

## MATH 0016B - CALCULUS FOR SOCIAL AND LIFE SCIENCES

### SECTION A

- |  |                                       |
|--|---------------------------------------|
| 1. Division:   | Sciences & Mathematics                |
| 2. Course Discipline:  | MATH                                  |
| 3. Course Number:  | 0016B                                 |
| 4. Course Title:   | CALCULUS FOR SOCIAL AND LIFE SCIENCES |
| 5. First semester this new version/new course will be offered: | 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:                       |           |
| <b>Total Hours per Week:</b>    | <b>4</b> | <b>Total Hours :</b>                  | <b>72</b> |
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 **REQUIRED** to be completed previous to enrollment in this course.)

Completion of MATH 16A or 30 with grade of "C" or better

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".)

Completion of MATH 8 with grade of "C" or better

#### Catalog Description And Other Catalog Information:

#### 8. Repeatability: Not Repeatable

Please note: Repeatability does not refer to repeating courses because of substandard grades or a lapse of time since the student took the course. A course may be repeated only 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:

Differentiation and integration of trigonometric functions, functions of several variables, partial derivatives, double integrals, introduction to differential equations, sequences and series, applications of calculus in the social and life sciences.

**Course Outline Information**

**10. Course 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.)

1. Apply the Fundamental Theorem of Calculus.
2. Use the disc method and washer method to find the volume of a solid of revolution. Use solids of revolution to solve real-life problems.
3. Use integration by substitution, integration by parts, partial fractions, and integration tables to find antiderivatives. Use techniques to solve real-life problems.
4. Evaluate improper integrals with infinite limits of integration and infinite integrands. Solve real-life problems.
5. Evaluate trigonometric functions (exactly and approximately), their limits and their derivatives. Calculate using degrees and radians.
6. Solve trigonometric equations (including real life applications) using identities and special angles.
7. Sketch the graphs of trigonometric functions using calculus when necessary.
8. Analyze points (distance between and midpoint) and surfaces (spheres, planes, traces, level curves) and graphs (quadric surfaces) in the three dimensional coordinate system.
9. Calculate partial derivatives and find extrema of functions of several variables including real life examples.
10. Use Lagrange multipliers to solve constrained optimization problems.
11. Evaluate double integrals and use them to find area and volume.
12. Find general solutions and particular solutions of differential equations. Solve differential equations using separation of variables and integrating factors. Use differential equations to model and solve real-life problems.
13. Find the limit of a sequence of numbers and use techniques to solve business and economic applications involving sequences.
14. Determine the convergence or divergence of an infinite series. Use the Ratio Test and Convergence Test to determine convergence or divergence for p-series.
15. Use Taylor's Theorem to determine the Taylor and Maclaurin series of simple functions.
16. Use Taylor polynomials for approximation.
17. Use the Power Rule, Exponential Rule and Log Rule to calculate antiderivatives.
18. Evaluate definite integrals to find the area bounded by two graphs.

**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. Integration
  - A) Antiderivatives
  - B) Indefinite Integrals
  - C) Integration Rules
    - 1. The constant rule
    - 2. The constant multiple rule
    - 3. The sum and difference rules
    - 4. The power rule
  - D) Integrating by Substitution
  - E) Area and Definite Integrals
  - F) The Fundamental Theorem of Calculus
- II. Applications and Techniques of Integration
  - A) The Area of a Region
  - B) The Volume of a Solid of Revolution
  - C) Integration by Substitution
  - D) Integration by Parts
  - E) Partial Fractions
  - F) Integration Tables
  - G) Improper Integrals
- III. Calculus of Trigonometric Functions
  - A) Introduction to Trigonometric Functions
  - B) Trigonometric Identities
  - C) Evaluating Trigonometric Functions
  - D) Solving Trigonometric Equations
  - E) Graphs of Trigonometric Functions
  - F) Limits of Trigonometric Functions
  - G) Derivatives of Trigonometric Functions
  - H) Integrals of Trigonometric Functions
  - I) Applications Involving Trigonometric Functions
- IV. Calculus of Functions of Several Variables
  - A) The Three-Dimensional Coordinate System
  - B) Surfaces in Space
  - C) Equations of Planes in Space
  - D) Equations of Quadric Surfaces
  - E) The graph of a Function of Two Variables
  - F) Partial Derivatives
  - G) Extrema of Functions of Two Variables
  - H) Optimization Problems
  - I) Constrained Optimization Problems
  - J) Lagrange Multipliers
  - K) Double Integrals
  - L) Area in the Plane
  - M) Volume of a Solid Region
- V. Introduction to Differential Equations
  - A) General Solution of a Differential Equation
  - B) Particular Solutions of a Differential Equation
  - C) Solving Differential Equations using Separation of Variables
  - D) First-Order Linear Differential Equations
  - E) Solving Differential Equations using Integrating Factors
  - F) Applications of Differential Equations
- VI. Sequences and Series
  - A) Definition of a Sequence
  - B) Limit of a Sequence
  - C) Infinite Series
  - D) Properties of Infinite Series
  - E) Geometric Series
  - F) p-Series
  - G) Convergence and Divergence of an Infinite Series
  - H) The Ratio Test
  - I) Power Series
  - J) Radius of Convergence of a Power Series
  - K) Taylor and Maclaurin Series
  - L) Taylor Polynomials

**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 in your textbook about 2 methods for calculating the volume of a solid of revolution.
2. Research online the history of Newton's discovery of the Binomial Series.

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

1. Write a 3 - 5 page report on Newton's discovery of the Binomial Series.
2. A 20-foot ladder leaning against the side of a house makes a 75 degree angle with the ground. How far up the side of the house does the ladder reach?
3. Find the relative extrema of the function  $y = x - \sin x$  over the interval  $(0, 2\pi)$ .

**c. Other** (Term projects, research papers, portfolios, 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, Edwards  
**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:**

**Methods of Instruction**

**14. Check all instructional methods used to present course content:**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Lecture        | <input type="checkbox"/> Activity  |
| <input type="checkbox"/> Discussion Seminar        | <input type="checkbox"/> Distance Education (requires supplemental form) |
| <input type="checkbox"/> Lab                       | <input type="checkbox"/> Work Experience                                 |
| <input checked="" type="checkbox"/> Directed Study | <input type="checkbox"/> Tutoring  |

Other: Computer activity

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

Example 1: Interactive lecture format to develop the concept of finding a power series representation of a variety of functions. For each type of function, the instructor will incorporate algebraic derivation and visual analysis through graphing. Students will participate verbally and will work several examples on their own.

Example 2: In class, small group collaborative learning activities will focus on determining which methods of integration to use for a variety of problems, for example Use solids of revolution to solve real-life problems. Students will practice recognizing which method to try, testing their conjectures, and developing solutions with peers.

## 15. Methods of Assessing Student Learning

### 15a. Methods of Evaluation:

- |  |  |
|--|--|
| <input type="checkbox"/> Essay Exam                  | <input checked="" type="checkbox"/> Reports              |
| <input checked="" type="checkbox"/> Objective Exam   | <input checked="" type="checkbox"/> Problem Solving Exam |
| <input checked="" type="checkbox"/> Projects         | <input type="checkbox"/> Skill Demonstration             |
| <input checked="" type="checkbox"/> Class Discussion | <input type="checkbox"/> 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 line segment from (0, 0) to (4, 2) is revolved about the y axis to form a cone. Find the volume of the cone. This question is graded based on the clarity, completeness, and correctness of the method used and of the solutions found.

Example 2. Find the area of the region bounded by the graphs of the equations  $y = x \ln x$ ,  $x = 3$ ,  $x = 5$  using integration by parts. This question is graded based on the clarity, completeness, and correctness of the method used and of the solutions found.

Example 3. Classify the surface given by  $x^2 + y^2 - z^2 = 1$ . Describe the traces of the surface in the xy-plane, the yz-plane and the xz-plane. (from outcome 8). 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 Discipline Assignment(s):

Mathematics

Comments:

## SECTION D

**General Education Information:**

**1. College Associate Degree GE Applicability:**

Communication & Analytic Thinking

**2. CSU/UC Applicability:**

B-4 Mathematics/Quantitative Reasoning

**3. IGETC Applicability:**

2: Mathematical Concepts & Quantitative Reasoning

**4. C-ID :**

## 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 351 Calculus for Life and Social Sciences II

Cal Poly SLO: MATH 162 Calculus for the Life Sciences II

UC Berkeley: MATH 16B Analytic Geometry and Calculus

UC Davis: MATH 16C Short Calculus

## 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.

Satisfies short calculus requirement for a variety of majors.

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

**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 includes all four math program's SLO's. (Equations and Expressions, 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 faculty members meet the minimum qualifications to teach this course. No special training is required.

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

No additional resources are needed since we have the classroom space and technology already available.

## SECTION G

**1. Maximum Class Size (recommended):** 35

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