General Education Course Information Sheet

Please submit this sheet for each proposed course

Department & Course Number	AN N NE M30 / ANTHRO M30 (suggested)
Course Title	Science in Archaeology (short title: ArchaeoSTEM)
Indicate if Seminar and/or Writing II course	---

1 Check the recommended GE foundation area(s) and subgroups(s) for this course

Foundations of the Arts and Humanities	
• Literary and Cultural Analysis	
• Philosophic and Linguistic Analysis	
• Visual and Performance Arts Analysis and Practice	
Foundations of Society and Culture	
• Historical Analysis	
• Social Analysis	
Foundations of Scientific Inquiry	
• Physical Science	**x** (elements)
With Laboratory or Demonstration Component must be 5 units (or more)	---
• Life Science	**x** (elements)
With Laboratory or Demonstration Component must be 5 units (or more)	---

2. Briefly describe the rationale for assignment to foundation area(s) and subgroup(s) chosen.

This course aims to introduce undergraduate students to selected elements of the physical and life science as these are used in archaeology, using archaeological examples as a paradigm and at the same time as evidence for the applicability and importance of the presented knowledge and skills. As an MD with a PhD in archaeology and a specialism in applying the natural sciences in archaeology I feel perfectly positioned to offer a course as proposed here (see, for instance, Barnard H., A.N. Dooley, G. Areshian, B. Gasparyan and K.F. Faull, Chemical evidence for wine production around 4000 BCE in the Late Chalcolithic Near Eastern highlands, *Journal of Archaeological Science 38*; 2011: 977-84; Barnard H., S.H. Ambrose, D.E. Beehr, M.F. Forster, R.E. Lanehart, M.E. Malainey, R.E. Parr, M. Rider, C. Solazzo and R.M. Yohe II, Mixed results of seven methods for organic residue analysis applied to one vessel with the residue of a known foodstuff, *Journal of Archaeological Science 34*; 2007: 28-37; Barnard H and J.W. Eerkens (eds.), *Theory and Practice of Archaeological Residue Analysis: British Archaeological Reports International Series 1650*, Oxford 2007).

3. "List faculty member(s) who will serve as instructor (give academic rank):
Hans Barnard MD PhD
Adjunct Assistant Professor (NELC) and Assistant Researcher (Cotsen Institute of Archaeology)

Do you intend to use graduate student instructors (TAs) in this course? Yes **x** No ____

If yes, please indicate the number of TAs 1

4. Indicate when do you anticipate teaching this course over the next three years:

2012-2013	Fall		Winter		Spring	**x**
	Enrollment		Enrollment		Enrollment	80
2013-2014	Fall		Winter		Spring	**x**

	Enrollment		Enrollment		Enrollment	80
2014-2015	Fall		Winter		Spring	**x**
	Enrollment		Enrollment		Enrollment	80

5. GE Course Units

Is this an ***existing*** course that has been modified for inclusion in the new GE? Yes **x** No ___

If yes, provide a brief explanation of what has changed.

The course ANNNEA CM169/269—ANTHRO CM110Q/210Q, *"An Introduction to Archaeological Science,"* was originally set-up to discuss with anthropology and archaeology students elements of the physical sciences that are used in present-day archaeological research. After offering the course several times the substantial gap in the most basic scientific knowledge and skills among especially the undergraduate students enrolled in the course became obvious. At the same time I discovered a personal interest in and talent for undergraduate instruction. I therefore propose to amend the existing course to cater to a larger audience of undergraduate students and use archaeology as a paradigm to introduce selected elements of the physical sciences and life sciences. The appeal of archaeology will attract those not primarily interested in the sciences, while the immediate relevance of the scientific knowledge and skills included in the course will help to consolidate these. The course material is adapted to a different and larger student enrollment. The original weekly quizzes are replaced by weekly on-line assignments and are now geared more towards problem solving than knowledge testing, while the original in-class activities are replaced by a second weekly on-line assignment which requires students to collaborate in an on-line environment such as Google Docs. A discussion section moderated by a Teaching Assistant has been added to discuss the weekly assignments.

Present Number of Units: **4** Proposed Number of Units: **4**

6. Please present concise arguments for the GE principles applicable to this course.

❑ General Knowledge	This course provides an overview of these elements of the natural sciences that should be common knowledge among UCLA graduates. Subjects range from the Pythagorean theorem to the translation of RNA into proteins, and from defining atoms, molecules and ions to calculating standard deviations, Pearson's correlations, and Student's t-tests.
❑ Integrative Learning	All learning in this course is centered on the application of the presented knowledge and skills in the field of archaeology, providing evidence for their applicability and importance. Archaeology is a particularly interdisciplinary field of research and can serve as paradigm for many elements of the natural sciences, for instance trigonometry in surveying, physical and organic chemistry in dating and residue analysis, and geology in ceramic analysis.
❑ Ethical Implications	As evident from the on-going debate on the fate of, among many others, the Bamiyan Buddhas, the Elgin marbles, and Native American petroglyphs, archaeology is directly connected to ethnic and national pride and thus the subject of heated debates on the ethics of stewardship and ownership. These will be the subject of assignments and discussions in class. The philosophy of science is also addressed in several of the lectures and discussions.
❑ Cultural Diversity	Archaeologists work in many countries in the world, among many different ethnic groups, and often investigate previous (pre-colonial) cultures associated with modern minority groups, such as the pre-Columbian cultures in Middle and South America, the late pre-Islamic cultures in the Middle East, and Native American Cultures in the United States. Rather than working in isolation, archaeologists more and more cooperate with local archaeologists and other stakeholders. These issues are touched upon in class and the readings.

❑ Critical Thinking	Critical thinking takes central stage in this course. Lectures and discussions are geared towards student participation, while weekly on-line assignments invite students to critically address the subjects discussed in class. A second set of weekly on-line assignments require problem solving skills related to the methods and techniques discussed in class and the readings. Both ethical issues and the philosophy of science are addressed in several of the lectures and discussions.
❑ Rhetorical Effectiveness	Students will be called upon for their input in class, not only during the planned discussion sections, but also by the questions posed by the instructor aimed to keep them engaged during the lecture sessions. A randomized roster will be used to secure a fair rotation of such prepared and *ad hoc* oral participation.
❑ Problem-solving	One set of weekly on-line assignments will address the subjects presented in class. These assignments do not aim to test knowledge, but rather to stimulate problem solving skills related to the methods and techniques discussed in class and the readings. A second set of on-line assignments invite students to critically address the subjects to be discussed in class.
❑ Library & Information Literacy	One set of weekly on-line assignments will require students to solve a number of problems, partly based on the lectures and readings as well as independent research using a variety of physical and on-line information sources ranging from UCLA's Research Library to Wikipedia.

(A) STUDENT CONTACT PER WEEK (if not applicable write N/A)

1.	Lecture:	3	(hours)
2.	Discussion Section:	1	(hours)
3.	Labs:	N/A	(hours)
4.	Experiential (service learning, internships, other):	N/A	(hours)
5.	Field Trips:	N/A	(hours)

(A) TOTAL Student Contact Per Week **4** **(HOURS)**

(B) OUT-OF-CLASS HOURS PER WEEK (if not applicable write N/A)

1.	General Review & Preparation:	2.0	(hours)
2.	Reading	2.0	(hours)
3.	Group Projects:	N/A	(hours)
4.	Preparation for Quizzes & Exams:	2.0	(hours)
5.	Information Literacy Exercises:	1.5	(hours)
6.	Written Assignments:	1.5	(hours)
7.	Research Activity:	2.0	(hours)

(B) TOTAL Out-of-class time per week **11** **(HOURS)**

GRAND TOTAL (A) + (B) must equal at least 15 hours/week **15** **(HOURS)**

Proposal for a new GE-course

Course Title

Science in Archaeology
(short title: ArchaeoSTEM)

Most of the constituent elements of the proposed class have been tested in course ANNEA CM169/269—ANTHRO CM110Q/210Q, "*An Introduction to Archaeological Science*," by the same instructor. The GE-course proposed here should likewise be cross-listed between NELC and Anthropology; course number ANNEA M30—ANTHRO M30 is suggested.

This proposal is supported by William Schniedewind (Chair, Department of Near Eastern Languages and Cultures), P. Jeffrey Brantingham (Vice Chair, Department of Anthropology), Charles Stanish (Director, Cotsen Institute of Archaeology), and Kym F. Faull (Director, Pasarow Laboratory of Mass Spectrometry).

Grading Structure

Students who submit and pass all of the weekly on-line assignments receive a passing grade. Students who fail to submit or pass more than two of the weekly assignments do a written final exam. With consent of the instructor other students can also take the final exam for a letter grade.

Instructional Format

The course consists of ten lectures; each divided in two instructional sessions, separated by a discussion of an assignment. Participation in class will be stimulated using a randomized roster. Each week all students do two on-line assignments: one comprises a dozen multiple-choice questions about the readings; the second comprises a brief activity to be reported in a collaborative on-line environment. There is no mid-term examination and a final written examination only for students who failed to submit or pass more than two assignments.

Proposed for a GE-Requirement?

Yes (see the table below and the attached form).

Proposed for a Major or Minor Requirement?

No.

Prerequisites?

None.

Course Description

Archaeology is rapidly developing due to the on-going introduction of new hardware, software and information dissemination technology. This process presents opportunities not only to obtain new scholarly insights, but also to provide integrated instruction in STEM skills. This class aims to use archaeological data as a paradigm in STEM education during ten weeks of lectures, discussion and assignments. Each week all students do two on-line assignments. One comprises a dozen multiple-choice questions about the readings. The questions address insight rather than factual knowledge. The second assignment comprises an activity which is reported upon in a collaborative on-line environment. Assignments will be available for nine days before they are due. Discussion of the assignments and the participation of students in class will be according to a randomized roster, which will also function as a check on the presence of students. All material shown in class, the assignments and the readings, except the textbook, will be available to students on UCLA's CCLE web-site.

Justification

Archaeology is a multi-disciplinary field of study, combining its own research methods and technologies with elements from geology, history, ethnography, geography, material science, statistics, biology, biochemistry, medicine, and others. In an undergraduate learning environment, the problem-based approach of archaeological projects instantly leads to STEM-based skills; skills that will be consolidated as they feed directly into an intellectual framework. The instant practical application of mathematics during surveying, geology during ceramic analysis or geophysical research, biochemistry during archaeological residue analysis, or biology during zooarchaeological or paleoethnobotanical research offers a point of departure for instructors as well as motivation to students. The fact that too few UCLA students can remember the difference between a molecule and an ion, or how to project a line on the abscissa using a cosine, illustrates the great need for STEM instruction at the most basic level. The appeal of archaeology can be used to introduce STEM subjects to students, including those not directly pursuing a career in

anthropology or archaeology, and at the same time show the relevance of these skills.

Syllabus

The table below presents the subjects of the weekly lectures, discussions and assignments, along with the readings. The GE component of each set is given in a separate column.

Week	Title	GE-component	Discussion	Assignment	Readings
1	Introduction	critical and ethical thinking	ethics of archaeology and heritage (with video)	compare maps	**Bahn**, P. and C. Renfrew (2008), *Archaeology: Theories, Methods and Practice*, London, Thames and Hudson (textbook, selected readings). Further reading: **Brothwell**, D.R. and A.M. Pollard (2005), *Handbook of Archaeological Sciences,* Chichester and New York, John Wiley and sons, Ltd. **McGovern**, P.E. (1995), Science in archaeology: A review, *American Journal of Archaeology 99:* 79-142.
2	Surveying, mapping and GIS	elements of trigonometry, sine, cosine, Pythagorean theorem	compare maps	measuring exercise	**Renfrew and Bahn**, *Archaeology*, pp. 73-120. **Smith**, M.L. (2005), Networks, territories, and the cartography of ancient states, *Annals of the Association of American Geographers 95*: 832-849. **Warden**, R. (2009), Towards a new era of cultural-heritage recording and documentation, *ATP Bulletin: Journal of Preservation Technology 40*: 5-10. **Williams**, P.R and D.J. Nash (2006), Sighting the *apu*: A GIS analysis of Wari imperialism and the worship of mountain peaks, *World Archaeology 38*: 455-468.

3	Remote sensing	elements of physics, electromagnetics, SI	measuring	game model of science	**Renfrew and Bahn**, *Archaeology*, pp. 177-230. **Davenport**, G.C. (2001), Remote sensing applications in forensic investigations, *Historical Archaeology 35*: 87-100. **Kvamme**, K.L. (2003), Geophysical surveys as landscape archaeology, *American Antiquity 68*: 435-457. **Leucci**, G. and S. Negri (2006), Use of ground penetrating radar to map subsurface archaeological features in an urban area, *Journal of Archaeological Science 33*, 502-512
4	Molecular archaeology	elements of physical chemistry, periodic table, stable isotopes	game model of science (with video)	classification exercise	**Renfrew and Bahn**, *Archaeology*, pp. 275-316. **Bentley**, R.A. (2006), Strontium isotopes from the earth to the archaeological skeleton: A review, *Journal of Archaeological Method and Theory 13*: 135-187. **Budzikiewicz**, H. and R.D. Grigsby (2006), Mass spectrometry and isotopes: A century of research and discussion, *Mass Spectrometry Reviews 25*: 146-157. **Hedges**, R.E.M. and L.M. Reynard (2007), Nitrogen isotopes and the trophic level of humans in archaeology, *Journal of Archaeological Science 34*: 1240-1251.
5	Dating	elements of physical chemistry, unstable isotopes	classification	form-function-style	**Renfrew and Bahn**, *Archaeology*, pp. 121-174. **Mellars**, P. (2006), A new radiocarbon revolution and the dispersal of modern humans in Eurasia, *Nature 439*: 931-935. **Rogers**, A.K. (2008), Obsidian hydration dating: Accuracy and resolution limitations imposed by intrinsic water variability, *Journal of Archaeological Science 35*: 2009-2016. **Wilson**, M.A., M.A. Carter, C. Hall, W.D. Hope, C. Ince, S.D. Savage, B. McKay and I.M. Betts (2009), Dating fired-clay ceramics using long-term power law rehydroxylation kinetics, *Proceedings of the Royal Society A*, doi: 10.1098/rspa.2009.0117.

6	Ceramic analysis	elements of geology, minerology	form-function-style (with video)	archaeology in the popular media	**Renfrew and Bahn**, *Archaeology*, pp. 317-356. **Barnard**, H., S.H. Ambrose, D.E. Beehr, M.D. Forster, R.E. Lanehart, M.E. Malainey, R.E. Parr, M. Rider, C. Solazzo and R.M. Yohe II (2007), Mixed results of seven methods for organic residue analysis applied to one vessel with the residue of a known foodstuff, *Journal of Archaeological Science 34*: 28-37. **Riederer**, J. (2004), Thin section microscopy applied to the study of archaeological ceramics, *Hyperfine Interactions 154*: 143-158. **Tite**, M.S. (2008), Ceramic production, provenance and use: A review, *Archaeometry 50*: 216-231.
7	Flora and fauna	elements of biochemistry, DNA, RNA, proteins	archaeology in the popular media (with video)	philosophy of science	**Renfrew and Bahn**, *Archaeology*, pp. 231-274. **Pennington**, H.L. and S.A. Weber (2004), Paleoethnobotany: Modern research connecting ancient plants and ancient peoples, *Critical Reviews in Plants Sciences 23*: 13-20. **Piperno**, D.R. (2009), Identifying crop plants with phytoliths (and starch grains) in Central and South America: A review and an update of the evidence, *Quaternary International 193*: 146-159. **Thomas**, R. (2005), Zooarchaeology, improvement and the British agricultural revolution, *International Journal of Historical Archaeology 9*, 71-88.
8	Databases	elements of information technology, databases	philosophy of science (with video)	age Clint exercise	**Renfrew and Bahn**, *Archaeology*, pp. 429-468. **Broquet-Appel**, J.-P., P.-Y. Demars, L. Noiret and D. Dobrowsky (2005), Estimates of Upper Palaeolithic meta-population size in Europe from archaeological data, *Journal of Archaeological Science 32*: 1656-1668. **Joyce**, R.A. and R.E. Tringham (2007), Feminist adventures in hypertext, *Journal of Archaeological Method and Theory 14*: 328-358. **Kintigh**, K. (2006), The promise and challenge of archaeological data integration, *American Antiquity 71*: 567-578.

9	Statistics	elements of statistics, correlation, hypothesis testing	age Clint	critique imagery	**Renfrew and Bahn**, *Archaeology*, pp. 545-577. **Aldenderfer**, M.S. (1998), Quantitative methods in archaeology: A review of recent trends and developments, *Journal of Archaeological Research 6*: 91-120. **Eerkens**, J.W. and R.L. Bettinger (2001), Techniques for assessing standardization in artifact assemblages: Can we scale material variability? *American Antiquity 66*: 493-504. **Neff**, H. (1993), Theory, sampling, and analytical techniques in the archaeological study of prehistoric ceramics, *American Antiquity 58*: 23-44.
10	Visual archaeology	elements of information technology, data reduction	critique imagery	none	http://hampsonmuseum.cast.uark.edu/browse.htm http://www.maya-archaeology.org/museums/copan/copangate.php http://seasia.museum.upenn.edu/ http://www.learn.columbia.edu/bourbonnais/ http://dlib.etc.ucla.edu/projects/Karnak/ **Hendrickson**, C. (2008), Visual field notes: Drawing insights in the Yucatan, *Visual Anthropology Review 24*: 117-132. **Monmonier**, M. and H.J. de Blij (1996), *How to Lie with Maps*, Chicago, University of Chicago Press: 139-173 (Chapters 10-11). **Tufte**, E.R. (2001), *The Visual Display of Quantitative Information*, Cheshire, Graphics Press: 13-51 (Chapter 1).

New Course Proposal

	Ancient Near East 30 Science in Archaeology
Course Number	Ancient Near East 30
Title	Science in Archaeology
Short Title	ARCHAEOSTEM
Units	Fixed: 4
Grading Basis	Letter grade or Passed/Not Passed
Instructional Format	Lecture - 3 hours per week Discussion - 1 hours per week
TIE Code	LECS - Lecture (Plus Supplementary Activity) [T]
GE Requirement	Yes
Requisites	None.
Course Description	Archaeology is rapidly developing due to the on-going introduction of new hardware, software and information dissemination technology. This process presents opportunities not only to obtain new scholarly insights, but also to provide integrated instruction in STEM skills. This class aims to use archaeological data as a paradigm in STEM education during ten weeks of lectures, discussion and assignments. Each week all students do two on-line assignments. One comprises a dozen multiple-choice questions about the readings. The questions address insight rather than factual knowledge. The second assignment comprises an activity which is reported upon in a collaborative on-line environment. Assignments will be available for nine days before they are due. Discussion of the assignments and the participation of students in class will be according to a randomized roster, which will also function as a check on the presence of students. All material shown in class, the assignments and the readings, except the textbook, will be available to students on UCLA"s CCLE web-site.
Justification	Archaeology is a multi-disciplinary field of study, combining its own research methods and technologies with elements from geology, history, ethnography, geography, material science, statistics, biology, biochemistry, medicine, and others. In an undergraduate learning environment, the problem-based approach of archaeological projects instantly leads to STEM-based skills; skills that will be consolidated as they feed directly into an intellectual framework. The instant practical application of mathematics during surveying, geology during ceramic analysis or geophysical research, biochemistry during archaeological residue analysis, or biology during zooarchaeological or paleoethnobotanical research offers a point of departure for instructors as well as motivation to students. The fact that too few UCLA students can remember the difference between a molecule and an ion, or how to project a line on the abscissa using a cosine, illustrates the great need for STEM instruction at the most basic level.
Syllabus	File *Science in Archaeology syllabus.doc* was previously uploaded. You may

	view the file by clicking on the file name.
Supplemental Information	
Grading Structure	100% - weekly written assignments (10% each)
Effective Date	Fall 2012

Instructor	Name	Title
	Hans Barnard	Assistant Adjunct Professor

Quarters Taught	☐ Fall ☐ Winter ☐ Spring ☐ Summer
Department	Near Eastern Languages & Cultures

Contact	Name	E-mail
Routing Help	ESTHER CHANG	estchang@humnet.ucla.edu

ROUTING STATUS

Role:	FEC Chair or Designee - Meranze, Michael (meranze@history.ucla.edu) - 52671
Status:	Pending Action

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 6/22/2012 10:17:43 AM
Changes:	No Changes Made
Comments:	Routing to Michael Meranze for FEC approval

Role:	Dean College/School or Designee - Schaberg, David C (dschaberg@college.ucla.edu) - 54856, 50259
Status:	Approved on 6/20/2012 9:03:34 PM
Changes:	No Changes Made
Comments:	No Comments

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 6/20/2012 12:53:46 PM
Changes:	Course Number, Multiple List, Grading Structure
Comments:	Per departments, removed multiple listing and changed course number back to 30. Routing to David Schaberg for Dean's approval.

Role:	Department/School Coordinator - Walters, Ann E (awalters@anthro.ucla.edu) - 52511
Status:	Denied on 6/20/2012 12:21:52 PM
Changes:	No Changes Made
Comments:	Ann Walters, staff designee, for P. Jeffrey Brantingham, Vice Chair, Anthropology

Role:	Department/School Coordinator - Chang, Esther S (estchang@humnet.ucla.edu) -

	54165
Status:	Approved on 5/31/2012 10:09:55 AM
Changes:	Course Number, Multiple List
Comments:	Changed the course number to meet the requirements of the anthropology department. Dr. Barnard has received permission to make this change and to multiple-list from the Anthro Dept Chair.

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 4/17/2012 12:10:07 PM
Changes:	No Changes Made
Comments:	Routing back to Esther Chang. Per Anthro dept, please remove Anthro multiple listing from this course.

Role:	Department/School Coordinator - Walters, Ann E (awalters@anthro.ucla.edu) - 52511
Status:	Denied on 4/17/2012 9:34:52 AM
Changes:	No Changes Made
Comments:	Ann Walters, staff designee, for P. Jeffrey Brantingham, Vice-chair.

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 3/13/2012 11:42:25 AM
Changes:	No Changes Made
Comments:	Routing to Ann Walters for Anthro dept chair approval

Role:	Department Chair or Designee - Schniedewind, William M (williams@humnet.ucla.edu) - 54165
Status:	Approved on 3/13/2012 1:50:00 AM
Changes:	No Changes Made
Comments:	No Comments

Role:	Initiator/Submitter - Chang, Esther S (estchang@humnet.ucla.edu) - 54165
Status:	Submitted on 3/6/2012 4:42:53 PM
Comments:	Initiated a New Course Proposal

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