CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ACADEMIC SENATE

GENERAL EDUCATION COMMITTEE

REPORT TO

THE ACADEMIC SENATE

GE-088-156

BIO 1040 – What is Evolution? (GE Area B2)

General Education Committee	Date: 07/13/2016
Executive Committee Received and Forwarded	Date: 08/17/2016
Academic Senate	Date: 08/31/2016 First Reading
	09/28/2016 Second Reading

BACKGROUND:

This is a new course for the semester calendar.

RESOURCES CONSULTED:
Faculty
Department Chairs
Associate Deans
Deans
Office of Academic Programs

DISCUSSION:

The GE Committee reviewed the ECO for this course and found it to satisfy the GE Student Learning Outcomes and other requirements for GE Area B2.

RECOMMENDATION:

The GE Committee recommends approval of GE-088-156, BIO 1040 – What is Evolution? for GE Area B2.

BIO - 1040 - What is evolution?

C. Course - New General Education* Updated

General Catalog Information

College/Department	**Biological Sciences**
Semester Subject Area	**BIO**
Semester Catalog Number	1040
Quarter Subject Area	**None Selected**
Quarter Catalog Number	
Course Title	What is evolution?
Units*	**(3)**
C/S Classification *	**C-01 (Large Lecture)**

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**
Instruction Mode*	**Face-to-Face** **Web-Assisted**
Grading Basis*	**Graded Only**

Repeat Basis*	**May be taken only once**
If it may be taken multiple times, limit on number of enrollments	**1**
Cross Listed Course Subject Area and Catalog Nbr (if offered with another department)	
Dual Listed Course Subject Area and Catalog number (If offered as lower/upper division or ugrd/grad)	
Choose appropriate type (s) of course(s)*	☐ Major Course ☐ Service Course ☑ GE Course ☐ None of the above
General Education Area / Subarea*	**B2**

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	An introduction to core biological concepts such as the nature of science, biochemistry, genetics, and ecology which provide a framework for deeply exploring the unifying principle of evolutionary biology. The course also explores societal challenges to studying evolution.

II. Required Coursework and Background

Prerequisite(s)	None

Corequisite(s)	
Pre or Corequisite (s)	
Concurrent	

III. Expected Outcomes

List the knowledge, skills, or abilities which students should possess upon	Students will be able to:

completing the course.*	a. Describe, identify and/or explain how major concepts in biology apply to the major theme of biological evolution. b. Explain, use, and apply the major principles of evolutionary biology. c. Describe how the results of evolutionary investigations apply and inform other areas of biology and modern society at large. d. Accurately apply and use the processes of science, including developing scientific questions, designing experiments, interpreting evidence to make claims, using scientific models, and applying quantitative reasoning to problems related to evolutionary biology.
If this is a course for the major, describe how these outcomes relate to the mission, goals and objectives of the major program.	
Explain how the course meets the description of the GE SubArea(s). Please select appropriate outcomes according to the GE Area/SLO mapping.	The course 'What is evolution?' allows students the opportunity to develop an understanding of the central theory of biological evolution that unites the disparate facts of biology as well as the critical thinking skills to: ask scientifically-oriented questions in evolutionary biology, design appropriate experimental procedures, collect and organize data, analyze and interpret data, and make claims based on evidence. Students will also critically evaluate controversies involved in the teaching and learning of evolution in the context of biological literacy.

The course will begin with investigations into the nature, practice, and limits of science. Students will then investigate and learn about vital biological concepts necessary to understand the breadth of the discipline and to build a foundation to more deeply understand evolution. As the course proceeds, the focus will turn to major concepts related to the theory of evolution. In-class and out-of-class assignments will integrate the practices of science so that students need to analyze, interpret and critique claims based on evidence and experimental designs as they learn the fundamental tenets of evolution. The analysis of evolutionary data and the development of models will require the development of quantitative skills. Near the end of the course, the societal context for teaching and studying evolution will be explored.

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

1a: Write effectively for various audiences.

Students will be given a term writing assignment that will be peer-reviewed using a rubric from the instructor, revised and turned in near the end of the term. The assignment is described in more detail in section IX.

1d: Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.

Students will have multiple opportunities to practice this critical practice of science as they collect data from simulations, and analyze provided datasets throughout the course.

1e: Apply and communicate quantitative arguments using equations and graphical representations of data.

Students will generate and be given multiple datasets in class and in assignments to be completed outside of class. To successfully make arguments, students will need to use and quantitative reasoning and to defend and explain the reasoning they used. They will also be asked to create and interpret graphical representations of data.

2a: Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.

This practice of science is similar to 1d except that students have to articulate the major scientific principles that link the evidence to their claim (a scientific argument). In and out of class assignments, especially those in the interactive models from Evobeaker (see below) will require this practice.

General Education Outcomes*

Ia. Write effectively for various audiences

Id. Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.

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.

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

IV. 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. Example of a possible text is:

- Zimmer, Carl. 2014. *Tangled Bank: An Introduction to Evolution*, Second Edition, Roberts and Company Publishers, Greenwood Village, CO and its accompanying study guide.

Online resources:

- Supplementary online tutorials and activities are available on the National Science Foundation supported website from the University of California Museum of Paleontology http://evolution.berkeley.edu/.
- Case studies at the National Center for Case Study Teaching in Science (more than 450 peer-reviewed case) at http://sciencecases.lib.buffalo.edu/cs/collection/ and BioQuest http://www.bioquest.org/icbl/cases.php

Support for science practices

- Research-based software for teaching has been developed to support student learning of evolution and incorporates many practices of science. Activities such as those available in the EvoBeaker package from Simbiotic software (http://simbio.com/products-college/EvoBeaker) will be used for in-class exercises and homework assignments.

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

V. Minimum Student Material

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 Material*		
	Computer	Microsoft Word, Excel, PowerPoint
	Internet	Email
	Flash Drive	Printer
	iClicker	Calculator
	Writing Instruments	

VI. 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*

Library Services	Information Technology (IT) Services
Classroom Management System (Blackboard)	Biology Learning Assistants
Photocopier	Scanner
Smart classroom	Lecture hall that can seat up to 110 students.

VII. 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*

Course themes

Major themes

- Evolution as the dominant theme to organize biological knowledge
- The nature of science
- The practices of science, especially the role of evidence in generating explanations and arguments

Course topics

1. The nature of science and science as a way of knowing
    a. How science as a way of knowing differs from other ways of knowing
    b. The methods of science, including hypothesis-driven research and other experimental, observational, and model building approaches
    c. Limits of science
    d. Values and ethics associated with scientific endeavors
2. Introduction to cells / macromolecules / levels of organization in biology
3. Introductory genetics
4. Introductory population and ecosystem ecology
5. History of evolutionary thought
6. How geology and paleontology reveal the history of life

7. Natural selection, including sources of evidence and analyzing data related to making claims about natural selection
8. Genetic drift, including developing and using models to make claims about the role of drift in evolutionary changes
9. Introduction to phylogenies or tree-thinking, including using data to reconstruct phylogenies
10. On the origin of species: understanding speciation
11. Controversies in teaching evolution
12. Human evolution
13. Contemporary issues (case studies; e.g. antibiotic resistance, cancer and evolution, conservation and evolution)

VIII. 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	Discussion
Problem solving	Case studies
Small group activities	Assigned readings
Online tutorials	

IX. Evaluation of Outcomes

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

- Exams will be delivered three to four times throughout the semester (two or three midterms and a final). Questions will span the range of Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, evaluation) and include both biological content but also questions that require the use of science practices (e.g. analyzing experimental designs, interpreting graphs). Instructors will be encouraged to use different types of formats including multiple choice, short answer, and essay formats.
- A term writing assignment is described in IX.2 below.
- Frequent quizzes, including pre-quizzes, will use the same types of questions as those used in the exams to give students and the instructor feedback on students' understanding before class and exams.
- Homework assignments that include tasks and questions similar to those on the exams will be completed on a weekly basis. Homework assignments will require students to gather and analyze data qualitatively and quantitatively using online simulations and provided data sets from authentic research studies. To reinforce metacognitive skills, other assignments will ask students to reflect on their growing understanding and questions they still have about understanding the content.
- In-class participation will be evaluated by students' responses to active learning tasks posed during class using classroom response systems such as iClickers.
- Attendance in large sections will be evaluated using classroom response systems such as iClickers.

Describe the meaningful writing assignments to be included.*

Students will have two options for completing a term paper assignment.

Option 1: Near the beginning of the course, students will write and defend an argument about the role of student understanding of biological evolution in the development of scientific literacy. They will also develop an argument

about whether or not learning evolution should be required in the K-12 education system. The instructor will grade the essays using a course rubric. Students will resubmit their term paper near the end of the course with revised arguments and a description of whether or not their ideas have changed as they learned the content of the course.

Option 2: Students will choose a case study in evolutionary biology that is relevant to their life, such as the evolution of antibiotic resistant bacteria, how molecular evolution affects the development of vaccines, or how species are adapting (or not) to climate change. Ten or more case studies will be provided (see section IV), but students may pursue other cases as approved by the instructor. In the writing assignment, students need to outline the types of evidence collected in the investigations, a summary of the evidence collected (including developing appropriate graphical representations of data), the evolutionary principles involved, and a description of why this case is relevant to them. The instructor will grade the essays using a course rubric. Students will resubmit their revised term paper near the end of the course with revisions.

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.*

Student Learning Outcomes	Methods of Assessment			
	Exams	Quizzes	Assignments	Participation
Describe, identify and/or explain how major concepts in biology apply to the major theme of biological evolution.	X	X	X	X

Explain, use, and apply the major principles of evolutionary biology.	X	X	X	X
Describe how the results of evolutionary investigations apply and inform other areas of biology and modern society at large.	X	X	X	X
Accurately apply and use the processes of science, including developing scientific questions, designing experiments, interpreting evidence to make claims, using scientific models, and applying quantitative reasoning to problems related to evolutionary biology.	X	X	X	X

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.*

Student Learning Outcomes	**Methods of Assessment**			
	Exams	**Quizzes**	**Assignments**	**Participation**
1a: Write effectively for various audiences.			X	
1d: Construct arguments based on sound evidence and	X	X	X	X

reasoning to support an opinion or conclusion.				
1e: Apply and communicate quantitative arguments using equations and graphical representations of data.	X	X	X	X
2a: Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.	X	X	X	X

X. This OPTIONAL Section is for describing Course/Department/College specific requirements.

Department/ College Required ECO Information (Optional)	