| XE - A | Engineering Mathematics(Compulsory for all XE Candidates) |
|---|---|

## Section 1: Linear Algebra

Algebra of real matrices: Determinant, inverse and rank of a matrix; System of linear equations (conditions for unique solution, no solution and infinite number of solutions); Eigenvalues and eigenvectors of matrices; Properties of eigenvalues and eigenvectors of symmetric matrices, diagonalization of matrices; Cayley-Hamilton Theorem.

## Section 2: Calculus

Functions of single variable: Limit, indeterminate forms and L'Hospital's rule; Continuity and differentiability; Mean value theorems; Maxima and minima; Taylor's theorem; Fundamental theorem and mean value theorem of integral calculus; Evaluation of definite and improper integrals; Applications of definite integrals to evaluate areas and volumes (rotation of a curve about an axis).

Functions of two variables: Limit, continuity and partial derivatives; Directional derivative; Total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers; Double integrals and their applications.

Sequences and series: Convergence of sequences and series; Tests of convergence of series with non-negative terms (ratio, root and integral tests); Power series; Taylor's series; Fourier Series of functions of period $2\pi$.

## Section 3: Vector Calculus

Gradient, divergence and curl; Line integrals and Green's theorem.

## Section 4: Complex variables

Complex numbers, Argand plane and polar representation of complex numbers; De Moivre's theorem; Analytic functions; Cauchy-Riemann equations.

## Section 5: Ordinary Differential Equations

First order equations (linear and nonlinear); Second order linear differential equations with constant coefficients; Cauchy-Euler equation; Second order linear differential equations with variable coefficients; Wronskian; Method of variation of parameters; Eigenvalue problem for second order equations with constant coefficients; Power series solutions for ordinary points.

## Section 6: Partial Differential Equations

Classification of second order linear partial differential equations; Method of separation of variables: One dimensional heat equation and two dimensional Laplace equation.

## Section 7: Probability and Statistics

Axioms of probability; Conditional probability; Bayes' Theorem; Mean, variance and standard deviation of random variables; Binomial, Poisson and Normal distributions; Correlation and linear regression.

## Section 8: Numerical Methods

Solution of systems of linear equations using LU decomposition, Gauss elimination method; Lagrange and Newton's interpolations; Solution of polynomial and transcendental equations by Newton-Raphson method; Numerical integration by trapezoidal rule and Simpson's rule; Numerical solutions of first order differential equations by explicit Euler's method.