

Part – A – Mathematics

1. Basics of differential and integral calculus (10 marks)

Differentiation, Integration of simple functions, formation of ordinary differential equations from physical models/process, solution by analytical method, numerical solution by Euler method.

Concept of maxima and minima, conditions for optimality

2. Basics of statistics and Probability theory (10 marks)

Axioms of probability theory, permutations and combinations based probability computation, conditional probability, Baye's theorem, random variables and distributions,

Expected values, concept of variance and co-variance of multivariate random variables, multivariate Gaussian distribution

3. Linear Algebra (20 marks)

Vectors and vector spaces, inner product, orthogonality, concept of basis set for vector spaces, matrices, rank of a matrix,

systems of linear equations, Solution by Gaussian elimination.

Concept of vector spaces associated with a matrix (row space, column space, left and right null space)

general Complete solution to system of equations $Ax=b$

eigenvalue and eigenvectors, spectral decomposition,

Concept of Singular value decomposition.