Code No.: **MDS 554**
Course Title:**Multivariable Calculus for Data Science**   Full Mark: 75
Nature: **Theory**(Compulsory)   Credit: 3

Course Description:

This course extends single variable calculus to higher dimensions. It will cover the vocabulary for understanding fundamental processes and phenomena and provide important background needed for further study in many diverse fields, particularly in data science. It will build tools to describe geometric objects and apply problem solving methods to answer a variety of questions, mathematical and otherwise.

Course Objectives:

After successful completion of this course, the student will be able to
- Learn vectors and the geometry of space
- Work with Vector functions
- Learn partial derivatives
- Compute multiple Integrals
- Learn vector calculus

Course Contents:

Unit 1: Vectors and the Geometry of Space   **[6 Hrs.]**
Three-Dimensional Coordinate Systems
Vectors
The Dot Product
The Cross Product
Equations of Lines and Planes

Unit 2: Vector Functions   **[8 Hrs.]**
Vector functions and space curves
Derivatives and integrals of vector functions
Arc length and curvature
Motion in space

Unit 3: Partial Derivatives   **[12Hrs.]**
Functions of several variables
Limits and continuity
Partial derivatives
Tangent planes and linear approximation
Chain rule
Directional derivatives and gradient vector
Maximum and minimum values
Lagrange multipliers

Unit 4: Multiple Integrals   **[10Hrs.]**
  Double integrals
   Polar coordinates
  Applications of double integrals
  Surface area
  Triple integrals
  Change of variables in multiple integrals
Unit 5: **Vector Calculus**   **[12Hrs.]**
  Vector fields
  Line integrals
  Green's theorem
  Curl and divergence
  Parametric surfaces and their areas
  Surface integrals
  Stokes' theorem
  Divergence theorem

References:

1. Edwards, Henry C., and David E. Penney (2002) .*Multivariable Calculus*. Prentice Hall,

2. Oliver Knill (2018).*Multivariable Calculus*, Harvard University

http://people.math.harvard.edu/~knill/teaching/summer/

3. James Stewart, *Multivariable Calculus*(2009).*Concepts and Contexts*, CengageLearning .
4. Denis Auroux (2010). *Multivariable Calculus.* Massachusetts Institute of Technology: MIT Open Course Ware, https://ocw.mit.edu..

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