matrix exist using Cayley-Hamilton theorem.


## MODULE-2

## UNIT-1

12L+8T+0P=20 Hours

## ORDINARY DIFFERENTIAL EQUATIONS (ODE)

First Order Differential Equations: Introduction to ODE, variable separable method, homogenous and non-homogenous differential equations, linear differential equations, Bernoulli's equations.

Second Order Differential Equations: Linear differential equations with constant coefficients with RHS of the form eax, $x n, \sin (a x)$ or $\cos (a x)$.

## SKILLS:

$\checkmark$ Find rank of a matrix using different methods.
$\checkmark$ Compute the eigen values and eigen vectors of a matrix.
$\checkmark$ Find analytical solution of a differential equation using appropriate method.
$\checkmark$ Demonstrate any one numerical method to solve differential equation

UNIT-2

## 12L+8T+0P=20 Hours

## APPLICATIONS OF ODE

Applications of ODE: Newton's law of cooling, Law of natural growth and decay, LR Circuit.

## PRACTICES:

- Check the order and degree of an ODE.
- Find solution for any four ordinary differential equations by applying suitable method.
- Find numerical solution for any four ordinary differential equations by applying suitable method.
- Discuss some applications of ODE.


## COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

| CO <br> No. | Course Outcomes | Blooms <br> Level | Module <br> No. | Mapping <br> with POs |
| :---: | :--- | :---: | :---: | :---: |
| 1 | Apply the concepts of rank, eigen values and <br> eigenvectors of a matrix and finding inverse of a <br> matrix and powers of a matrix. | Apply | 1 | $1,2,9,10,12$ |
| 2 | Apply differential equations in real life problems. | Apply | 2 | $1,2,9,10,12$ |
| 3 | Analyse the solution of a system of linear equa- <br> tions and find it. | Analyze | 1 | $1,2,9,10,12$ |
| 4 | Inspect the analytical method for solving differ- <br> ential equations and applications. | Analyze | 2 | $1,2,9,10,12$ |

## TEXT BOOKS:

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", 2nd edition Universal Science Press, New Delhi, 2018.
2. B. S. Grewal,"Higher Engineering Mathematics", 44th edition, Khanna Publishers, 2018.

## REFERENCE BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley \& Sons, Inc, 2015.
2. H. K. Dass and Er. RajanishVerma, "Higher Engineering Mathematics", 3rd revised edition, S. Chand \& Co., 2015.
3. B. V. Ramana, "Advanced Engineering Mathematics", TMH Publishers, 2020.
4. T. K.V. Iyengar et al, "Engineering Mathematics, I, II, III", S. Chand \& Co., New Delhi.
