CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ACADEMIC SENATE

GENERAL EDUCATION COMMITTEE

REPORT TO

THE ACADEMIC SENATE

GE-070-156

AST 3050- Archaeoastronomy (GE Area B5)

General Education Committee	**Date: 09/12/2016**
Executive Committee **Received and Forwarded**	**Date: 10/19/2016**
Academic Senate	**Date: 10/26/2016** **First Reading**

BACKGROUND:

The Department of Physics and Astronomy introduced a new semester course for GE Area B5.

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 SLO's and other requirements of GE Area B5

RECOMMENDATION:

The GE Committee recommends approval of GE-070-156, AST 3050 – Archaeoastronomy, for GE Area B5.

AST - 3050 - Archaeoastronomy

C. Course - New General Education* Updated

General Catalog Information

College/Department Physics and Astronomy

Semester Subject Area AST

Semester Catalog Number 3050

Quarter Subject Area

Quarter Catalog Number NA

Course Title Archaeoastronomy

Units* (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

Instruction Mode*	**Face-to-Face**
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)	ANT 3050
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*	**B5**

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	Archaeoastronomy is a course synthesizing ancient and modern astronomical concepts. Students will explore the themes of early science and empiricism emphasizing ancient cultures and their concepts of astronomy, cosmology, and time. Technological tools used by ancient societies to obtain and record astronomical data and knowledge will be studied. Examples will be drawn from ancient world cultures such as the Maya, the Aztec, Ancient Greece, Ancient China and others. An introduction to modern astronomical instrumentation and astrophysical

insights will provide context for understanding the achievements and limitations of ancient scientists.

II. Required Coursework and Background

Prerequisite(s) Prerequisite: Completion of GE Area A and GE Area B sub-areas 1, 2, 3, and 4

III. Expected Outcomes

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

After taking this course students should be able to:

Describe basic elements of the night sky
Practice naked eye and telescopic astronomical observations
Develop an understanding of science and empiricism throughout time
Develop a cross-cultural understanding of the night sky, including the modern scientific perspective
Compare and contrast different cultural conceptions of astronomy
Understand and employ different systems of measuring time and of calendric systems
Describe the various forms of instrumentation used throughout time for viewing the night sky and how these affected people's views and construction of their cosmos
Describe how ancient societies mapped the cosmos onto the landscape.
Employ modern astronomical coordinate systems to predict rise, transit, and set times of celestial objects (can be assisted by planetarium software).

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

Archaeoastronomy is an inherently interdisciplinary topic that draws heavily upon physical science and mathematics (via astronomy) to understand human activities in ancient societies. Commerce and migration depended upon a mastery of astronomy for navigation, while the rise of agriculture (a

according to the GE Area/SLO mapping.

topic directly relevant to the life sciences) depended upon a mastery of astronomy for calendars. The purpose of this course is thus for students to learn the quantitative measurement and observational techniques that our predecessors used to build their societies, organize their activities, and sustain life.

The major focus of a synthesis course is to integrate and focus fundamental concepts and issues. Each course in this category shall:

Include readings from original primary/historical sources, as opposed to only secondary sources.

An extensive list of primary sources is included below.

Promote original and critical thinking in writing and/or discussion.

See responses below for the specific ways in which GE SLOs Ia and Ib will be addressed.

Focus attention on understanding the interrelationships among the disciplines and their applications.

See the paragraph above concerning the interdisciplinary nature of archaeoastronomy.

Examine ideas and issues covered in this area in deeper and/or broader more integrative ways.

Students will go beyond the interpretation of specific facts or observations in isolation, and will draw upon the complementary expertise of the archaeologist and astronomer team-teaching the course.

Encourage synthetic-creative thinking in order to identify problems, understand broader implications and construct original ideas.

See response to the previous item.

Identify and evaluate assumptions and limitations of ideas and models.

Much of the class will be spent on examining astronomical data, historical records, and archaeological records. All of these data sources are typically found in incomplete pieces, forcing a scholar to deal with uncertainty. Students will participate in discussions and complete assignments that require them to evaluate multiple competing hypotheses or interpretations that are consistent with the incomplete information that is available.

Develop written and oral communication skills appropriate for an upper division course (completion of courses in Area A: Subareas A1, A2, & A3 is required.)

See meaningful writing assignment in section IX of this ECO, and the discussion of GE SLOs Ia and Ib below.

Provide student work for assessment of the student's understanding of the required educational objectives in this subarea or in this course.

See Section IX of this ECO

The relationship between science, technology, and civilization

Archaeoastronomy is, by its nature, concerned with the ways in which investigations of astronomy enabled our predecessors to develop calendars, agriculture, navigation, and other technologies and innovations crucial to the emergence of civilizations.

The effect science and technology have on culture and human values.

See previous item.

The application and generalization of basic scientific or quantitative knowledge from the foundational courses to real world or practical problems

Developing the necessary background in astronomy will draw heavily upon the students' knowledge of physical science from B1, as well as quantitative skills developed in B4. Analyzing the strengths and limitations of astronomical observation and measurement techniques will draw on the facility with measurement and data analysis developed in the B3 course, as well as quantitative skills developed in B4. The role of astronomically-derived calendars in the emergence of agriculture will draw upon knowledge of botany developed in B2.

Describe how these outcomes relate to the associated GE Learning Outcomes listed below.*	1a. Writing effectively for various audiences. Writing assignments will assess students' abilities to convey data and arguments effectively to broad audiences. 1b. Speak effectively to various audiences Oral presentations and in-class discussions along with group assignments encourage various forms of communication contexts and audiences. 1c. Find, evaluate, use and share information effectively and ethically.

Research paper and hands-on activities will effectively teach students to gather data ethically and present it to a broad audience.

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

Research papers and group activities will require critical thinking
and presentation of arguments with both quantitative and qualitative data.

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

The course is team taught by an archaeologist and an astronomer and will provide students with an interdisciplinary perspective on methods, approaches, and show students how to use qualitative and quantitative data to investigate topics relevant to the class.

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

This course synthesizes archaeological, anthropological, physics and astronomy data and methods. We will work with both qualitative and quantitative data to present students with cross cultural examples of science and empiricism in the ancient world.

2d. Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions

This course will be team-taught by an archaeologist and an astronomer and the lecture topics and assignments have been designed to blend the approaches and methods of both disciplines.

General Education Outcomes*

- **Ia. Write effectively for various audiences**
- **Ib. Speak effectively to various audiences.**
- **Ic. Find, evaluate, use, and share information effectively and ethically.**
- **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.**
- **IId. Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions.**

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*

Possible Texts

Aveni, Anthony 2001 *Skywatchers: A Revised and Updated Version of Skywatchers of Ancient Mexico.* University of Texas Press.

Krupp, E.C. 2003 *Echoes of the Ancient Skies: The Astronomy of Lost Civilizations.* Dover Publications.

Penprase, Bryan E. 2010 *The Power of the Stars: how Celestial Observations Have Shaped Civilization.* Springer.

Supplementary Sources

Aveni, Anthony:

1989 *Empires of Time: Calendars, Clocks and Culture.* Basic Books.

1992 *Conversing with the Planets: How Science and Myth Invented the Cosmos.* Crown.

1999 Stairway to the Stars: Skywatching in Three Great Ancient Cultures. Wiley.

2008 *People and the Sky: Our Ancestors and the Cosmos.* Thames and Hudson.

Chamberlain, Von Del, J.B. Carlson and M.J. Young, 2005 *Songs from the Sky: Indigenous Astronomical and Cosmological Traditions of the World.* Ocarina Books.

Dowd, Anne S. and Susan Milbraith, 2015 *Cosmology, Calendars and Horizon-based Astronomy in Ancient Mesoamerica.* University of Colorado Press.

Evans, James, 1998 *The History and Practice of Ancient Astronomy.*
Oxford University Press.

Kelley, David H., Eugene F. Malone, and Anthony Aveni, 2011 *Exploring*

Ancient Skies: A Survey of Ancient and Cultural Astronomy. 2nd edition. Springer.

Neugebauer, O. 1969 *The Exact Sciences in Antiquity*, Dover

Ruggles, Clive (Editor), 2011 Archaeoastronomy and Ethnoastronomy: Building Bridges Between Cultures.
Cambridge University Press.

Primary Sources

Anonymous. 2015 The Dresden Codex. Create Space Independent Publishing.

Cleary, Timothy, 2011 *The Stars We Know: Crow Indian Astronomy and Lifeways.* Waveland Press.

Cullen, Christopher, 2007 *Astronomy and Mathematics in Ancient China.*
Cambridge University Press.

Delire, J.M., 2012 *Astronomy and Mathematics in Ancient India.* Peeters Publishers.

Duran, Diego, 1977 *Book of Gods and Rites and the Ancient Calendar.*
University of Oklahoma Press.

Freidel, David and Linda Schele, 1995 *Maya Cosmos.* William Morrow.

Holbrook, Jarita, R. Thebe Medupe, Johnson O. Uruma, 2008 *African Cultural Astronomy.* Springer.

Kristemaker, Jacob and Sun Xiaochun, 1997 *The Chinese Sky During the Han.* Brill Academic Publishing.

Lehoux, Daryn, 2007 *Astronomy, Weather, and Calendars in the Ancient World: Parapegmata and Related Texts in Classical and Near Eastern Societies.* Cambridge University Press.

Malville, J.M., 2012 *Prehistoric Astronomy in the Southwest.* 3D Press.

Rice, Prudence

2007 *Maya Calendar Origins.* University of Texas Press.

2004 *Maya Political Science: Time, Astronomy and the Cosmos*.
University of Texas Press.

Sagan, Carl, 1996 *The Demon-Haunted World: Science as a Candle in the Dark*. Ballantine Books

Sahaghun, Bernardino, 2012 *The Florentine Codex*. 13 vols. University of Utah Press.

Journals

Archaeastronomy Journal

Internet Sources

- The Center for Archaeoastronomy (http://terpconnect.umd.edu/~tlaloc/archastro/)
- ISAAC, the International Society for Archaeastronomy and Astronomy in Culture (http://terpconnect.umd.edu/~tlaloc/archastro/isaac.html)
- Clive Ruggles Web Page (http://www.cliveruggles.net/)
- Cultural Astronomy, University of Chicago (http://ecuip.lib.uchicago.edu/diglib/science/cultural_astronomy/)
- Ancient Astronomy and Africa (http://www.as.utexas.edu/~wheel/africa/index.htm)
- Planetarium software (for example Stellarium: http://www.stellarium.org)

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.

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*

External Support

Library Services
Stockroom
Graphic Services
Information Technology (IT) Services
Classroom Management System (e.g. BB)
Copier

Physical Space & Major Equipment

lecture room with seating for up to 40 students
smart classroom (computer/projector)
2 GPS-guided suitcase telescopes (housed in Physics & Astronomy stockroom)
overhead screen
white board/dry erase markers
adjustable lighting

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* The topics that will be covered will include, but are not limited to:

Science and Empiricism in the Ancient World
A Brief history of Archaeoastronomy and Cultural Astronomy
Calendar Systems, Time Keeping, and the Stars
Coordinate Systems: Mapping the sky onto the earth,
architecture, observation and cosmography
The Stars, Myth and Cosmologies
Solar phenomena
Lunar Phenomena

Construction of Constellations
Stars and Planets: Modern astrophysical descriptions
Star clusters, Nebulae, the Milky Way and nearby galaxies: Naked-eye appearance and modern astrophysical descriptions
Comets, Supenovae, and other rare, transient naked-eye phenomena with modern astrophysical descriptions

Each of these topics will be presented through cross-cultural examples.

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*	Team-taught lectures and discussions by an astronomer and an archaeologist; course will be interdisciplinary throughout. Hands-on, sky and planet watching activities (both naked-eye and telescopic), a journal of the night sky and other such activities will help students hone observation skills. Field trips to the Griffith Observatory or to the desert to sky watch. Guest Lectures from local experts such as Ed Krupp, Karl Taube and Bryan Penprase among others. Online exercises using online resources on astronomy and archaeology.

IX. Evaluation of Outcomes

Describe the methods to be used to evaluate students' learning, i.e. written exams, term papers, projects, participation,	Students' learning of course content is evaluated via the following work: Attendance and Participation Research project

quizzes, attendance, etc.*

a. The research project is quite flexible and can be a focused case study of a specific culture's astronomical traditions or an experimental reconstruction of ancient technologies for sky watching, keeping time or other related projects in-line with the themes of the class.
b. Written research report constitutes a major writing assignment.

Oral presentations of readings or small projects done in class.
Hands-on Exercises with mini-reports will encourage writing and observational skills.
Quizzes or exams will combine multiple-choice, conceptual questions with short-answer written responses to probe deeper mastery of the content.

Describe the meaningful writing assignments to be included.*

The research project is quite flexible and can be a focused case study of a specific culture's astronomical traditions or an experimental reconstruction of ancient technologies for sky watching, keeping time or other related projects in-line with the themes of the class. Hands-on Exercises with mini-reports provide opportunities for students to receive feedback on their work prior to the end of the term.

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.*

Matrix relating Course SLOs to components of the course.

	Exams	Research Projects	Ha act
Describe basic elements of the night sky	x		
Practice naked eye and telescopic astronomical observations			x
Develop an understanding of science and empiricism throughout time	x	x	
Develop a cross-cultural understanding of the night sky, including the modern scientific perspective	x	x	x
Compare and contrast different cultural conceptions of astronomy	x	x	
Describe the various forms of instrumentation used throughout time for viewing the night sky and how	x	x	
Understand and employ different systems of measuring time and of calendric systems	x		x

these affected people's views and construction of their cosmos				
Describe how ancient societies mapped the cosmos onto the landscape.	x			
Employ modern astronomical coordinate systems to predict rise, transit, and set times of celestial objects (can be assisted by planetarium software).	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.*

Matrix relating GE SLOs to components of the course. D=develop and M = mastery

Gen. Ed. Outcomes	**1a**	**1b**	**1c**	**1d**	**1e**	**2a**		**2d**
Assessments								
Exams	D				D			D
Research Project	D		D	D	D	D		D
Hands-on Activities	D		D	D	D	D		D
Discussion		D/M						D
Presentations		D/M		D	D	D		D

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

Department/ College Required ECO Information (Optional)