CALCULUS SYLLABUS

Module 1: Single Variable Calculus

- Differentiation
  - Extrema on an interval
  - Rolle's Theorem and the Mean Value Theorem
  - Increasing and decreasing functions
  - First derivative test and second derivative test
  - Maxima and minima
  - Concavity
- Integration
  - Average function value
  - Area between curves
  - Volumes of solids of revolution

Module 2: Multivariable Calculus

- Functions of two variables
- Limits and continuity
- Partial derivatives
- Total differential
- Jacobian and its properties

Module 3: Application of Multivariable Calculus

- Taylor's expansion for two variables
- Maxima and minima
- Constrained maxima and minima
- Lagrange's multiplier method

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Module 4: Multiple Integrals

- Evaluation of double integrals
- Change of order of integration
- Change of variables between Cartesian and polar coordinates
- Evaluation of triple integrals
- Change of variables between Cartesian, cylindrical, and spherical coordinates

Module 5: Special Functions

- Beta and Gamma functions
- Interrelation between Beta and Gamma functions
- Evaluation of multiple integrals using Gamma and Beta functions
- Dirichlet's integral
- Error functions and complementary error functions

Module 6: Vector Differentiation

- Scalar and vector-valued functions
- Gradient, tangent plane, and directional derivative
- Divergence and curl
- Scalar and vector potentials
- Statement of vector identities with simple problems

Module 7: Vector Integration

- Line, surface, and volume integrals
- Statement of Green's Theorem, Stokes' Theorem, and Gauss' Divergence Theorem
- Verification and evaluation of vector integrals using the theorems

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