

MATHEMATICAL FOUNDATIONS FOR ENGINEERS (*non-credit course*)

Matrices: Determinant of a square matrix, properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Inverse of a matrix, Computation of inverses, solution of system of linear equations by matrix inversion method and Cramer's rule. Elementary transformation on a matrix. Rank of a Matrix, Linear dependence. Solutions of Linear Systems: Existence and Uniqueness.

Vector Algebra: Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of vectors. Scalar Product – Angle between two vectors, properties of scalar product, and applications of dot products. Vector Product – Right handed and left handed systems, properties of vector product and applications of cross product. Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration.

Coordinate Geometry: Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two point form, intercept form and normal form. General equation of a line. Distance of a point from a line.

Sections of a cone: circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

Differential Calculus: Derivative as a rate measure – rate of change – velocity – acceleration – related rates – Derivative as a measure of slope – tangent, normal and angle between curves. Maxima and Minima. Mean value theorem – Rolle's Theorem – Lagrange Mean Value Theorem – Taylor's and Maclaurin's series, l' Hôpital's Rule, stationary points – increasing, decreasing, maxima, minima, concavity convexity and points of inflexion.

Integral Calculus: Properties of definite integrals, Area, length, volume and surface area.

Differential Equations: Formation of differential equations, order and degree, solving differential equation – variable separable homogeneous, linear equations. Second order linear equations.

Statistics and Probability Theory: Measures of dispersion: Mean, median and mode, variance and standard deviation of ungrouped/grouped data. Probability, conditional probability, independent events, total probability and Baye's theorem. Random Variable, Probability density function, distribution function, mathematical expectation, variance, Discrete Distributions – Binomial, Poisson, Continuous Distribution – Normal distribution.