Course Outline

Course Title: Calculus And Analytical Geometry II
Common Course Title: MAC2312
Effective Term: Fall 2021 (Aug 9, 2021)
Credit Hours: 5 Units

Next Review : Aug 8, 2026
Contact Hour Breakdown: *(Per 16 week Term)*

Total: 80
Lecture: Lab:
Clinic: Other:

Requirements

Pre-requisite with minimum grade required

MAC2311 (C)

Course Description:

This is the second of a three-course sequence in calculus. Topics include techniques of integration, conics, polar coordinates, indeterminate forms, L'Hôpital's Rule, proper integrals, infinite series, parametric equations, improper integrals, volume, arc length, surface area, work, and other applications of integration. A graphing calculator may be required in certain sections of this course. Recommendation of the Mathematics Department or at least a grade of C in the prerequisite course is required.

Course Outline

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Unit 1: Techniques of Integration

General Outcome
1.0 Apply systematic procedures for estimating and evaluating elementary integrals.

Specific Learning Outcomes
1.1 Integrate by using basic integration formulas.
1.2 Integrate by using algebraic, trigonometric and other substitution methods.
1.3 Integrate by parts.
1.4 Integrate certain trigonometric integrals involving powers of trigonometric functions.
1.5 Integrate by trigonometric substitution when integrands contain expressions of the forms: $a^2 - u^2$, $u^2 - a^2$, $a^2 + u^2$, or $ax^2 + bx + c$

1.6 Evaluate integrals with rational integrands by the use of partial fractions.

Unit 2: Polar Coordinates and Conics

General Outcome
2.0 Explain the relationship between Cartesian and polar coordinates, and be able to convert relations in the plane based on one system to the other. In addition, the students should be able to apply the concepts of calculus to these relations and their graphical representations.

Specific Learning Outcomes
2.1 Apply knowledge of the polar coordinate system to change points and/or equations from the Cartesian coordinate system to the polar coordinate system and vice versa.

2.2 Graph polar equations including some polar equations of conics.
2.3 Find the points of intersection of curves whose equations are in polar form.
2.4 Find plane areas when the equations of curves are given in polar form.
2.5 Identify the standard equations, parameters, and the relationship among the parameters for the parabola, the ellipse, and the hyperbola; and graph these curves.
2.6 Apply the concept of arc length to determine the length of an arc of a specified curve in polar coordinates.

Unit 3: Indeterminate Forms and Improper Integrals

General Outcome
3.0 Evaluate limits that are in indeterminate form and either evaluate convergent improper integrals or show divergence.

Specific Learning Outcomes
3.1 Recognize limits in indeterminate form.
3.2 Apply L'Hôpital's Rule to evaluate limits involving indeterminate forms.
3.3 Evaluate or show divergence of improper integrals that involve infinite limits of integration.
3.4 Apply the comparison tests to show convergence or divergence of an improper integral.
3.5 Apply the concepts to evaluate or show divergence of improper integrals in which the integrand has an infinite discontinuity.
3.6 Estimate the value of a convergent improper integral.

Unit 4: Sequences and Infinite Series

General Outcome
4.0 Determine the convergence or divergence of infinite sequences and infinite series, evaluate certain convergent infinite series, and determine the set of numbers over which a power series converges.

Specific Learning Outcomes
4.1 Define infinite sequences, infinite series (including geometric, harmonic and p series), convergence and divergence of sequences and series, and identify the properties of monotonic sequences.
4.2 Determine if an infinite sequence diverges or converges and, if the latter, find its limit.

4.3 Find sums of convergent geometric and telespcoping series.
4.4 Determine convergence or divergence of a series by applying tests of convergence or divergence, including the n-th term, geometric series, p-series, alternating series, integral, ratio, root, direct, and limit comparison tests.
4.5 Determine whether an alternating series converges absolutely, converges conditionally, or diverges.
4.6 Determine the radius and interval of convergence of a power series.
4.7 Find the power series expansion for functions including e^x, sinx, cosx, 1/x, and 1/(1-x).

4.8 Find the derivative and the antiderivative of a power series, and determine the interval of convergence of the resulting power series.
4.9 Find Taylor's expansion with remainder for differentiable functions.
4.10 Estimate the error in approximating a convergent series by a partial sum.

Unit 5: Parametric Equations

General Outcome
5.0 Graph curves from their parametric equations, and apply the concepts of calculus to such curves.

Specific Learning Outcomes
5.1 Sketch a curve from its parametric representation.
5.2 Determine which of these terms apply to a curve: simple, smooth, closed.
5.3 Obtain a Cartesian equation of a curve given in parametric form.

5.4 Without eliminating the parameter, find dy/dx for a curve given in parametric form.
5.5 Find the equations of the tangent line and the normal line at a given point of a curve given in parametric form.
5.6 Find the length of a specified arc of the curve.

Unit 6: Applications of the Definite Integral

General Outcome
6.0 Using definite integrals, find the area of a plane region, the volume of a solid, the length of an arc of the graph of a function, and the work done by a force.

Specific Learning Outcomes
6.1 Calculate the area of a region between two curves.
6.2 Calculate the volume of a solid of revolution using the Disc/Washer Method.
6.3 Calculate the volume of a solid of revolution using the Shell Method.
6.4 Calculate the volume of a solid using known cross-sections.
6.5 Calculate the length of an arc of the graph of a function over a finite interval.

6.6 Calculate the area of a surface of revolution formed by revolving a finite curve, in rectangular and polar coordinates, about a horizontal or vertical line.

6.7 Find the work done by a force using definite integrals.

Unit 7: Vectors in the Plane

General Outcome

7.0 Review two-dimensional vectors and operations.

Specific Learning Outcomes

7.1 Define vectors in the plane.

7.2 Define vector operations.

7.3 Prove properties of vector operations.

7.4 Define unit vectors.