CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

MATHEMATICS 280 – ANALYTIC GEOMETRY AND CALCULUS II

4 hours lecture, 4 units

Catalog Description
A second course in differential and integral calculus of a single variable: integration; techniques of integration; infinite sequences and series; polar and parametric equations; applications of integration. Primarily for science, technology, engineering and math majors.

Prerequisite
"C" grade or higher or "Pass" in MATH 180 or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Essential vocabulary and concepts
    a. Limits
    b. Continuity
    c. Differentiation
    d. Integration
2) Evaluating limits: Algebraic, trigonometric, logarithmic and exponential functions
3) Limit Calculations
    a. Using L'Hopital's Rule
    b. Solving limits with indeterminate forms
4) Evaluating derivatives
    a. Implicitly
    b. Algebraic, trigonometric, logarithmic and exponential functions
5) Evaluating integrals: Algebraic, trigonometric, logarithmic and exponential functions
6) Graphing
    a. Sketch of families of curves
    b. Interpreting function behavior from derivatives
7) Modeling and Applications
    a. Related rates
    b. Relative extrema
    c. Area between curves

Course Content
1) Methods of Finding Antiderivatives: Integration by parts, use of integral tables to include partial fractions. Numerical methods for integration including midpoint, trapezoidal and Simpson's rule and their relationship and order of errors. Improper integrals. Slope fields for finding antiderivatives, differentiation of integrals with respect to the upper limit.
2) Applications of the Definite Integral: Integral representation of a quantity of interest such as volume or total income by first examining a finite sum approximation of the quantity and then extrapolating to the limit. Selection of topics from applications in geometry, economics, physics and probability.
3) Evaluate improper integrals

4) Approximations: Graphical and numeric approaches to Taylor polynomials and series. The Taylor series and Fourier series as approximation of functions using simpler functions. Geometric series and their applications are discussed. The notion of a convergent series via investigation of Taylor polynomials. Contrast of Taylor and Fourier approximations. Radius and interval of convergence. Differentiation and integration of power series.
5) Polar Coordinates and Complex Numbers: Conversion between polar and rectangular coordinates. The area formula in polar coordinates. Addition and subtraction of complex numbers and the geometric representation of complex numbers using a parallelogram in the plane. Euler's formula for de Moivre's theorem.
6) Conic Sections: Standard and general forms of parabolas, ellipses and hyperbolas including translations and rotations and the general second-degree equation
7) Historical contributions of number and mathematical theories and concepts from diverse cultures

Course Objectives
Students will be able to:
1) Use the following techniques of integration to evaluate the antiderivative of a single-variable function:
   a. integration by Parts
   b. trigonometric Integrals
   c. trigonometric Substitution
   d. partial Fractions for integrating rational functions
   e. various Strategies of Integration
   f. integration using Computer Algebra Systems
2) Apply numerical methods of integration including midpoint, trapezoidal and Simpson's rule and their relationship and order of errors to evaluate both proper and improper integrals.
3) Use integrals to solve application problems involving:
   a. volume
   b. length of a curve,
   c. area of a surface,
   d. quantities of interest from physics,
   e. quantities of interest from engineering,
   f. quantities of interest from biology,
   g. quantities of interest from economics, or
   h. quantities of interest from statistics.
4) Evaluate improper integrals of a function where
   a. the interval of integration is infinite, and
   b. the integral has an infinite discontinuity.
5) Use the Mean Value Theorem and L'Hopital's Rule to evaluate integrals and solve problems.
6) Use series to solve application problems.
7) Apply each of the following tests to determine whether a series converges or diverges:
   a. integral test,
   b. comparison test,
   c. alternating series test,
   d. ratio test, and
   e. root test.
8) Represent functions as a power series.
9) Evaluate the limit of a sequence.
10) Apply Taylor and Fourier series as approximations of functions using simpler functions.
11) Convert between polar and rectangular coordinates.
12) Use polar coordinates to evaluate the following:
   a. the area inside a polar curve,
   b. length of a curve, and
   c. slope of the tangent line,

13) Use parametric equations to evaluate the following:
    a. the area under a curve
    b. length of a curve,
    c. area of a surface of revolution, and
    d. slope of the tangent line
14) Identify, manipulate and graph the standard and general forms of each of the following:
    a. parabolas,
    b. ellipses, and
    c. hyperbolas.

Method of Evaluation
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Quizzes which measure the student's ability to: apply numerical methods of integration including midpoint, trapezoidal and Simpson's rule to evaluate both proper and improper integrals; use the Mean Value Theorem and L'Hopital's Rule to evaluate integrals and solve problems; use Geometric series to solve application problems.
2) Exams which measure the student's ability to: use various techniques of integration to evaluate the antiderivative of a single-variable function; use integrals to represent a quantity of interest by first examining a finite sum approximation of the quantity and then extrapolating to the limit; convert between polar and rectangular coordinates and use the area formula in polar coordinates; identify, manipulate and graph the standard and general forms of the conic sections including translations and rotations.
3) Individual projects which measure the student's ability to: apply Taylor and Fourier series as approximations of functions; select and apply appropriate technology to model, analyze and interpret a collection of data or to solve real-world application problems requiring the use of analytic geometry and calculus.
4) Group-work, class activities, homework, and/or quizzes which measure the student's ability to select and apply appropriate technology including but not limited to computer programs and graphing utilities to model, analyze and interpret a collection of data or to solve real-world application problems requiring the use of analytic geometry and calculus.

Special Materials Required of Student
Graphing utility, portfolio

Minimum Instructional Facilities
Smart classroom with writing boards covering three walls, graphing utility overhead viewing panels, projection screen

Method of Instruction
1) Lecture and discussion
2) Teamwork

Out-of-Class Assignments
1) Problem sets
2) Exploratory activities and/or projects
3) Reading and/or writing assignments

Texts and References
1) Required (representative example): Stewart, James. *Calculus, Early Transcendentals*. 8th edition. Cengage, 2015.
2) Supplemental: None

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Modeling and Applications
    a. Surface area
    b. Volume by slicing or by cylindrical shells
2) Integration Techniques
    a. Identify and apply appropriate integration techniques
    b. Using parts
    c. Using trigonometric substitution
    d. Using trigonometric power reduction methods
    e. Solving improper integrals
3) Sequence and Series
    a. Characterizing special types of sequences and series
    b. Determining limits of sequences
    c. Calculating terms, partial sums and sums of infinite series
    d. Using various tests on series to determine convergence
    e. Using Maclaurin and Taylor series to approximate functions
4) Graphing and Analytic Geometry
    a. Using conics
    b. Using polar coordinates
    c. Using parametric equations

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Use analytical, numerical, and graphical methods to solve calculus problems related to real-valued functions, polar & parametric equations, and power series.
2) Solve multi-disciplinary application problems and interpret the results in context
    *For the complete list of **learning objectives**, please see the **Course Objectives** section