COURSE OUTLINE OF RECORD

Number: MATH G180
TITLE: Calculus 1

ORIGINATOR: Gary Kirby Jr.
EFF TERM: Fall 2018
FORMERLY KNOWN AS:
DATE OF OUTLINE/REVIEW: 04-18-2018
CROSS LISTED COURSE:
TOP NO: 1701.00
CID: MATH 211

SEMESTER UNITS: 5.0
HRS LEC: 90.0
HRS LAB: 0.0
HRS OTHER: 0.0
CONTACT HRS TOTAL: 90.0
STUDY NON-CONTACT HRS RECOMMENDED: 180.0

CATALOG DESCRIPTION:
This is the first course in a three-course sequence designed for mathematics, science and engineering majors. The topics covered in this course include limits and continuity, derivatives of algebraic and transcendental functions, applications of derivatives, indefinite integrals, definite integrals, the Fundamental Theorem of Calculus and applications of integration. UC credit limitations: MATH G140 and MATH G180 combined: maximum credit, 1 course. C-ID: MATH 211, 900S.

JUSTIFICATION FOR COURSE:
PREREQUISITES:
• GWC Math Placement Level of 80 or higher.
or
• MATH G170: Precalculus with a minimum grade of C or better
or
• OCC Math Placement Level of 70 or higher.
or
• MATH A170: Precalculus with a minimum grade of C or better
or
• CCC Math Placement Level of 90 or higher.
or
• MATH C170: Precalculus with a minimum grade of C or better
or
• MATH G115: College Algebra with a minimum grade of C or better
and
• MATH G120: Trigonometry with a minimum grade of C or better
or
• MATH A115: College Algebra with a minimum grade of C or better
and
• MATH A120: Trigonometry with a minimum grade of C or better
or
• MATH C115: College Algebra with a minimum grade of C or better
and
• MATH C120: Trigonometry with a minimum grade of C or better

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:
Mathematics
MATH G180-Calculus 1

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00
CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]
GRADING POLICY: Pass/No Pass [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]
OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]
TRANSFER STATUS: CSU Transferable[ ] UC/CSU Transferable[X] Not Transferable[ ]
BASIC SKILLS STATUS: Yes [ ] No [X] LEVELS BELOW TRANSFER: Not Applicable
CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable
NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course
OCCUPATIONAL (SAM) CODE: E
REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:
REQUIRED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]
Chemistry(Associate in Arts)
Computer Science(Associate in Science for Transfer)
General Biology(Associate in Arts)
General Biology(Associate in Arts)
Geology(Associate in Science for Transfer)
Liberal Arts: Emphasis in Mathematics(Associate in Arts)
Mathematics(Associate in Science for Transfer)
Mathematics(Associate in Arts)
Physics(Associate in Arts)
Physics(Associate in Arts)

GE AND TRANSFER REQUIREMENTS MET:
IGETC Area 2: Mathematical Concepts and Quantitative Reasoning
  2A: Mathematics
CSU GE Area B: Scientific Inquiry and Quantitative Reasoning
  B4 - Mathematics/Quantitative Thinking

PROGRAM LEVEL LEARNING OUTCOME(S) Supported by this course:

1. State and interpret the definition of derivatives, and compute the derivatives of basic and transcendental functions of one or more variables.

2. Apply concepts of differential and integral calculus of one or more variables to solve problems involving rates, area, volume, and lengths of arcs.

3. State and interpret the definition of integrals, and calculate definite and indefinite integrals involving basic and transcendental functions.

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. The successful student will be able to
   Calculate limits when they exist, and explain why when they do not exist.

2. Compute derivatives of polynomial, rational, algebraic, exponential, logarithmic, and trigonometric functions

3. Evaluate definite and indefinite integrals.

COURSE OBJECTIVES:

1. State and apply the definitions of limits, derivatives, definite integrals, and indefinite integrals.
2. Determine if a function is continuous at a real number.
3. Find the derivative of a function as a limit.
4. Find the equation of a tangent line to a function.
5. Compute the derivatives of algebraic and transcendental functions using the definition, the sum rule, the product rule, the quotient rule, and the chain rule.
6. Compute the limit of a function with and without L'Hospital's Rule.
7. Use implicit differentiation.
8. Use differentiation to solve applications such as related rate problems and optimization problems.
9. Graph functions by applying information obtained from the first and second derivative.
10. Calculate definite integrals using the definition, formulas, Riemann Sums, and simple substitutions.
11. Evaluate definite integrals using the Fundamental Theorem of Calculus and using the Substitution Method.
12. Evaluate indefinite integrals using the definition, formulas, and simple substitutions.
13. Use definite integrals in terms of either $x$ or $y$ to compute areas.

**COURSE CONTENT:**

**LECTURE CONTENT:**

**A. Functions and Models**
1. Functions, domains, and ranges
2. Catalog of functions: polynomial, rational, algebraic, and transcendental
3. Inverse functions and their properties
4. Review of properties of exponential and logarithmic functions
5. Development of the inverse trigonometric functions and their properties

**B. Limits and Rates of Change**
1. Definition and computation of limits using numerical, graphical, and algebraic approaches, including two-sided limits and one-sided limits with graphical interpretations.
2. Computing limits using sum, difference, product, quotient, and other rules
3. Computing limits indirectly using the "Squeeze" theorem and other methods
4. Formal epsilon-delta definitions of limits
5. Definition of continuity, a survey of continuous functions, and the Intermediate Value Theorem
6. The definition of limits as approaches positive and negative infinity and its graphical interpretation as horizontal asymptotes
7. Slopes of tangent lines and velocities as applications of limits

**C. Derivatives**
1. The definition of the derivative of a function
2. Computing derivatives using only the limit definition
3. Derivative formulas for constant, monomial, trigonometric, exponential, logarithmic, and hyperbolic functions
4. Computing derivatives using the power rule, sum rule, product rule, and quotient rule.
5. Computing derivatives using the chain rule.
6. Computing derivatives using implicit differentiation, applications of implicit differentiation.
7. Computing higher order derivatives explicitly and implicitly.
8. Related rates applications.
9. Differentials and their use as estimations in applications.
10. Differentiation of inverse functions.

D. Applications of the Derivative
1. Identifying critical numbers, local extrema, and absolute extrema.
2. Rolle’s Theorem, The Mean Value Theorem, and applications of these theorems.
3. Identifying intervals where \( f(x) \) is increasing or decreasing.
4. Using The First Derivative Test for identifying local extrema (maximum and minimum values).
5. Concavity and points of inflection.
7. L’Hospital’s Rule and indeterminate forms.
8. Curve sketching, identifying local and absolute extrema, intervals where the graph is increasing or decreasing, concavity, inflection points, and asymptotes.
10. Antiderivatives as an example of a basic differential equation.

E. Integrals
1. Summation notation and properties of finite sums.
2. Areas computed as Riemann sums.
3. Definition of the definite integral as a limit of a Riemann sum.
5. The Fundamental Theorem of Calculus.
7. Antiderivatives and indefinite integrals.
8. Using u-substitution in definite and indefinite integrals.

F. Applications of Integration
1. Computing area under a curve, and area between curves by constructing definite integrals and integrating with respect to \( x \) or \( y \).
METHODS OF INSTRUCTION:
   A. Lecture:
   B. Lab:
   C. Tutoring – noncredit:
   D. Direct Study/IS:
   E. Other simultaneous interactive:
   F. Audio – One Way:
   G. Other passive medium:
   H. Independent Study:

INSTRUCTIONAL TECHNIQUES:

The primary mode of instruction is the lecture/demonstration method. Some sections may utilize graphing calculators.

COURSE ASSIGNMENTS:
   Reading Assignments
   Course textbook which provides explanations, worked examples, and problems to be solved.
   Out-of-class Assignments
   Homework assignments as given by instructor.
   Writing Assignments
   Homework, quizzes, and examinations covering topics presented in the course.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Projects (ind/group)
Problem Solving Exercises
Demonstration of Critical Thinking:
   Analysis and application of mathematical techniques presented in the course; mathematical modeling and computational methods.
Required Writing, Problem Solving, Skills Demonstration:
   Homework, quizzes, and examinations covering topics presented in the course.

TEXTS, READINGS, AND RESOURCES:
TextBooks:

LIBRARY:
   Adequate library resources include: Print Materials
   Non-Print Materials
   Online Materials
   Services
   Comments:

Attachments: