AMG- Mathematics- Calculus of Several Variables and Vector Calculus

Unit-1 Limits and Continuity

   1.1 Functions of Several Variables :- Functions of two variables, Domain and
      Range, Graphs, Level Curves, Functions of Three or More Variables
   1.2 Limits and Continuity.

Unit-2 Partial Derivatives and Differentiability
   2.1 Definition and examples.
   2.2 Higher Derivatives, Clairaut's Theorem (Statement Only) , Partial
      Differential Equations, Wave equation.
   2.3 Differentiable function, Differentials
   2.4 Chain Rule, Homogeneous Functions, Euler's theorem

Unit-3 Extreme Values

   3.1 Extreme values of functions of two variables.
   3.2 Necessary conditions for extreme values.
   3.3 Second Derivative Test (without proof).
   3.4 Lagrange Multipliers (with one constraints)

Unit-4 Multiple Integrals

   4.1 Iterated Integrals, Fubini's Theorem (Statement only)
   4.2 Double integral over general regions, Change of order of integration for two variables.
   4.3 Double integral in Polar coordinates.
   4.4 Triple integrals , Evaluation of triple integrals. Triple integrals in spherical coordinates
Jacobians , Change of variables in multiple integrals .(Results without proofs)

Unit- 5 Vector-Valued Functions

    5.1 Curves in Space, Limits and Continuity, Derivatives and Motion,
     Differentiation Rules for Vector Function, Vector Functions of Constant
     Length.
    5.2 Integrals of Vector Functions.

    5.3 Arc Length along a Space Curve, Speed on a Smooth Curve, Unit
     Tangent Vector.
    5.4 Curvature of a Plane Curve, Circle of Curvature for Plane Curves, Curvature
     and Normal Vectors for a Space Curve.

Unit 6: Integrals

    6.1 Line Integral of Scalar Functions, Additivity, Line integral in the Plane.
    6.2 Vector Fields, Gradient Fields, Line Integral of Vector Fields, Line Integrals with
     respect to dx, dy, dz .
    6.3 Work done by a Force over a Curve in Space, Flow Integrals and Circulation
     for Velocity Fields, Flow across the Simple Closed Plane Curve.
    6.4 Path Independence, Conservative and Potential Functions.

      6.5 Divergence, Two forms for Green's Theorem, Green's Theorem in the
           Plane (Proof for special regions),

Unit- 7: Surface Integrals

7.1 Parameterizations of Surfaces, Implicit surfaces.

7.2 Surface integrals, Orientation of Surfaces.

7.3 Surface Integrals of Vector Fields.

Unit- 8: Applications of Integrals

8.1 The Curl Vector Field, Stokes' Theorem(without proof), Conservative Fields and
    Stokes' Theorem.

8.2 Divergence in three Dimensions, Divergence Theorem (without proof).

8.3 Unifying the Integral Theorems.