ANNEXURE- I

Choice Based Credit Course A/B : 50 Marks

Name: Some Methods in Applied Mathematics: (30 + 20)

Gr-A : Differential equations: (30 Marks = 20 + 10)

(i) Ordinary Differential Equation: (20)

Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, Singular solutions of first order ODEs.
Linear homogeneous differential equation: Ordinary and singular points, Series solution. Linear non-homogeneous differential equation: Solution by variation of parameters, Strum -Liouville's equation. Eigen value problem. Green's function.
Legendre function. Rodrigues formula. Orthogonal property. Recurrence relations.
Bessel function. Orthogonal property. Recurrence relations.
Hypergeometric function.

System of ODE's Flow diagram, Phase portrait, Isocline. Fixed points and their nature. stability, asymptotic stability, Liapunov function, Linearization at a critical point. Lotka-Volterra model.

(ii) Partial Differential Equation: (10)

Classification of second order partial differential equations. Three Fundamental equations: Laplace, Wave and Diffusion. Their solution.
Concept of nonlinearity and wave breaking. Solution of Burger and KdV equations.

Gr-B : Numercal Analysis: (20 Marks)

Computer Number System: Control of round-off-errors, Instabilities – Inherent and Induced, Hazards in approximate computations, Well posed computations, Well-posed and Ill-posed problems, The direct and inverse and identification problems of computation.

Numerical Solution of System of Linear Equations: Triangular factorisation methods, Matrix inversion method, Operation counts, Iterative methods – Jacobi method, Convergence condition of Gauss-Seidel method and Gauss-Jacobi method, Importance of diagonal dominance

Solution of Non-linear Equations: Modified Newton-Raphson method (for real roots-simple or repeated). Roots of Real Polynomial Equations: Sensitivity of polynomial roots, Lagrange's theorem, Hua's theorem, Bairstow's method of quadratic factors. Non-Linear Systems of Equations: Newton's method.

Numerical Integration: Newton-Cotes formulae, Gauss-Legendre and Gauss-chebyshev quadratures. Romberg integration, Simpson's adaptive quadrature, Fredholm integral equation. Improper integrals.

Introduction to Numerical Solution of differential equation: Runge-Kutta methods for first order IVP-ODE. Multistep methods – Adams-Bashforth method and Adams-Moulton method. Finite Difference Methods (FDM) for two-point BVP. Finite Difference Methods (FDM) for PDE. Numerical solution of one-dimensional Heat equation and Wave Equation through explicit and implicit FDM.

References:

1. E.A. Coddington and N. Levison, Theory of Ordinary Differential Equations, Tata McGraw Hill, 1955.
2. E.L. Ince, Ordinary Differential Equations, Dover, 1956.
3. N.N. Labedev, Special Functions, and their applications, Dover, 1972.
4. I.N. Sneddon, Special functions of Mathematical Physics and Chemistry, Longman, 1980.
5. R. Courant and D. Hilbert, Methods of Mathematical Physics (2 Vols.), Wiley, New York, 1966.
6. Lawrence C. Evans, Partial Differential Equations, Second Edition, American Mathematical Society, 2014.
7. I.N. Sneddon, Elements of partial differential equations, McGraw Hill, 1986.
8. Erich Zauderer, Partial Differential Equations of Applied Mathematics, A Wiley- Interscience Publication, John Wiley and Sons, 1983.
9. C.R. Chester, Techniques in partial differential equations, McGraw Hill, New York, 1971.
10. K.S. Rao, Introduction to partial differential equations, Prentice Hall, New Delhi, 1997.
11. S.D. Conte and C. DeBoor, Elementary Numerical Analysis: An Algorithmic Approach, McGraw Hill, N.Y., 1980.
12. K.E. Atkinson, An Introduction to Numerical Analysis, John Wiley and Sons, 1989.

13. W.F. Ames, Numerical Methods for PDEs, Academic Press, N.Y., 1977.
14. C.T.H. Baker and C. Phillips, The Numerical Solution of Nonlinear Problems, C.P. Oxford, 1981.
15. C.E. Fröberg, Introduction to Numerical Analysis, Addison-Wesley Publishing Company, 1969.
16. R. Zurmuhl, Numerical Analysis for Engineers and Physicists, Allied Publishers Private Limited, Calcutta.
17. L. Fox, Numerical Solution of Ordinary and Partial Differential Equations, Oxford, 1962.
18. C. Pozrikidis, Numerical Computation in Science and Engineering, Oxford University Press, Inc., N.Y., 1998.