GREEK AND ROMAN STUDIES 321
ANCIENT TECHNOLOGY
COURSE OUTLINE
WINTER 2011

Instructor:	Dr John Humphrey
Office:	SS 530; telephone 220-5538; email humphrey@ucalgary.ca
Office Hours:	MWF 11:00-11:50, TR 10:00-10:50, or by appointment; email consultation any time
Class Time:	MWF 12:00-12:50
Classroom:	ST 147
Texts:	J.W. Humphrey et al. *Greek and Roman Technology: A Sourcebook* (London: Routledge, 1998). Paper. J.P. Oleson, editor. *Handbook of Engineering and Technology in the Classical World* (Oxford, 2008).
Essay/Exams:	1. Five **class discussions**, worth 25% of the final grade. In the third week of class I will organize you into groups of eight, from whom you will choose a scribe. The topic for each discussion will be explained a few days in advance, and each group will draft its response to the question (generally about 2 pages in length); this you will submit to me electronically before the discussion period. I'll moderate the discussion itself. Your grade will be a combination of the written response (two-thirds) and the quality of the class discussion (one-third). 2. Four short **research reports**, worth 40% of the final grade. At intervals through the term you will submit a short paper (about 4 pages in length) in answer to one of a selection of questions about material recently discussed in class. 3. An end-of-term **essay** will account for 35% of the final grade. Topics are listed later in this document. Essays should be between 2500 and 3000 words in length, and be a balance of description and interpretation. I am happy to receive from you in advance a 1-page outline and an annotated bibliography for advice. You may submit your essay any time in the term, but no later than at the last class (Wednesday 13 April); papers arriving after that will not be read, and will receive a grade of F; essays will be marked in the order submitted. 4. There will be no final examination in this course.
Notes:	1. The withdrawal deadline for this course is Friday 15 April 2011. The last day to withdraw with a refund of fees is Friday 21 January 2011. 2. The Department of Greek and Roman Studies draws the attention of all students in its courses to the University regulations on plagiarism, cheating, and other academic misconduct, which can be found in the on-line version of the 2010-2011 University *Calendar* (http://www.ucalgary.ca/pubs/calendar/current/k-2.html).

Course Schedule

	DATE		TOPIC	SOURCEBOOK
Jan	10	Mo	Introduction to the course	
	12	We	Historical outline i: nomads and farmers of the Stone Ages	
	14	Fr	Historical outline ii: empires of the Bronze Age	
	17	Mo	Historical outline iii: the Greek and Roman Mediterranean	
	19	We	Sources of information: archaeology	introduction
	21	Fr	Sources of information: ancient texts	introduction
	24	Mo	Sources of energy, and basic machines in antiquity	chapter 2a-b
	26	We	Hero of Alexandria and mechanical gadgets	chapter 2c
	28	Fr	Military technology	chapter 12
	31	Mo	**Discussion 1:** Why was there no ancient industrial revolution?	
Feb	02	We	Agriculture i: cultivation and domestication	chapter 3
	04	Fr	Agriculture ii: farms and agricultural tools	chapter 3
	07	Mo	Agriculture iii: food-processing	chapter 4
	09	We	Agriculture iv: diet	chapter 4
	11	Fr	Hydraulics i: wells and water-lifting devices	chapter 8
	14	Mo	Hydraulics ii: water conduction and water conservation	chapter 8
	16	We	Hydraulics iii: urban water systems: Athens and Rome	chapter 8
	18	Fr	**Discussion 2**: Using ancient hydraulic techniques in developing countries	
	21-25		*Reading week: no classes*	
	28	Mo	Metals 1: mining and smelting	chapter 9a
Mar	02	We	Metals ii: metallurgy and metalworking	chapter 9a
	04	Fr	Ceramics i: ancient pottery making	chapter 9d
	07	Mo	Ceramics ii: pottery shapes and styles	chapter 9d
	09	We	Ceramics iii: an ancient symposium; glass and textiles	chapter 9c
	11	Fr	Writing i: Bronze-Age scripts: cuneiform, hieroglyphs, and Linear B	chapter 11b
	14	Mo	Writing ii: alphabets: Greek and Latin	chapter 11b
	16	We	Writing iii: books and publication	chapter 11b
	18	Fr	**Discussion 3**: The importance of communication	
	21	Mo	Time-keeping	chapter 11a
	23	We	Transportation i: ships	chapter 10b
	25	Fr	Transportation ii: harbours	chapter 10b
	28	Mo	Transportation iii: wheeled vehicles, roads, and bridges	chapter 10a
	30	We	Transportation iv: currency, weights & measures, and trade	chapter 10c
Apr	01	Fr	**Discussion 4**: Societies' attitudes toward technological development	
	04	Mo	Construction i: Bronze-Age ziggurats and pyramids	chapter 7
	06	We	Construction ii: Bronze-Age Greek cities and citadels	chapter 7
	08	Fr	Construction iii: classical Greek construction	chapter 7
	11	Mo	Construction iv: Roman imperial engineering	chapter 7
	13	We	**Discussion 5**: How structures reflect the societies that build them	
	15	Fr	*class cancelled*	

Report Topics

You must submit **four** reports during the term, to be chosen from the following list. Each assignment must be submitted by the beginning of our class on the day it is due; otherwise it will not be marked. Please write about 4 (double-spaced) pages for each report, and include specific references to ancient sources and archaeological remains to bolster your argument. Reports that include significant and appropriate material from beyond the required texts will be eligible for (but not guaranteed) an **A**.

01 What technologies in the modern world are still dependent on those sources of energy available to the ancients (humans, animals, water, and wind)? What advances in harnessing these sources have-we made in the past 1500 years? Could we benefit at all from imitating the ancients? [26 January]

02 Were fossil fuels used in antiquity? For what purposes do you think they could have been better harnessed? [26 January]

03 In the Library, find a diagram and description of Hero's steam turbine. How did it work? How functional was it? Why was it not used to power machinery in antiquity? [26 January]

04 Is there any truth to the idea that the Trojan Horse was in fact an ancient siege engine? Examine the literary texts about the Trojan War, and compare them to what we know of Greek and Near Eastern siege machinery. [31 January]

05 Find at least two ancient sources that describe Archimedes' rôle in the Roman siege of Syracuse (Sicily) at the end of the 3rd century BCE. Do you accept the existence of the anti-siege machines credited to him? [31 January]

06 What basic mechanical principles (e.g., lever, wedge, etc.) are illustrated by agricultural tools and food-processing from the Neolithic Age to the Roman Empire? How did they improve agricultural efficiency? Is it true that there have been no significant developments in agricultural techniques during the last 1300 years? [7 February]

07 Why has the water screw, credited to Archimedes in the 3rd century BCE and still used today in the Middle East, been one of humankind's most successful technological devices? [11 February]

08 Examine the ancients' use of water wheels to generate power. How did the output compare to other sources of energy in antiquity? [14 February]

09 Find and browse through a translation of Frontinus' *On Aqueducts.* Discuss its usefulness and reliability as a source of information about Roman urban water supplies. What errors does Frontinus make in his calculations of flow? [16 February]

10 Read about how Roman engineers were able to survey the angle of a slope and measure horizontal distances when constructing aqueducts. How accurate were they? How accurate are our surveyors? [16 February]

11 How did the ancients test for water purity? Did they treat water that was impure? [16 February]

12 As the materials used for manufacturing tools changed from the Palaeolithic to the Iron Age, so did the shape and function of those tools: describe how and why material determined shape and function. [2 March]

13 Investigate the procedures used for casting large bronze statues in Greek and Roman antiquity. Have we made advances in the last two millennia? [2 March]

14 From the examples you have seen, and others you can find, how do you think the shapes of ceramic vessels were designed to suit their various functions in antiquity? What modern parallels do you notice? Do you think that aesthetic appeal played a part in determining the design of an ancient pot? [4 March]

15 Describe ancient Roman cooking utensils. What evidence do they give us about diet, food safety, and dining? [7 March]

16 If you own a simple loom, or can find instructions for making one, weave a modest piece of fabric. Describe the design of your loom and how it functions, and the particular method of weaving you used; compare it with ancient techniques, and assign a date to your weaving. Submit your fabric with your written answer. [9 March]

17 Describe and evaluate ancient Greek and Roman methods of extinguishing fires. [11 March]

18 After studying the examples of cuneiform and hieroglyphs in the slide programme or in one of the works in the bibliography, choose a short and simple children's story and devise your own simple but logical pictographic script in which to translate it (and include the original English text, please!). How functional is this form of writing? How influential are your own experiences and 21st-century Canadian society in determining the symbols you use? [16 March]

19 Discuss the design and accuracy of ancient sundials. Do they give us any insight into the social and commercial life of antiquity? [23 March]

20 Daniel Boorstin (*The Discoverers*) has suggested that the seasonably variable hours of ancient societies were an impediment to industrial and commercial advancement. Is he right? [23 March]

21 Compare what you have seen of ancient harbours with the descriptions of harbours given by the ancient sources; then read some modern descriptions of some ancient examples. What were the basic principles of design and construction of harbours in antiquity? [28 March]

22 From what you have read and seen in this part of the course, how did the local environment, topography, and available materials in antiquity determine the method of transportation used, both by sea and by land? [30 March]

23 Read more about the construction of the Great Pyramid of Cheops in some reliable text, then amuse yourself with the relevant chapter of Erich von Däniken's *Chariots of the Cods?* Was it possible to quarry, transport, erect, and finish the stones in 20 years, as Herodotus said? Include your calculations. [4 April]

24 How did the local environments determine both the materials and the styles of construction in the Bronze Age? What other factors affected these aspects? [6 April]

25 Discuss what the plan of a Roman house (*domus*) reveals about the family structure of its inhabitants. [8 April]

26 What are the most significant advances that engineering has made in the last 1500 years? What are we able to do now in this field that was beyond the capability of the Roman engineers? [11 April]

27 Read what the Roman engineer Vitruvius has to say about the ideal education of architects and engineers in the 1st century BCE. (*On Architecture* Book 1, Chapter 1). Should our Faculties of Environmental Design and Engineering follow his advice? [11 April]

Essay Topics

Essays should be between 2500 and 3000 words in length, inclusive of footnotes and bibliography; illustrations are usually useful. If you would find it helpful, you may give me in advance a one-page essay outline and an annotated bibliography, but this should be done at least ten days before the essay itself is due. Essays may be submitted at any time during the term, up to 12:00 on Wednesday 13 April, and will be graded in order of receipt; essays submitted later than the deadline will not be marked.

01 Discuss the importance of the work of **either** Archimedes of Syracuse **or** Hero of Alexandria in the evolution of technology.

02 Pliny the Elder has been described as "an enthusiastic admirer of nature [and of superstition], and a vigorous critic of contemporary man. He is a sturdy Roman in his dislike of the Greeks and distrust of their influence." First, read as much of Pliny's *Natural History* as you can manage, and then evaluate the truth of the description above, and the impact that his personal beliefs and biases have on the reliability of his encyclopedic work.

03 Was Gordon Childe (*What Happened in History*) correct in calling the alphabet, coinage, and iron "popular" and "democratic" technologies?

04 The societies of classical Greece and imperial Rome tended to view technological progress with a mix of suspicion and disdain. Using especially the first and last chapters of the *Sourcebook*, describe their attitude in general, and speculate on the impact it had on the evolution of their technologies and their societies.

05 The mythological stories of the Greeks and Romans often contain references to important (if hazily remembered) technological inventions and processes from their own past. Find half a dozen important examples of these stories, and discuss their reliability and their importance as a source of information for us.

06 Humans seem by nature to be a conservative bunch, reluctant to change what is familiar. Using specific examples (from such ancient technologies as construction, ceramics, and writing), determine whether this generalization was true in the Greek and Roman worlds, identify similar examples in our contemporary culture, and speculate on whether this conservatism is a help or hindrance to human society.

07 It is perhaps inevitable, given the nature of their societies and the surviving literature, that we read little about the influence of women in ancient technological development. First, analyze why this silence exists; then, beginning with the Neolithic Age and ending with the Roman Empire, outline what we do know of women's involvement, and speculate on what areas they might have contributed to that we are now unaware of.

08 If you could travel back in time to the ancient Mediterranean world at the beginning of the first millennium CE, what single contemporary technological device would you take with you that would have the most positive and widespread impact on the society of the time? Remember that the device must be functional within the ancient limitations of machinery and fuel; it must be able to be reproduced by the ancients; and its effects must be overwhelmingly beneficial (no thermonuclear device for the Romans to use against the Parthians).

General Bibliography

Some of the following works are housed in the Reserve Reading Room of the Library, where they are available for consultation and, infrequently, for short-term loan. Copies of the rest are available in the main stacks.

General Works

C. Singer et al. A *History of Technology,* vols. 1 and 2.

T.K. Derry and T.I. Williams. *A Short History of Technology from the Earliest Times to A.D. 1900.*

A.P. Usher. *A History of Mechanical Inventions.*

M. Daumas, ed. *A History of Technology and Invention,* vol. 1.

V.G. Childe. *What Happened in History.*

K.D. White. *Greek and Roman Technology.*

R.J. Forbes. *Studies in Ancient Technology,* 9 vols.

J.G. Landels. *Engineering in the Ancient World.*

L. Sprague de Camp. *The Ancient Engineers.*

H. Hodges. *Technology in the Ancient World.*

Before the Greeks and Romans

K.P. Oakley. *Man the Toolmaker.*

S. Cole. *The Neolithic Revolution.*

Classical Antiquity

E. Vermeule. *Greece in the Bronze Age.*

A. Burford. *Craftsmen in the Greek and Roman World.*

C. Mossé. *The Ancient World at Work.*

Specific Technologies

K.D. White. *Roman Farming.*

J.F. Healy. *Mining and Metallurgy in the Greek and Roman World.*

A.T. Hodge. *Roman Aqueducts and Water Supply.*

L. Casson. *The Ancient Mariners.*

D. Diringer. *Writing.*

D. Hill. *A History of Engineering in Classical and Medieval Times.*

Bibliography

J.P. Oleson. *Bronze-Age, Greek, and Roman Technology: A Selected, Annotated Bibliography.*