

## **MT - 222 Linear Algebra & Ordinary Differential Equation**

### **Linear Algebra:**

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, eigen value and eigen vectors of a matrix, Diagonalization. Applications of linear algebra (Scaling, translation, rotation and projection) with graphical representation.

### **Introduction to ODEs:**

The Concepts & Terminologies: Order and Degree; Linearity & Non-linearity; A Brief Classification of ODEs; Formulation of ODEs: Concrete Examples; Solutions: General & Particular: Concrete Examples & Applications: Initial Value Problems (IYP) and Boundary Value problems (BVP): A Brief Introduction to Issues related to Existence & Uniqueness of Solutions.

### **The First Order ODEs: Linear and Non-Linear:**

Variable Separable Cases & Applications: Growth & Decay Problems, Newton's Law of Cooling, Torricelli's Law, Simple Kinematical Dynamical Applications; Exact and No-Exact ODEs: Solution Procedures and Integrating Factors; The Standard Linear Differential Equation of First Order: Solution Procedures and Applications to RL-Circuits and RC-Circuits, Bernoulli's Equations & Logistical Growth Models. Direction Fields and Euler's and Picard's Iterative Schemes for the 1<sup>st</sup> Order ODEs,

### **The Linear Second Order ODEs: Homogeneous and Non-Homogeneous Cases:**

Linear Second Order Homogeneous ODE with Constant Coefficients: Solution Procedures and the Principle of Linear Superposition and Applications --- Mechanical Systems & Electrical Systems, Undamped and Damped Harmonic Oscillators: Linear Second Order Non-Homogeneous ODEs with Constant Coefficients: Solution Procedures and the Principle of General Linear Superposition: Complementary Functions & Particular Solutions---the Method of Undetermined Coefficients & Variation of Parameters: Applications: Spring-Mass Systems -- Damped & Undamped Harmonic Oscillators with Forcing Terms and their ODEs and Solutions; RCL-Circuits and their ODEs and Solutions; The Physics and Mathematics of the Phenomenon of Resonance in Mechanical & Electrical Systems; Cauchy-Euler ODEs and their Solution Procedures.

### **Partial Differential Equation:**

Formation of partial differential equations. Solutions of first order linear and special types of second and higher order differential equations. Homogeneous partial differential equations of order one, Lagrange's multiplier.

### **Advance Calculus & Vector Calculus:**

Double & triple integral with application (Area, centroid, moment of inertia) vector differentiation & vector integral with applications, Green & Stokes theorem with applications.

### **Recommended Books**

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| 1. Elementary Linear Algebra                       | Howard Anton       | Seven Edition |
| 2. Advance Engineering Mathematics                 | Erwin Kreyszig     | Seven Edition |
| 3. Differential Equation A modeling<br>Perspective | Robert L. Barrelli | 1998          |
| 4. Introduction to Differential Equation           | J. Farlaw          | 1994          |
| 5. Differential Equation                           | G. Zill            |               |