MATH-213 Calculus-III

Credit Hours: 3-0

Prerequisite: MATH-111 Calculus-I

Course Objectives: This is the third course of Calculus and builds up on the concepts learned in first two courses. The students would be introduced to the vector calculus, the calculus of multivariable functions and double and triple integrals along with their applications.

Core Contents: Analytic geometry in three dimensions, Vectors, continuity and limit for a function of three variables, Directional derivatives, Multiple integrals, Green's, Divergence and Stokes' theorems.

Detailed Course Contents: Curves in Space and Their Tangents, Integrals of Vector Functions;Projectile Motion, Arc Length in Space, Curvature and Normal Vectors of a Curve, Tangential and Normal Components of Acceleration, Velocity and Acceleration in Polar Coordinates Functions of Several Variables, Limits and Continuity in Higher Dimensions, Partial Derivatives,The Chain Rule.

Directional Derivatives and Gradient Vectors, Tangent Planes and Differentials, Extreme Values and Saddle Points, Taylor's Formula for Two Variables, Partial Derivatives with Constrained Variables, Double and Iterated Integrals over Rectangles, Double Integrals over General Regions Area by Double Integration, Double Integrals in Polar Form.

Triple Integrals in Rectangular Coordinates, Triple Integrals in Cylindrical and Spherical Coordinates, Substitutions in Multiple Integrals, Line Integrals of Scalar Functions, Vector Fields and Line Integrals: Work, Circulation, and Flux, Path Independence, Conservative Fields, and Potential Functions, Green's Theorem in the Plane, Surfaces and Area, Surface Integrals,Stokes Theorem, The Divergence Theorem and a Unified Theory.

Course Outcomes: After reading this course the students will be able to

- Handle vectors fluently in solving problems involving the geometry of lines, curves,planes, and surfaces in space.
- Visualize and draw graphs of surfaces in space.
- Differentiate functions of vectors.
- Calculate extreme values using Lagrange multipliers.
- Solve double and triple integrals.
- Use various theorems to convert integrals from surface to volume and/or line integrals

Textbook: J. Hass, C. Heil and M. E. Weir, Thomas' Calculus, 14th Edition, Pearson, 2017

Reference Books:

1. J. Stewart, Single Variable Calculus: Early Transcendentals, 6th Edition, Pacific Grove,Ca: Brooks/Cole, Thompson Learning, 2008.
2. H. Anton, I. Bevens, S. Davis, Calculus, 8th Edition, John Wiley & Sons, Inc. 2005
3. Hughes-Hallett, Gleason, McCallum, et al, Calculus Single and Multivariable, 3rdEdition. John Wiley & Sons, Inc. 2002.
4. Frank A. Jr, Elliott Mendelson, Calculus, Schaum's outlines series, 4th Edition, 1999
5. C. H. Edward and E. D. Penney, Calculus and Analytics Geometry, Prentice Hall, Inc.1988
6. E. W. Swokowski, Calculus and Analytic Geometry, PWS Publishers, Boston, Massachusetts, 1983.

Weekly Breakdown		
Week	***Section***	***Topics***
1	13.1, 13.2	Curves in Space and Their Tangents, Integrals of Vector Functions; Projectile Motion
2	13.3-13.5	Arc Length in Space, Curvature and Normal Vectors of a Curve, Tangential and Normal Components of Acceleration
3	13.6	Velocity and Acceleration in Polar Coordinates
4	14.1, 14.2	Functions of Several Variables, Limits and Continuity in Higher Dimensions
5	14.3, 14.4	Partial Derivatives, The Chain Rule
6	14.5, 14.6	Directional Derivatives and Gradient Vectors, Tangent Planes andDifferentials
7	14.7	Extreme Values and Saddle Points
8	14.9, 14.10	Taylor's Formula for Two Variables, Partial Derivatives with Constrained Variables
9	**Mid Semester Exam**	
10	15.1, 15.2	Double and Iterated Integrals over Rectangles, Double Integrals overGeneral Regions
11	5.3, 15.4	Area by Double Integration, Double Integrals in Polar Form
12	15.5, 15.7	Triple Integrals in Rectangular Coordinates, Triple Integrals inCylindrical and Spherical Coordinates
13	15.8, 16.1	Substitutions in Multiple Integrals, Line Integrals of Scalar Functions,
14	16.2	Vector Fields and Line Integrals: Work, Circulation, and Flux
15	16.3-16.5	Path Independence, Conservative Fields, and Potential Functions, Green's Theorem in the Plane, Surfaces and Area
16	6.6, 16.7	Surface Integrals, Stokes' Theorem
17	16.8	The Divergence Theorem and a Unified Theory
18	**End Semester Exam**	