ADVANCED MATHEMATICS & NUMERICAL ANALYSIS (MA 401)

(For all Branches except ME)

Theory Marks - 100 **Pass Marks – 35**
Sessional Marks – 50 **Time: 3 hours**

Unit-I: Series solution of Differential equations:- **25 Marks** Series solution by the method of Frobenius, Validity of series solution, Ordinary and singular points, Series solution of a differential equation when x = 0 is an ordinary point or a singular point, Solution of Bessel's equation, Recurrence formulae for Bessel's functions $J_n(x)$, Expansions for J_0 and J_1 , Value of $J_{1/2}$ and $J_{-1/2}$, Generating function for J_n (x), Orthogonality of Bessel's functions, Integral form of Bessel's function, Legendre's equation, Rodrigue's formula, Legendre polynomials $P_n(x)$, Generating function for P_n (x), Recurrence formulae for $P_n(x)$,

Unit-II: Partial differential equations: **28 Marks.**

Formation of partial differential equations, equation solvable by direct integration, Lagrange's linear equations, non-linear equations of first order, Charpit's method.
solution of heat equations, wave equations and Laplace equations by the method of separation of variables.

Unit-III: Numerical Analysis: **35 Marks.**

Concept of significant digits & rounding of numbers; error analysis: absolute, relative & percentage error, error in series approximation.
Solution of non-linear equations (Newton-Raphson method, Bisection method, Regula-falsi method), Solution of linear algebraic equations: Gauss elimination method, Gauss-siedel method. Solution of ordinary differential equations: Taylor's series method, Runge Kutta method.
Interpolations and approximation: operators: Δ, E, ∂.
Forward, backward & central interpolation. Newton's, Langrange's & Stirling's interpolation formulae , Numerical Integration: Gaussian quadrature, Trapezoidal Rule and Simpson's Rule.

Unit-IV: Optimization Methods: **12 Marks.**

Optimization by calculus: unconstrained function of a signal variable, unconstrained function of multiple variables, Functions with equality constraints, Functions with inequality constraints.

Text/References:

1. Higher Engineering Mathematics: B. S. Grewal, Khanna publishers
2. Introductory methods of numerical analysis: S. S. Sastry, PHI
3. Numerical methods in Science and Engineering: S. Rajasekaran, Wheeler.
4. A Text book of Engineering Mathematics: N. P. Bali, Manish Goyal, Laxmi publication
5. Numerical methods: M. K. Jain & S. R. K. Iyengar, Wiley.
6. Operation Research: Prem Kumar Gupta, D.S. Hira, S. Chand & Co.
7. Numerical Mathematical Analysis: James B. Scarborough, Oxford & IBH Publishing co.