CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ACADEMIC SENATE

GENERAL EDUCATION COMMITTEE

REPORT TO

THE ACADEMIC SENATE

GE-006-190

MAT 1200: Calculus for Life Sciences (GE Sub-Area B4)

General Education Committee	Date: 10/30/2019
Executive Committee Received and Forwarded	Date: 11/06/2019
Academic Senate	Date: 11/13/2019 First Reading 12/04/2019 Second Reading

TITLE OF REFERRAL: MAT 1200: Calculus for Life Sciences (GE Sub-Area B4)

BACKGROUND:
The Mathematics and Statistics Department wishes to modify the content of the course MAT 1200: Calculus for Life Sciences.

RESOURCES CONSULTED:
Office of Academic Programs
Berit Givens; Hector Mireles; Ángel Valdés

DISCUSSION:
This is an existing course for GE sub-are B4. At the request of the Biological Sciences department and the Physics and Astronomy department, the content was modified by removing multivariable calculus and increasing review of trigonometry. But while the expected learning outcomes were modified, the GE student' learning outcomes (SLO's) for sub-area B4 have not and the course ECO continues to meet the rubrics of courses for GE sub-area B4.

RECOMMENDATION:

The GE recommends approval of GE-006-190 MAT 1200: Calculus for Life Sciences (GE Sub-Area B4).

Curriculog printout provided for reference only. For latest information refer to Curriculog database

MAT - 1200 - Calculus for Life Sciences

C. Course - New/Modify General Education

General Catalog Information

Department* Mathematics and Statistics

Proposal Type* ○ New GE Course ◉ Modify GE Course

Modification Summary In order to allow students to move from MAT 1200 into PHY 1210, some basic trigonometry content needs to be added. At the request of the chairs of Biology and Physics, we are modifying the course to allow for this at the expense of the multivariable calculus content. Doing this change caused the 2 learning outcomes regarding multivariable content to be replaced by 3 outcomes regarding trigonometry. The standard trigonometry class is already a GE Area B4 class as well.

Establish or Modify Articulation Agreement* Yes No

Subject Area* MAT

Catalog Number* 1200

Formal Course Title* Calculus for Life Sciences

Abbreviated Course Title* Calculus for Life Sciences

Unit(s)* (3)

C/S Classification* C-02 (Lecture Discussion)

To view C/S Classification Long Description click: http://www.cpp.edu/~academic-programs/scheduling/Documents/Curriculum%20Guide/Appendix_C_CS_Classification.pdf

Component* Lecture

Contact Hour(s)

Instruction Face-to-Face Web-Assisted

Grading Basis*	Graded Only
Repeat for Credit*	May be taken only once
Repeat for Credit Limit	
If course may be repeated for credit, total units applicable to degree and max units per semester.	
When Offered	
Cross Listed Course Subject Area and Catalog Nbr	
Dual Listed Course Subject Area and Catalog Nbr	
Course Category (select all that apply)*	☐ ☑ ☑
GE Area/Subarea*	B4

To view the General Education SubArea definitions, click http://www.cpp.edu/~academic-programs/scheduling/Documents/Ch.3-GeneralEducationProposals.pdf.

I. Catalog Description

Catalog Description* Concepts of functions and the idea of change. Review of algebraic, rational, exponential, and logarithmic functions. Brief review of fundamental topics in right triangle trigonometry. Graphing, limits, derivatives, differentials, and integrals of single variable functions listed above. Optimization problems and the Fundamental Theorem of Calculus. Special emphasis is given to applications in life sciences.

II. Required Coursework and Background (i.e. Enrollment Requirements)

Prerequisite(s) MAT 105; MAT 1050; MAT 1052; or appropriate score on placement test

Corequisite(s) (leave blank if none)	
Pre or Corequisite(s) (leave blank if none)	
Concurrent (leave blank if none)	

III. Course Note(s) (OPTIONAL)

Note(s)	

IV. Expected Outcomes

A. List the knowledge, skills, or abilities which students should possess upon completing the course.*

Upon successful completion of the course, students will be able to:

1. Distinguish between and calculate total change, average and instantaneous rates of change, and relative change.
2. Analyze a data set to construct an appropriate model with parameters for life sciences applications; write a function and sketch a graph.
3. Approximate derivatives numerically, visualize derivatives graphically, and interpret the meaning of first and second derivatives in applications.
4. Compute derivatives using short-cut techniques, and by using the product and quotient rules, and the chain rule.
5. Generate the graph of a function by using the derivative.
6. Grasp the meaning of the definite integral as the limit of Riemann sums, approximate it numerically, and recognize the connection between the derivative and definite integral in the Fundamental Theorem of Calculus.
7. Calculate the area under a curve and between two curves, estimate the total accumulated change given a graph, and manipulate a graph to find the average value of a function on an interval.
8. Select integration formulas and methods to find antiderivatives and indefinite integrals, and to calculate definite integrals.
9. Identify special triangles and their related angle and side measures.
10. Evaluate the trigonometric function of an angle in degree and radian measure.
11. Apply right triangle trigonometry to express vectors or forces into

12. Explain course concepts and methods through literate verbal and written communication.

B. If this is a course for the major, describe how these outcomes relate to the mission, goals and objectives of the major program.

C. Explain how the course meets the description of the GE SubArea(s). Please select appropriate outcomes according to the GE Area/SLO mapping. *

In Calculus for Life Sciences, students continue to develop critical thinking skills and problem-solving techniques for exercises that include real-world processes in biological and health sciences, medicine, population growth, ecology, and sustainability.

Students who successfully complete this course will be able to use shortcut rules to differentiate and integrate functions; and more importantly, understand, explain, and apply the underlying concepts of single variable calculus. Applications that require quantitative reasoning and problem-solving techniques are emphasized throughout the course.

D. Describe how these outcomes relate to the associated GE Learning Outcomes listed below.*

SLOs 1a) and 1e) are addressed in course exercises. Students are required to present solutions to questions in a clear and coherent form using correct mathematical notation and terminology. Expositions of a problem or topic must be stated with complete sentences, whether verbal or symbolic. Students explain concepts and techniques to the instructor during classs and through written assignments and tests, and to classmates (with varying levels of comprehension) during classroom discussion and activities inside and outside of the classroom.

SLO 2a) is reinforced through homework and test problems that focus on life sciences applications.

The challenge of calculus coupled with the student interest generated through the use of life sciences applications, make difficult math relevant which in turn motivates, and requires students to demonstrate an active pursuit of intellectual growth mentioned in SLO 4b).

General Education Outcomes*

Ia. Write effectively for various audiences

Ie. Apply and communicate quantitative arguments using equations and graphical representations of data.

IIa. Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.

IVb. Demonstrate activities, techniques, or behaviors that promote intellectual or cultural growth.

To view the mapping, click https://www.cpp.edu/~academic-programs/Documents/GE%20SLO%20Mapping.pdf

V. Instructional Materials

Provide bibliography that includes texts that may be used as the primary source for instruction, and other appropriate reference materials to be used in instruction. The reference list should be current, arranged alphabetically by author and the materials should be listed in accepted bibliographic form.

Instructional Materials*

Texts may vary over time. A possible text (in print and digital format) is the following.

Hughes-Hallett, D., et al., *Applied Calculus,* 5th edition (2014).

WileyPLUS: E-book, online homework, refresher quizzes.

Additional notes and multimedia materials may also be posted online by the instructor.

Faculty are encouraged to make all materials accessible. Indicate with an asterisk those items that have had accessibility (ATI/Section 508) reviewed. For more information, http://www.cpp.edu/~accessibility

VI. Minimum Student Materials

List any materials, supplies, equipment, etc., which students must provide, such as notebooks, computers, internet access, special clothing or uniforms, safety equipment, lockers, sports equipment, etc. Note that materials that require the assessment of a fee may not be included unless the fee has been approved according to University procedures.

Minimum Student Materials*	Paper and pencil. Some instructors may require calculators. Internet access for possible online homework and activities. Plug-ins and players (e.g., cdf) for multimedia and graphical content.

VII. Minimum College Facilities

List the university facilities/equipment that will be required in order to offer this class, such as gymnastic equipment, special classroom, technological equipment, laboratories, etc.

Minimum College Facilities*	Classroom; chalkboard or whiteboard and chalk or markers and eraser; laptop or desktop computer with internet access, plug-ins and players for multimedia and graphical content; and a classroom projection system.

VIII. Course Outline

Describe specifically what will be included in the course content. This should not be a repetition of the course description but an expansion that provides information on specific material to be included in the class, e.g. lecture topics, skills to be taught, etc. This should not be a week-by-week guide unless all instructors are expected to follow that schedule.

Course Outline*	Life sciences and some physical applications distinguish this course from other calculus courses; and therefore, should be emphasized throughout. Additionally, concepts should take priority over procedures. 1. Functions and change a. Linear, power, rational, exponential, and logarithmic functions b. Average rate of change and relative change c. Exponential growth and decay

e. Proportionality

2. Rate of change: the derivative

a. Instantaneous rate of change

b. The tangent line and the derivative function

c. Limits, continuity, and the limit definition of derivative

d. Second derivatives

3. Differentiation shortcuts

a. Formulas for powers, polynomials, exponential, and logarithmic functions

b. The product and quotient rules

c. The chain rule

4. Applications of the derivative

a. Increasing and decreasing functions

b. Inflection points and concavity

c. Local extrema

d. Global extrema

e. Modeling populations with logistic functions; carrying capacity; point of diminishing returns

f. The surge function and drug concentration

5. The definite integral and the Fundamental Theorem of Calculus

a. Distance and accumulated change

b. The definite integral, area, and interpretations

c. Total change and the fundamental theorem of calculus

d. Average value of a function

6. Antiderivatives, indefinite integrals, and applications

a. Antiderivatives

b. The indefinite integral

c. Integration by substitution

7. Right triangle trigonometry

a. Basics of angle and side measurements

b. Fundamentals of trigonometric functions

c. Application to the resolution of forces

IX. Instructional Methods

Describe the type(s) of method(s) that are required or recommended for the instruction of this course (lectures, demonstrations, etc.). Include any method that is essential to the course, such as the use of particular tools or software.

Instructional Methods*

Lecture, classroom discussion and problem-solving and small group activities, computer-based demonstrations and activities.

X. Evaluation of Outcomes

A. Describe the methods to be used to evaluate students' learning, i.e. written exams, term papers, projects, participation, quizzes, attendance, etc.*

1. Homework or quizzes or both consisting of multiple choice and short answer questions

2. Exams and a cumulative final exam consisting of open-ended questions

3. In addition to written homework assignments and/or quizzes, students must prepare a paper, essay, exposition, poster, or presentation that explores, in a literate manner, an application, question, theorem, or other topic of the course.

B. Describe the required meaningful writing assignments to be included. *

In addition to written homework assignments and/or quizzes, students must prepare a paper, essay, exposition, poster, or presentation that explores, in a literate manner, an application, question, theorem, or other topic of the course.

Examples of topics include the following.

1. Population center of the U.S.

2. Medical case study: anaphylaxis

3. Coroner's rule of thumb

4. CFCs in the atmosphere

5. Proving the derivative shortcut formulas

7. Medical case study: impact of asthma on breathing

8. Carbon dioxide in pond water

9. Malthus: population outstrips food supply

10. Verhulst: the logistic model

11. The flu in WWI

C. Discuss how these methods may be used to address the course and program outcomes, as appropriate. Include or attach a matrix to align the evaluation methods to the outcomes.*

	Evaluation Methods		
Expected Course Outcome	**Homework/Quizzes**	**Exams**	**Written Assignments**
1	√	√	√
2	√	√	√
3	√	√	√
4	√	√	
5	√	√	√
6	√	√	√
7	√	√	√

8	√	√	
9	√	√	√
10	√	√	√
11	√	√	√

D. If this is a general education course, discuss how these methods may be used to address the associated GE Learning Outcomes listed below. Include or attach a matrix to align the evaluation methods to the outcomes.*

Area B4	**Evaluation Methods**		
GE Outcome	**Homework/Quizzes**	**Exams**	**Written Assignments**
I.a.			I or M
I.e.	I	M	M
II.a.	I	M	M
IV. b.	I and M	M	I and M

XI. Course/Department/College Specific Requirements (OPTIONAL)

Department/ College Required ECO Information (Optional)	

FOR OFFICE OF ACADEMIC PROGRAMS USE ONLY

AY Proposal Submitted	2019-2020
AY Proposal Implemented	
PS Academic Group	75-CSCI
PS Academic Organization	487-MATH
Course Type	Mathematics
PS Course ID (for modified courses only)	005006
Impact Report (for modified courses only)	☑ Attached

FOR ACADEMIC SENATE OFFICE USE ONLY

Senate Referral Number	GE-006-190
Senate Report Number	