MATH-112 Calculus-II

Credit Hours: 3-0

Prerequisite: None

Course Objectives: This is the second course of Calculus. As continuation of Calculus I, it focuses on techniques of integration and applications of integrals. The course also aims at introducing the students to infinite series, parametric curves and polar coordinates.

Core Contents: Integration techniques and applications of integration, Infinite Series, Vectors and Geometry of Space.

Detailed Course Contents: Techniques of integration: Integrals of elementary, hyperbolic, trigonometric, logarithmic and exponential functions. Integration by parts, substitution and partial fractions. Approximate integration. Improper integrals.

Applications of integrals: Area between curves, average value. Volumes. Arc length. Area of a surface of revolution. Applications to economics, physics, engineering and biology.

Infinite series: Sequences and series. Convergence and absolute convergence. Tests for convergence: divergence test, integral test, p-series test, comparison test, limit comparison test, alternating series test, ratio test, root test. Power series. Convergence of power series. Representation of functions as power series. Differentiation and integration of power series. Taylor and Maclaurin series. Approximations by Taylor polynomials.

Conic section, parameterized curves and polar coordinates: Curves defined by parametric equations. Calculus with parametric curves: tangents, areas, arc length. Polar coordinates. Polar curves, tangents to polar curves. Areas and arc length in polar coordinates.

Course Outcomes: Upon completion of the course, the student will be able to:

- Integrate various types of functions using the various integration methods: substitution rule, integration by parts, trigonometric substitutions, partial fractions and rational substitutions.
- Apply integration to find areas, volumes, arc length, and surface areas and evaluate improper integrals.
- Find the limit of sequences, use various convergence tests (geometric series test, divergence test, integral test, comparison tests, alternating series tests, ratio test, and root test) to determine convergence or divergence of series, estimate sum of some series,
- Find the interval and radius of convergence of power series and represent some functions as power series.

- Find vector projections, equations of lines and planes in space understand quadratic surfaces.

Text Book: Joel Hass, Christopher Heil and Maurice D. Weir, Thomas' Calculus, 14th Edition. Pearson Company, 2017

Reference Books:

1. Stewart, James. Single Variable Calculus: Early Transcendentals 6th edition. PacificGrove, 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,
4. 3rd Edition. John Wiley & Sons, Inc. 2002.
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, Massachosetts.

**Weekly Breakdown**
Week	*Section*	*Topics*
1	8.1, 8.2	Basic Integration Formulas, Integration by Parts
2	8.3-8.5	Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fractions
3	8.8	Improper Integrals
4	10.1, 10.2	Sequences, Infinite Series
5	10.3, 10.4	The Integral Test, Comparison Tests
6	10.5, 10.6	Absolute Convergence, The Ratio and Root Tests
7	10.7, 10.8	Power Series, Taylor and Maclaurin Series
8	10.9, 10.10	Convergence of Taylor Series, Applications of Taylor Series
9	**Mid Semester Exam**	
10	11.1, 11.2	Parametrization of Plane Curves, Calculus with Parametric Curves
11	11.3, 11.4	Polar Coordinates, Graphing Polar Coordinate Equations
12	11.5	Areas and Lengths in Polar Coordinates
13	11.6, 11.7	Conic Sections, Conics in Polar Coordinates, Note: The topic "Quadratic Equations and Rotations" should be covered from Section 10.3 of the 11th Edition of Thomas' Calculus.
14	12.1, 12.2	Three-Dimensional Coordinate Systems, Vectors
15	12.3, 12.4	The Dot Product, The Cross Product
16	12.5	Lines and Planes in Space
17	12.6	Cylinders and Quadratic Surfaces
18	**End Semester Exam**	