MA 411 (CE & Ch.E)
ADVANCED MATHEMATICS AND NUMERICAL ANALYSIS

Theory – 100 marks.
Sessional – 50 marks.
Time – 3 Hours.

Unit-I: Partial differential equations: **25 Marks.**

Formation of partial differential equations, equation solvable by direct integration, linear and non-linear equations of first order, homogenous linear equation with constant coefficients solution of heat equation, wave equation and Laplace equation.

Unit-II: Calculus of Complex variables: **20 Marks.**
Analytic functions, C-R equations, Conjugate functions, Harmonic functions, orthogonal systems, formation of analytic function, Conformal mapping, Integration of a Complex function, Cauchy's integral theorem, Power series representation of complex functions, Laurent's series, singularities, Residue theorem.

Unit-III: Numerical Analysis: **35 Marks.**
Solution of non-linear equations (Newton-Raphson method, Bisection method, Regula-falsi method), Solution of linear algebraic equations (Gauss elimination method, Gauss-siedel method, Gauss Jordan method), Solution of ordinary differential equations (Taylor's series method, Runge Kutta method).
Interpolations and approximation: operators: Δ, E, ∂.
Gregory- Newton's forward and backward formula, Langrange's interpolation formula & Bessel's formula with remainder terms or errors, Chebyshev polynomial approximation.
Numerical Integration: Trapezoidal Rule, Simpson's Rule and Gaussian quadrature.

Unit-IV: Optimization Methods: **20 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. Complex variable & applications   : Churchil   : Mc Graw Hills.
2. Elements of P.D.Es.   : I. M. Snedon   : S. Chand & Co.
3. Numerical methods in Science and Engineering   : S. Rajasekaran   : Wheeler.
4. Numerical methods with Computer programs in C++: Pallab Ghosh   : Prentice Hall.
5. Numerical methods.   : M. K. Jain & S. R. K. Iyengar: Wiley.
6. A Text Book on Engineering Mathematics.   : Bali, Saxena, Iyengar: Laxmi Publications.
7. Operation Research.   : Prem Kumar Gupta : S. Chand.
8. Advanced Engineering Mathematics.   : Peter V O'Neil   : Thomson Books.
9. Analysis of Descret Physical systems.: Koenig, Y. Toked & H. K. Kesavan: Mc Graw Hill.

MA 401 Mathematics IV (Common to ME,EE,INE,CS,IPE)

Theory: 100

Sessional: 50
Time: 3 hours

Unit 1: Series Solutions   25 Marks

Power series solution of initial value problems, Power series solution using recurrence relations, singular points and the method of Frobenius, solution of Bessel's equation and Bessel's functions, solution of Legendre's equation and Legendre Polynomials, orthogonal set of functions, Strum-Liouville Problem, eigen values and eigen functions of singular problems, Bessel's functions as eigen functions of singular problem, Legendre Polynomials as eigen functions of singular problems, eigen function expansions.

Unit 2: Partial Differential Equations   25 Marks

Basic concepts, formation of partial differential equations, equation solvable by direct integration, linear and non-linear equations of first order. Homogenous linear equations with constant coefficients, solutions of heat equations, wave equations, transmission line equations and Laplace equations.

Unit 3: Tensor Analysis   20 Marks

Curvilinear coordinates, unit vectors in curvilinear system, representation of as vector F in terms of unit base vectors, contravariant and covariant components of F, arc length and volume element in orthogonal curvilinear coordinates. Transformations of coordinates. Definition of tensors, fundamental operations with tensors, Symmetric and skew-Symmetric tensors, Riemannian space and metric tensor, Conjugate tensor, Christoffel symbols.

Unit 4: Calculus of Complex Variables   20 Marks

Analytic functions, C-R equations, conjugate functions, Harmonic functions, orthogonal systems. Formation of analytic functions, conformal mapping, integration of a complex functions, Cauchy's Integral Theorem, power series representation of complex functions, Laurent's Series, singularities, Residue Theorem.

Unit 5: Z-Transform   10 Marks

Definition, properties, Z-transform of some basic sequences, Z-transforms of some basic discrete functions, Shifting theorems.

Text books and References:

1. Advanced Engg. Maths, E. Kreyszig. Wiley Eastern Ltd.
2. Advanced Engg. Maths, Peter V. O. Neil. Thomson Books.
3. A Text Book on Engg. Maths, Bali, Tyenger. Laxmi Publishers.
4. Higher Engg. Maths, B.S. Grewal. Khanna Publishers.
5. Linear Algebra and it's Applications, Gilbert Strang. Thomson Books.
6. Calculus, James Stewart. Thomson Books.
7. Laplace Transform, Spiegel. Thomson Books.
8. Elements of Partial Differential Equations, I. M. Snedon. S. Chand and Co.
9. Text book of Vector Calculus by Shanti Narayan, S. Chand and Co.
10. Function of Complex Variables by Shanti Narayan, S. Chand and Co.