

28. Mathematics A-Course**B.A./B.Sc. Mathematics A-Course-II****Total Mark: 100****Appendix 'A'****(Outlines of Tests)**

Linear Algebra and Differential Equations

:

100 Marks

Appendix 'B'**(Syllabi and Courses of Reading)****Linear Algebra and Differential Equations****100 Marks**

Note: Attempt six questions by selecting two questions from Section I, one question from Section II, one question from Section III and two questions from Section IV.

Section-I (4/12)**Matrices, Determinants and System of Linear Equations**

- Definition of matrix, various types of matrices
- Algebra of matrices
- Determinant of square matrix, cofactors and minors
- Laplace expansion of determinants
- Elementary matrices, Adjoint and inverses of matrices
- Rank of a matrix
- Introduction to systems of linear equations
- Cramer's rule, Gaussian elimination and Gauss Jordan method
- Solution of homogenous and non-homogenous linear equations
- Net work flow problems

Vector Spaces

- Real vector spaces, subspaces
- Linear combination and spanning set.
- Linear independence and linear dependence, basis and dimension, row space, Column space and Null space

Linear Transformations

- Introduction to linear transformation
- Matrices of linear transformations
- Rank and nullity

Section-II (2/12)**Inner Product Spaces**

- Inner product and norm
- Cauchy Schwarz inequality
- Norm of a vector, triangle inequality
- Parallelogram identity
- Orthonormal sets and basis

- The Gram-Schmidt process
- Eigen values and Eigen vectors
- Diagonalization, Orthogonal diagonalization
- Orthogonal matrices, similar matrices

Section-III (2/12)

Introduction to Differential Equations

- Historical background and motivation
- Basic mathematical models: Directional fields
- Classification of differential equations
- Formation of differential equation

First Order Differential Equations

- Modeling with first order differential equations
- Applications of first order ODEs in problems of decay and growth, population dynamics, logistic equation
- Separable equations
- Homogeneous and non-homogeneous equations
- Linear and nonlinear equations
- Exact and non-exact equations and integrating factors
- Orthogonal trajectory, Bernoulli, Ricatti, Clairaut's equations

Section-IV (4/12)

Second Order Differential Equations

- Homogenous equations
- Homogenous equations with constant coefficients
- Fundamental solutions of linear homogenous equations
- Operator method, Method of undetermined coefficients
- Cauchy Euler's equation
- Linear independence and the wronskian
- Variation of parameters, reduction of order
- Applications to mechanical and electrical systems

Higher Order Linear Differential Equations

- General theory of n th order linear differential equations
- Homogenous equations with constant coefficients
- The methods of undermined coefficients
- The method of variation of parameters

Power Series Solution of Second Order Linear Differential Equations and Laplace Transforms

- Power Series solution near an ordinary point, Legendr's equation
- Regular singular points, Series solution near a regular singular point

- Laplace transform, inverse Laplace transform
- Applications of Laplace transforms to solve ODEs

Recommended Books:

1. Howard Anton and Chris Rorres, Elementary Linear Algebra Applications Version, John Wiley and Sons Inc. 9th Edition, 2005
2. Bernard Kolman, David R. Hill, Introduction Linear Algebra with Applications, Prentice Hall International, Inc. 7th Edition, 2001
3. Seymour Lipschutz, Theory and Problems of Beginning Linear Algebra, Schaum's Outline Series, Mc-Graw Hill Company, New York, 1997
4. W.E. Boyce and Diprima, Elementary Differential Equations, 8th Edition, John Wiley & Sons, 2005
5. Erwin, Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 2004
6. Dennis G.Zill & Michael R. Cullen, Differential Equation With Boundary Value Problems, PWS Publihing Company, 2000