

Sem 1: Mathematics for MEC 1

Unit 1: Limit, continuity, differentiability of a function.

Basics of function: Function and their graphs: Increasing and decreasing functions, even and odd functions, Examples of known functions: power functions, polynomial functions, rational functions, algebraic functions, trigonometric, exponential and logarithmic functions. [6 hrs]

Limit of a function at a point: An informal(intuitive) definition limit of a function and limit laws, Evaluating the limits of polynomial and rational functions, Sandwich theorem, One sided limits, Limit of $\frac{\sin \theta}{\theta}$. [10 hrs]

Continuity of a function: Definition of continuity of a function using limits. Continuity of composition of functions, Intermediate value theorems and its application, Limits at infinity (horizontal asymptotes), and infinite limits (vertical asymptotes) [6 hrs]

Differentiability of a function: The derivative as a function, Differentiable functions are continuous, Differentiation rules and problems of differentiation, The derivative as a rate of change, Extreme values of functions in closed intervals, The Mean Value theorem. [8 hrs]

Unit 2: Matrices [15 hrs]

Linear algebra Linear models in economics and engineering. System of linear equations. Row reduction and Echelon form. Vector equations. The matrix equation $Ax=b$. Solution sets of linear systems. Applications of linear systems. Matrix operations. The inverse of a matrix, Determinants Characterizations of invertible matrices.

Text books:

1. George B Thomas Jr, Maurice Weir and Joel Hass, Thomas' Calculus, 12th edition, Pearson, 2014. limited, 2005.
2. David C Lay. Linear Algebra and its Applications. Third edition. Pearson, 2006.

Practical 2 Credits, 3 hrs/session

1. Introduction to Python -I
2. Introduction to Python -II
3. Problems using basic differentiation rule and chain rule
4. Implicit Differentiation. Indeterminate forms:L'Hospital's rule.
5. Successive differentiation, Leibnitz rule.
6. Limit and Continuity of a function
7. Finding the Row Echelon form and rank of matrix

8. Solving system of linear equations with no solutions or unique solution
9. Solving system of linear equations with infinite solutions; expressing the solution in parametric form

Sem 2: Mathematics for MEC 2

Unit I: Function of several variables: Limit and continuity (without $\epsilon - \delta$ definition), partial derivatives, Mixed derivatives, Differentiability, The chain rule, Directional derivative and gradient vectors, Extreme values and saddle points. Lagrange Multiplier (15 hours)

Unit II Integration and its application: Trigonometric Integrals(Reduction formulas), Integration using trigonometric Substitutions, Integration by partial fractions. Volume of a solid: Solids of revolution, The Washer method, The Shell method. Arch-length, Area of surface of revolution. (15 hours)

Unit III: Ordinary Differential Equations I: Definition of differential equations and formation. Families of curves, orthogonal trajectories. Growth, decay, mixing. Homogeneous equations. Exact equations. Integrating factors. Linear equations. Reduction of order. (15 hours)

Practical 2 Credits, 3 hrs/session

1. Partial derivatives
2. Finding and plotting the extreme values and saddle points.
3. Lagrange's multiplier.
4. Linear equations. Integrating factors.
5. Bernoulli's form (reducing it to linear equations).
6. Exact equations: condition for exactness and solving for exact equations
7. Reduction formulas of trigonometric integrations.
8. Arc-length (in cartesian and polar coordinates)
9. Area of the surface of revolution.

Text Book:

1. George B Thomas Jr, Maurice Weir and Joel Hass, Thomas' Calculus, 12th edition, Pearson, 2014.