Anthropology 589/ Material Science Engineering 597
Archaeology and Materials Science

Instructors:
H. Kory Cooper, Assistant Professor
Department of Anthropology & School of Materials Engineering
hkcooper@purdue.edu, 496-7430
Office Hour: Thurs 2-3, Stone Hall 322A

Carol Handwerker, Reinhardt Schumann Jr.
Professor of Materials Engineering
School of Materials Engineering
handwerker@purdue.edu, 494-0147
Office Hours: Tues 10:30-11:30, ARMS 2331

Lecture: T,Th 8:30-9:20, ARMS 1103
Lab: Th 9:30-11:30, ARMS 2130

PDFs of readings will be posted on Blackboard and the course website:

Catalog Description: This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course will focus on the analysis and interpretation of archaeological artifacts and provide opportunities for hands-on learning.

Additional Course Information: Archaeology is the study of past cultures through an examination of the materials they left behind (artifacts and sites), which informs most directly on their technology. This course integrates the theoretical approaches used by archaeologists and other anthropologists to study technology with instruction in the use of modern technology used to analyze artifacts from archaeological and museum contexts. Laboratory assignments will provide students with hands-experience in the analysis and interpretation of archaeological material and will be augmented by demonstrations of manufacturing techniques and analytical equipment.

Prerequisite: junior, senior, or graduate standing in Anthropology, Art and Design, Materials Engineering, Chemical Engineering, Chemistry, or permission of the instructor.

Course Reading Material:

Required
1) Journal articles and book chapters will be assigned throughout the semester on a variety of topics and posted on Blackboard as pdfs.

Additional suggested reading: These two books are recommended for those who would benefit from additional general background reading on archaeology and/or material science.
Course Grade Assessment and Assignment:

<table>
<thead>
<tr>
<th>Grade Assessment</th>
<th>Pts.</th>
<th>%</th>
<th>Letter Grade Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Participation</td>
<td>20</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>Peer Review</td>
<td>20</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>Laboratory Assignments</td>
<td>120</td>
<td>30</td>
<td>C</td>
</tr>
<tr>
<td>Film Quizzes</td>
<td>20</td>
<td>5</td>
<td>D</td>
</tr>
<tr>
<td>Annotated bibliography</td>
<td>60</td>
<td>15</td>
<td>F</td>
</tr>
<tr>
<td>Project Proposal</td>
<td>80</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>40</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Final Exam</td>
<td>40</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Class Participation & Peer Review – At the beginning of the semester you will be divided into teams of four for working on laboratory assignments and leading discussion of assigned readings once during the semester. Your class participation score will be based on regular attendance, participation in discussion throughout the semester, and how well prepared you are to lead discussion when it is your team’s turn to do so. You and your team will also have an opportunity to evaluate each other’s performance and participation in labs and discussion.

Laboratory Assignments – There are 13 labs listed on the course syllabus but Lab 4 counts as part of your research paper/proposal grade. The other 12 labs are each worth 10 points (2.5%), 12x2.5% = 30% of your course grade. Some labs consist of hands-on exercises analyzing artifacts (or sometimes replications) and other labs focus on demonstrations of relevant manufacturing processes or analytical instrument and require a write-up describing the demonstration, the operating principles behind a particular instrument, and the benefit of the demonstrated technique or instrument to the analysis of archaeological material. Attendance at all activities scheduled during lab time is mandatory. Labs 1, 3, and 4 will be accomplished individually but for all other labs each team will turn in a single report, due the week after assigned during scheduled lab time.

Film Quizzes – Five films of varying length will be shown throughout the semester addressing a number of topics. Some will be shown during lecture or lab others you will watch outside of class via links on the course website. For each film you will be given a set of 2-3 questions to answer during class or turn in at the next class meeting. Each quiz is worth 4 points, 1% of your course grade.

Research Paper/Proposal and Annotated Bibliography – Instead of a traditional research paper each student will write a hybrid research paper/proposal. During week 3 we will go over funding agency guidelines and discuss the results of funded materials science projects in archaeology during lecture. During week 4 you will present your research proposal idea during lab time and we will discuss each other’s ideas. During week 16 (last week of class) you will turn in a hard copy of a ~15 page single-spaced (12 pt. font) research proposal and provide the class with a brief oral summary. In developing your research proposal you will prepare an annotated bibliography and turn it in with your proposal. The annotated bibliography and project proposal are each worth 15% and 20%, respectively. The proposal score is broken down as follows: initial presentation of idea (5%), final presentation of idea (5%), format of proposal (5%) and content of proposal (5%), i.e., how well articulated is the research question and how thoroughly developed is the proposal with regard to addressing this question.
Anthropology Majors - Please remember to keep clean copies of all of your written assignments for your anthropology portfolios. During your final semester, you will compile a portfolio of your significant written work in anthropology and from other courses, too, if you wish. The department’s website provides further information about the portfolio requirement and exit interview.

Midterm Exam – A take-home midterm will be assigned February 23rd and due March 6th. Students should work on this exam individually. It will consist of terms you will need to define and a series of short and long essay based on readings, labs/demonstrations, and discussions and will be worth 10% of your course grade.

Final Exam – A take-home final worth 10% of your course grade and similar in format to the midterm will be assigned April 19th and due May 1st.

Learning Outcomes:
1. Understand the historical development of anthropological and archaeological approaches to the study of technology, and the role of materials science in archaeological research.
2. Obtain a more nuanced understanding of, and appreciation for, ancient and contemporary technologies and material science and engineering.
3. Demonstrate the ability to write a research proposal incorporating materials science in the investigation of past technology.
4. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability.

General expectations: Attendance at lectures and labs and keeping up with assigned readings are crucial for successfully completing this course. Parts of some lectures will be made available as PDF documents on Blackboard. Please avoid the following during lecture because they are distracting to your fellow classmates and detract from the classroom environment: reading ANYTHING, e.g., the paper (including doing crossword puzzles), books (novels, textbooks, etc., even those for this course), and chatting with classmates. You may use a laptop computer to take notes but internet surfing is NOT allowed, neither is talking, texting, emailing, or checking your email or messages via any electronic device. Reading the course syllabus and staying registered in this class means you agree that the schedule, grading criteria, and rules regarding classroom behavior are appropriate.

Campus emergency: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information about changes in this course will be available through the Blackboard Vista web page and by contacting the instructors via email. www.itap.purdue.edu/tlt/faculty

Course Schedule

Week 1 Introduction to Course
Readings:
1) Henderson Chapter 7


**Jan 10th:** Introduction to Course (Handwerker & Cooper)

**Jan 12th:** Introduction to Archaeology and Anthropology (Cooper) *Handwerker in D.C.*

**Lab 1:** Intro to Arch and Anth cont. (Cooper), Lab Safety/Student Survey/Syllabus, Tour of MSE labs.

**Week 2** Materials Science Methods

Readings:
1) Henderson Chapters 1 and 2
3) Callister et al. select sections of Chapter 1, 2, 3 and 9

**Jan 17th:** Overview of methods (Handwerker)

**Jan 19th:** Overview of methods (Handwerker)

**Lab 2:** Introduction to optical microscopy, microstructures, and phases (Handwerker & Cooper).

**Week 3** Research Proposal Topics, Formulating Research Problems, Ethnoarchaeology

Readings:
1) Grant guidelines for NSF Archaeology and Archaeometry, Wenner-Gren (online)
2) Journal articles based on awarded research grants – TBA

**Jan 24th:** Overview of guidelines and format and discussion of funded research (Cooper & Handwerker)

**Jan 26th:** continued (Cooper & Handwerker)

**Lab 3:** Demonstration of online research tools (Cooper) and anti-plagiarism software (Handwerker) and description of annotated bibliography.

**Week 4** Approaches to the Study of Technology & Ethnoarchaeology

Readings:
3) Film Quiz 1: Harpoon Manufacturing (see course Website)

**Jan 31st:** Anthropological and archaeological approaches to the study of technology (Cooper)

**Feb 2nd:** Discussion led by Team 1

**Lab 4:** Brief presentation of student research topics (2 slides, 5 min per student). Written explanation of research topic (1-2 paragraphs) due next week.

**Week 5** Stone & Bone Technology

Readings:
1) Henderson Chapter 6

**Feb 7**\textsuperscript{th}: Lithic technology (Cooper)
**Feb 9**\textsuperscript{th}: Discussion of readings led by Team 2
**Lab 5**: Lithic description and typology (Cooper). **RESEARCH PAPER/PROPOSAL TOPIC DUE at beginning of Lab.**

**Week 6** Ceramics
Readings:
1) Henderson Chapter 4, pg. 109-141
2) Callister et al. part of Chapter 12

**Feb 14**\textsuperscript{th}: Ceramics in non-industrialized societies (Handwerker)
**Feb 16**\textsuperscript{th}: Film Quiz 2: *Indian Pottery of San Ildefonso*
**Lab 6**: Basics of archaeological ceramic analysis, thin-sections (Cooper).

**Week 7** Ceramics, part 2
Readings:
3) Film Quiz 3: Ceramic Mass Production in China

**Feb 21**\textsuperscript{st}: Chinese porcelain and European “china” (Handwerker)
**Feb 23**\textsuperscript{rd}: Discussion led by Team 3
**Lab 7**: Ceramic analysis part II – XRD (Handwerker/MSE Grad Student). **TAKE HOME MIDTERM DISTRIBUTED**

**Week 8** Construction Materials – **Handwerker and Cooper both at conferences this week.** No lecture or lab. Read assigned material below and work on Midterm.
Readings:

**Feb 28**\textsuperscript{th}: **NO LECTURE**
**Mar 1**\textsuperscript{st}: **NO LECTURE OR LAB**

**Week 9** Metallurgy, part 1
1) Henderson Chapter 5, pg. 208-240

3) Film Quiz 4: metallography sample preparation video (course website)

**Mar 6th**: Origins and development of metallurgy (Cooper) **TAKE-HOME MIDTERM DUE IN CLASS, one copy for each instructor**

**Mar 8th**: Origins and development of metallurgy, part 2 (Cooper)

**Lab 8**: Film Quiz 5: *Black Hephaistos*, split into groups for copper smelting & phase diagrams

**Week 10 – Mar 12-17th**  
**Spring Break – No Class**

**Week 11 – Metallurgy, part 2**

Readings:

**Mar 20th**: Discussion of readings led by Team 4

**Mar 22nd**: Introduction & overview of metal microstructures (Handwerker)

**Lab 9**: Casting and mechanical working of metals (native copper or scrap?), sample preparation, and description of metal microstructures (archaeological samples) Part 1 (Handwerker & Cooper)

**Week 12 – Metallurgy, part 3**

Readings:

**Mar 27th**: Innovation (Cooper) **ANNOTATED BIBLIOGRAPHY DUE**

**Mar 29th**: Discussion led by Cooper/Handwerker

**Lab 10**: Casting and mechanical working of metals (native copper or scrap?), sample preparation, and description of metal microstructures (archaeological samples) Part 2 (Handwerker & Cooper)

**Week 13 – Glass**

Readings:
1) Henderson Chapter 3, pg. 24-51
2) Callister et al. Chapter 13
Apr 3rd: Ancient Glass (Handwerker & Cooper)
Apr 5th: Kaiser - Bruker pXRF training
Lab 11: Kaiser - Bruker pXRF training

**Week 14.** - Artifact Conservation and Forgeries
Readings:

April 10th: Archaeological Preservation and Field Conservation Methods (Cooper)
PAPER/PROPOSAL DUE
April 12th: Forgery detection case studies (Handwerker)
Lab 12: Conservation electrochemistry

**Week 15 – Technology and the environment – Cooper-Society for American Archaeology**
Readings:

Apr 17th: Pyrotechnology, Pre-Industrial Pollution, and Sustainability (Handwerker)
Apr 19th: Discussion TAKE-HOME FINAL DISTRIBUTED
Lab 13: E-Waste (Handwerker)

**Week 16 – Presentation of Project Proposals**
Apr 24th & 26th: Lectures and lab this week will be used for students to give a brief final presentation of their research proposal.

TAKE-HOME FINAL EXAM DUE MAY 1ST. Two hard copies must be submitted, one to each instructor by 5:00 pm.