SIERRA COLLEGE

MATH 0016A - CALCULUS FOR SOCIAL AND LIFE SCIENCES

SECTION A

1. Division:	Sciences & Mathematics
2. Subject Code:	MATH
3. Course Number:	0016A
4. Course Title:	CALCULUS FOR SOCIAL AND LIFE SCIENCES
5. Semester of First Offering:	FALL 2013

SECTION B   General Course Information

1.Units: 4.0   **Variable Units:** N/A

2.This Course is: Degree-Applicable Credit - Transferable

3A. Cross-List: **3B. Formerly:**

Course Format and Duration

4. Standard Term Hours per Week		**5. Standard Term Total Semester Hours**	
Lecture/Discussion:	4	Lecture/Discussion:	72
Lab:		Lab:	
Activity:		Activity:	
By Arrangement:		By Arrangement:	
Total Hours per Week:	4	**Total Hours :**	72

6. Minimum hours per week of independent work done outside the class: 8

Course Preparation - (Supplemental form B required)

7a. Prerequisite(s): (Course and/or other preparation/experience that is <u>REQUIRED</u> to be completed previous to enrollment in this course.)

Completion of MATH 12 with grade of "C" or better, or placement by matriculation assessment process

7b. Co-requisite(s): (Courses and/or other preparation that is REQUIRED to be taken concurrently with this course.)

7c. Advisory: (MINIMUM preparation RECOMMENDED in order to be succesful in this course. Also known as "Course Advisory".)

Not recommended for students with grade of "C" or better in MATH 30

Catalog Description And Other Catalog Information:

8. Repeatability: **Not Repeatable**

Please note: Repeatability does <u>not</u> refer to repeating courses because of substandard grades or a lapse of time since the student took the course. A course may be repeated <u>only </u>if the course content differs each time it is offered and the student who repeats it is gaining an expanded educational experience as stipulated in Title V.

☐ Skills or proficiencies are enhanced by supervised repetition and practice within class periods.

☐ Active participatory experience in individual study or group assignments is the basic means by which learning objectives are attained.

☐ Course content differs each time it is offered.

Explanation for above repeatability selection:

9a. Grading Option: Standard Grade

9b. Catalog Description:

Review of functions, limits, differentiation and integration of algebraic functions, calculus for exponential and logarithmic functions, applications of calculus in social and life sciences. This course is not intended for students majoring in mathematics, engineering, physics, or chemistry.

Course Outline Information

10. Student Performance Objectives: (Performance objectives for all credit courses must indicate that students will learn critical thinking and will be able to apply concepts at college level.Performance objectives must be related to items listed in Section 11.)

For all objectives the student will work with algebraic, exponential and logarithmic functions.
1. Analyze functions and be able to graph (with and without technology), interpret graphs, find inverses and solve application problems.
2. Calculate the limits of a function including the limit at a point and the limit at infinity. Determine when limit exists and how limits relate to continuity of a function over an interval.
3. Calculate the derivative of a function from the definition, using rules for differentiation, and implicit differentiation.
4. Interpret the meaning of the derivative as it relates to the slope of the tangent line to a graph, the instantaneous rate of change, intervals on which a function is increasing or decreasing, and marginal cost, revenue and profit.
5. Interpret the results of the first and second derivative tests and use to find relative extrema on open and closed intervals.
6. Identify relative extrema, points of inflection, concavity, critical points, horizontal and vertical asymptotes, points of non-differentiability and use to sketch graphs of functions.
7. Analyze the differentials of a function and how it relates to approximate rates of change and real life problems.
8. Solve "real life" situations using calculus. These should include (but not be limited to) the average and instantaneous rates of change; velocity and acceleration; related rates problems; optimization problems; and logistic growth problems.
9. Calculate the antiderivatives of basic algebraic functions.

11. Course Content Outline: (Provides a comprehensive, sequential outline of the course content, including all major subject matter and the specific body of knowledge covered.)

I. Review of Functions and Graphs
A) Rectangular Coordinate System
B) Graphs of Equations
C) Linear Functions
D) Quadratic Functions
E) Composite Functions
F) Inverse Functions
II. Limits
A) Limit of a Function
B) Properties of Limits
C) Evaluating Limits
D) One-sided Limits
E) Existence of a Limit
III. Continuity
A) Definition of Continuity
B) Determining Continuity of a Function
C) Continuity on a Closed Interval
D) Discontinuity
IV. Differentiation
A) Tangent Line to a Graph
B) Definition of the Derivative
C) Differentiability and Continuity
D) Rules for Differentiation
1. The constant rule
2. The constant multiple rule
3. The sum and difference rules
4. The power rule
5. The product and quotient rules
6. The chain rule
E) Rates of Change
F) Higher-Order Derivatives
G) Implicit Differentiation
H) Related Rates
V. Applications of the Derivative
A) Increasing and Decreasing Functions and Intervals
B) Relative and Absolute Extrema
C) Concavity and Points of Inflection
D) Curve Sketching
E) Optimization Problems
F) Differentials
G) Partial Fractions
VI. Calculus of Exponential and Logarithmic Functions
A) Review of Exponential and Logarithmic Functions
B) Derivatives of Exponential and Logarithmic Functions
C) Exponential Growth and Decay
D) Applications involving Exponential and Logarithmic Functions
VII. Integration
A) Antiderivatives
B) Indefinite Integrals
C) Integration Rules

12. Typical Out-of-Class Assignments: (Credit courses **require** two hours of independent work outside of class for each lecture hour, less lab/activity classes. List type of assignments including library assignments.)

a. Reading Assignments: (Submit at least 2 examples.)
1. Read the textbook section on the First Derivative Test and the Second Derivative Test. Solve problems based using both methods. State which method is preferable in each problem and why.
2. Read supplementary handouts on topics such as modeling population growth using exponential functions. Research a specific example to share with the class.

b. Writing, Problem Solving or Performance: (Submit at least 2 examples)

1. Compute the slope of the tangent line to the circle $(x-2)^2+(y+3)^2=9$ at the point $(2,0)$. Interpret the meaning of your answer.
2. Determine all relative extrema of the function $f(x)=2x^3-4x^2+5x$ using the first derivative test.

c. Other (Term projects, research papers, porfolios, etc.)

13. Required Materials:
a. All textbooks, resources and other materials used in this course are college level?
- ☑ Yes
- ☐ No

b. Representative college-level textbooks (for degree applicable courses) or other print materials:

Book 1:
Author:	Larson
Title:	Calculus, an Applied Approach
Publisher:	Brooks Cole Cengage Learning
Date of Publication:	2013
Edition:	9th

c. Other materials and/or supplies required of students:

14. Check all Instructional methods used to present course content:

☑	Lecture	☑	Activity
☑	Discussion Semminar	☐	Distance Education (requires supplemental form)
☐	Lab	☐	Work Experience
☑	Directed Study	☐	Tutoring

Other:

Give detailed examples of teaching methodology that relate to the course performance objectives:

1. Instructor will create a worksheet to be completed during the class period that requires the students to collaborate to find the solutions to real-world optimization problems.
2. After the instructor demonstrates a related rates problem involving water filling a cylindrical tank, students will calculate the rate at which water rises in a conical tank, and write a verbal description of the results of their mathematical computations.

15. Methods of Assessing Student Learning
15a. Methods of Evaluation:

☐	Essay Exam	☐	Reports
☑	Objective Exam	☑	Problem Solving Exam
☑	Projects	☐	Skill Demonstration
☑	Class Discussion	☐	Other

15b. (All courses must provide for measurement of student performance in terms of stated student performance objectives, Area 10, and culminate in a formal recorded grade based on uniform standards. Submit at least 2 examples.)

Example 1. The combined perimeter of an equilateral triangle and a square is 10. Find the dimensions of the triangle and square that produce a minimum total area. (from outcome 5). This question is graded based on the clarity, completeness, and correctness of the method used and of the solutions found.

Example 2. Find the critical numbers and the open intervals on which the function $f(x) = 2x/(16-x)$ is increasing and decreasing (from outcome 4). This question is graded based on the clarity, completeness, and correctness of the method used and of the solutions found.

Example 3. Using differentials, approximate the possible error and the relative error in computing the volume of a sphere if the radius of a sphere is measured to be 6 inches with a possible error of 0.02 inch. (from outcome 7). This question is graded based on the clarity, completeness, and correctness of the method used and of the solutions found.

SECTION C
1. Program Information:
- ☑ In an approved program
- ☐ Part of a new program
- ☐ Not part of an approved program

2. TOP Code Information
Program Title: Mathematics, General 170100

3. Course SAM Code:
- ☐ A - Apprenticeship Course
- ☐ B - Advanced Occupational
- ☐ C - Clearly Occupational
- ☐ D - Possibly Occupational
- ☑ E - Non-Occupational

4. Faculty Minimum Qualifications/Degrees:

Mathematics

Comments:

SECTION D

General Education Information:

1. College Associate Degree GE Applicability:

Communication & Analytic Thinking

2. CSU GE Applicability:

B-4 Mathematics/Quantitative Reasoning

3. IGETC Applicability:

2: Mathematical Concepts & Quantitative Reasoning

4. CAN :

5. LDTP:

SECTION E

1. Articulation Information: (Required for Transferable Courses Only)

☑   CSU Transferable

☑   UC Transferable

☐   CSU/UC Major Requirement.

If CSU/UC major requirement, list campus and major. (Note: Must be lower division)

2. List at least one community college and its comparable course. If requesting CSU and/or UC transferability also list a CSU/UC campus and comparable lower division course

American River College: MATH 350 Calculus for Life and Social Sciences I
CSU Sacramento: MATH 26A Calculus I for Social and Life Sciences
UC Santa Barbara: MATH 34A Calculus for Social and Life Sciences

SECTION F

Planning and Resources: Please address the areas below:

1. Evidence of Need or Potential: recommendations of advisory committee, connection to existing or planned degrees/certificates, or regional/national developments, transfer university requirements.

Meets GE Math transfer requirements to CSU system.

2. Appropriateness to Mission: connection to basic skills, transfer, career technical education, or lifelong learning; relationship

Transfer and lifelong learning.

3. Place in Program/Department: relationship to student learning outcomes identified by program, connection to general education, or articulation with other institutions.

Meets GE applicability for Math Competency and Communication and Analytical Thinking. Course aligns with three of the four Math program Student Learning Outcomes (Visual Models, Applied Problems, Communication).

4. Availability of Faculty and Facilities: minimum qualifications to teach course, special training for instructors, or long-term physical impact of course.

All math instructors meet minimum qualifications for the course.

5. Potential Impact on Resources: impact on library, computer support, transportation, equipment, or other needs

Classroom space, FTEs.

SECTION G

1. Maximum Class Size (recommended):   35

2. If recommended class size is not standard, then provide rationale: