

MATHEMATICS –II
(Common to all branches)

Instruction	4 Periods per week (3 Theory + 1 Tutorial)
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 Marks

Course objectives:

- To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
- To provide an overview of ordinary differential equations
- To introduce series solutions of differential equations
- To study special functions like Legendre and Bessel functions

Outcomes: After completing this course, the students will be able to

- solve system of linear equations and eigenvalue problems
- solve certain first order and higher order differential equations
- find the series solutions of certain differential equations
- apply this knowledge to solve the curriculum problems

UNIT – I

Matrices :

Elementary row and column operations, Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

UNIT – II

Ordinary Differential Equations of First Order:

Exact first order differential equations, Integrating factors, Linear first order equations, Bernoulli's, Riccati's and

Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT – III

Linear Differential Equations of Higher Order :

Linear independence and dependence, Solutions of second and higher order linear homogeneous equations with constant coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, Solution of Euler-Cauchy equation, Simultaneous linear differential equations.

UNIT – IV

Series Solutions of differential equations:

Ordinary and Singular points of an equation, Power series solution, Series solution about a regular singular point, Frobenius method, Beta, Gamma and error functions.

UNIT – V

Special Functions:

Legendre's differential equation and Legendre's polynomials, Rodrigue's formula, Generating function for Legendre's polynomials $P_n(x)$, Recurrence relations for Legendre's polynomials $P_n(x)$, Orthogonal and Orthonormal functions, Orthogonal property of Legendre's polynomials $P_n(x)$, Bessel's differential equation and Bessel's functions, Derivatives and integrals of Bessel's functions, Recurrence relations for $J_n(x)$, Generating function for $J_n(x)$.

Suggested Reading:

1. R.K. Jain & S.R.K. Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition, 2014.
2. Dr.B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
3. Dr.M.D.Raisinghania, *Ordinary and Partial differential equations*, S.CHAND, 17th Edition 2014.
4. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, , 2012.