Roman Technology and Art
(or How to Think Like the Romans)
Topics in Greek and Roman Art and Archaeology
CLAS/FA 145
Syllabus

Brandeis University, Spring 2007
Tuesday and Friday, 10:30 a.m. – 12:00 p.m., Block H, Abelson, room 131

Instructors:
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This course satisfies requirements for both for the Schools of Creative Arts (CA) and Humanities (HUM). It also fulfills the requirement for a course in quantitative reasoning in the School of Science.

If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see Professor Koloski-Ostrow immediately.

Rationale of Course:
This course investigates a selection of the most famous monuments and cultural institutions of the ancient Roman world in order to understand the impulse for the technologies that created them and the technologies themselves. The material covered in the course is by no means a full survey of ancient Roman art and architecture, although the monuments and topics covered are firmly placed in their historical and cultural contexts (such as Roman bridges and ships and transportation, baths and thermal technology, temples, arches, amphitheaters, theaters, aqueducts, and more.) We consider numerical estimation from simple problems to the more complex, sea and land transportation, arch and bridge construction, Roman weights, measures and their calendar, architectural engineering and construction of the Colosseum (amphitheaters), Roman baths, and the Pantheon (a unique temple), aqueducts and hydraulic issues, and military machinery and defenses. To a lesser extent,

we shall consider small-scale technologies used in metallurgy, sculpture, and painting. Students will be required to assess Roman technologies through the application of modern physics. While the chronological dimensions of the course encompass broad parameters from the 8th c. BCE to the end of the Roman Empire in 4th century CE in order to cover a variety of technological achievements over a long period of time, we shall pay particular attention in the course to the world of Roman Italy in the imperial period (1st c. BCE to about the 3rd century CE).

Some of the more philosophical questions we shall attempt to answer follow. What needs and desires of the Romans could be fulfilled through their understanding and manipulation of nature? By what standards should we judge the value of natural knowledge systems that appear to bear so little resemblance to modern science? Has technological sophistication historically depended on scientific sophistication, and vice versa? What are the causes of technological change?

Required Texts:

1. Rabun Taylor, *Roman Builders: A Study in Architectural Process* (Cambridge Univ. Press, 2003) (hard cover ISBN: 0521803349; paperbk. ISBN: 0521005833) abbrev.: Taylor

2. Paul MacKendrick, *The Mute Stones Speak* (W.W. Norton & Co. 1983 or latest) (paperbk. ISBN: 0-393-30119-2) (price: $14.95) abbrev.: MacKendrick (**posted on WebCTVista and in Library Reserve**)

3. Frank Sear, *Roman Architecture* (Cornell Univ. Press, 1992) (paperbk. ISBN: 0-8014-9245-9) out of print, but on reserve, abbrev.: Sear (**posted on WebCTVista and in Library Reserve**)

4. Additional readings focused on particular aspects of Roman technology will be posted in WebCTVista throughout the course of the semester.

Recommended Texts:

5. Fred S. Kleiner, *A History of Roman Art* (Thomson Wadsworth, 2007) (paperbk. ISBN: 0-534-63846-5) abbrev.: Kleiner

6. JoAnn Shelton, *As the Romans Did* (Oxford Univ. Press 1988 or latest) (paperbk. ISBN: 0-19-508974-X) (price: $43.95) abbrev.: Shelton

7. Nancy and Andrew Ramage, *Roman Art, Romulus to Constantine* (Prentice Hall 2000) (ISBN: 0-13-440702-4) (price: ca. $72.00) abbrev.: Ramage and Ramage

Most of the required and recommended texts are also on RESERVE (indicated with **R** below) in the library along with other suggested reading material for the course to be updated from time to time.

Course Requirements:

1. You should be present (in mind and body) and participate as actively as you can during lectures, discussions, and any out-of-class activities or fieldtrips. Questions are always welcome and encouraged. Names of students will be read from the student rosters for class attendance, especially at the beginning of the term so that your professors can get to know you. For the rest of the semester, classes will have sign-in sheets for attendance. Please note that it quickly becomes apparent who is present and who is not, especially from the class sign-in sheets that will be distributed.

2. You must complete all assigned readings (from required texts and from books on reserve or articles posted on WebCTVista). Your appreciation and understanding of lectures, discussions, and in-class experiments will be greatly enhanced if you complete reading assignments by their due date. This syllabus contains assignments from your required texts and from various books on reserve for the semester. Since our lectures are original creations, you are advised *not* to miss them. Many points made in them cannot be found in the required or reserve reading.

3. The course will not have a midterm exam. Instead, most weeks three or four students in the class will come to the front of the class and perform an experiment under the guidance of Professor Meyer on the Roman topic of the week. The rest of the class will also be given the data and expected to analyze findings as homework. These assignments are required of everyone in the class, must be submitted each week, and in total will serve as a large part of your term grade (50%). You will lose one grade step for every day that your homework is late (A+ to A to A- to B+--unless you have a medical or other truly valid excuse, presented IN ADVANCE, if at all possible).

4. The course will not have a final exam. You will instead complete a term project (which includes a written description and quantitative analysis of about 5-6 pages total) related to a Roman technology of your choice. In partial preparation for this final project, a prospectus (directions forthcoming) will be due on Friday, March 30. You will, of course, also receive a full explanation of the final project as well. To complete the final project successfully your work will require a sustained effort over many weeks, close attention to class problems and discussions, and much initiative on your part. The final project is due on the last day of class, Tuesday, May 1, 2007. You will have ample opportunities to consult with your professors and the T.A. before the final project is due. You will lose one grade step for every day that your final project is late (A+ to A to A- to B+--unless you have a medical or other truly valid excuse, presented IN ADVANCE, if at all possible).

Course Requirements with Approximate Grade Determination:

1) Class attendance (taken regularly), participation in experiments and discussions, completion of reading assignments (20%)
2) Quantitative Reasoning assignments (ca. 5-10 for the term) (50%)
3) Prospectus for the Final Project (10%)
4) Final Project—Designing and Solving a Problem involving Quantitative Reasoning in Roman Technology (due Tuesday, May 1) (20%)

Total: (100%)

An optional short research paper (2-3 pages) can replace one of the homework assignments (problems in quantitative reasoning) in the event that you had to miss the discussion and class experiment related to the homework (but ONLY if you have special permission from your professors for a valid reason). You may also write a short research paper to replace one homework assignment if you received a poor grade on an assignment (B- or lower, again, ONLY with permission from your professors).

Academic Honesty (last, but hardly least!):

You are expected to be honest in all of your academic work. Brandeis University policy on academic honesty is contained in your *Student Handbook* in section 5 under "Rights and Responsibilities." Instances of cheating, plagiarism, or other alleged dishonesty will be reported to the Office of Campus Life for possible referral to the Student Judicial System. The adjudication process is also outlined in your *Handbook*. Potential consequences of academic dishonesty include (in addition to an "E" on the assignment) failure in the course, disciplinary probation, and suspension from the University. A record of any offense will remain in a student's disciplinary file in the Office of Student Affairs throughout his or her career at Brandeis. Please know that we take this code very seriously. If you have any questions about our expectations, please ask us.

Lecture topics for the entire semester are listed by date below, along with due dates for assignments, special events, and special lectures. Reading assignments are listed for the first five weeks of the course. Further reading assignments will be forthcoming.

Please contact your professors or the T.A. if you have questions about the readings.

Course Syllabus by topic for Semester (subject to some modification):

Tues., Jan. 16 Introduction to the Roman World, their Technologies, and their Art and Architecture
Some Lessons in Simple Numerical Estimation
Required: Buy books. Familiarize yourselves with WebCTVista materials.

Fri., Jan. 19 The City of Rome, Issues of Urban Infrastructure and City-Planning across a 1000 years
Presentation of a Problem in reasonable estimation.
Required Reading: Taylor Intro., 1-20; MacKendrick chs. 1-4, 1-140 (WebCTVista).
Recommended Reading: Kleiner ch. 1, 1-16; Sear ch. 1, 10-28 (WebCTVista); Shelton ch. 1, 6-17 and ch. 2, 18-36; Ramage and Ramage Intro,, chs. 1-2, 8-85 (R);

_____end of week 1

Tues., Jan. 23 Pompeii and Herculaneum: Small-Scale Technologies
Required Reading: K.D. White, *Greek and Roman Technology*, ch. 6 "Food Technology," 63-72 (WebCTVista); Sear ch. 2, 29-48 (WebCTVista); Robert J. Forbes, *Studies in Ancient Technology*, 1958, ch. 7, "Fire and Food," 57-61.
Recommended Reading: Kleiner ch. 2, 16-29 and ch. 3, 30-45; Shelton ch. 4, 59-80 and ch. 5, 81-103.

Fri., Jan. 26 Pompeii and Herculaneum cont.
Presentation of a Problem involving weighing in air and water.
Required Reading: MacKendrick ch. 8, 244-281 (WebCTVista); Sear ch. 6, 103-133 (WebCTVista).
Recommended Reading: Shelton ch. 7, 127-167 and ch. 8, 168-189; Kleiner ch. 10, 138-151.

_____end of week 2

Tues., Jan. 30 Romans on the Move: Economics, Trade, and Transportation
Required Reading: MacKendrick chs. 5-7, 141-243 (WebCTVista); Horace *Satire* I.5 on trip to Brindisi (WebCTVista); K.D. White, *Greek and Roman Technology*, ch. 10 "Land Transport," 127-140 (WebCTVista).
Recommended Reading: Kleiner ch. 4, 46-59, ch. 5, 60-77, ch. 7, 88-101; Ramage and Ramage chs. 3-4, 86-133 (R); Shelton ch. 14, 325-331.

Fri., Feb. 2 Roman Ships
Presentation of a Problem on the cargo capacity of Roman ships.
Required Reading: review MacKendrick ch. 7, 222-228 (WebCTVista); K.D. White, *Greek and Roman Technology*, ch. 11 "Ships and Water Transport," 141-156 (WebCTVista).
Recommended Reading: review Shelton ch. 14, 325-331; review Kleiner ch. 5, 60-77.

_____end of week 3

Tues., Feb. 6 Connecting the Landscape—Roman Bridges, Roads, Sewers, and Viaducts

Required Reading: K.D. White, *Greek and Roman Technology*, ch. 8 "Civil Engineering and Surveying," 91-100 (WebCTVista).
Recommended Reading: review Kleiner ch. 7, 88-101.

Fri., Feb. 9 Presentation of a Problem on force and the principles of the arch.
Required Reading: K.D. White, *Greek and Roman Technology*, ch. 7 "Roman Building Technology," 83-90 (WebCTVista).
Recommended Reading: review Kleiner ch. 7, 88-101, especially 92-96.

_____end of week 4

Tues., Feb. 13 Romans Understanding their Universe
Roman Festivals, Religion, Death, and their Calendar
Introduction to Weights and Measures
Required Reading: TBA
Recommended Reading: Kleiner ch. 6, 79-87 and ch. 15, 216-229; Shelton ch. 6, 104-126.

Fri., Feb. 16 Presentation of a Problem concerning estimation of quantities of bread and/or wine.
Required Reading: review K.D. White, *Greek and Roman Technology*, ch. 6 "Food Technology," 63-72 (WebCTVista).
Recommended Reading: review Kleiner ch. 6, 79-87; review Shelton ch. 7, 152-167.

_____end of week 5

Midterm Recess: No University exercises Saturday, February 17 to Sunday, February 25

Tues., Feb. 20 No class, Midterm Break
Fri., Feb. 23 No class, Midterm Break

_____end of week 6

Tues., Feb. 27 Roman Architecture and Engineering
The Amphitheater and Blood Sports
Required Reading: Taylor ch. 1, 21-58 and ch. 3, 92-132; MacKendrick ch. 9, 282-313 (WebCTVista); review Sear ch. 2, 29-48 (WebCTVista); Sear chs. 3-5, 49-102 (WebCTVista).
Recommended Reading: K.D. White, *Greek and Roman Technology*, ch. 7 "Roman Building Technology," 83-90 (WebCTVista); Kleiner ch. 8, 102-119 and ch. 9, 120-137.

Fri., Mar. 2 Presentation of a Problem on ropes and pulleys.
Scene from *Gladiator*.
Required Reading: Taylor ch. 4, 133-173; Sear ch. 7, 134-153 (WebCTVista).
Recommended Reading: review Kleiner ch. 8, 102-119 and ch. 9, 120-137.

_____end of week 7

Tues., Mar. 6 Roman Architecture and Engineering cont.
Large Building Projects
Required Reading: MacKendrick ch. 10 314-341 (WebCTVista); Taylor, ch. 2 59-91 (WebCTVista).
Recommended Reading: review Kleiner ch. 9, 120-137; Ramage and Ramage ch. 6, 162-179 (R).

Fri., Mar. 9 Presentation of a Problem concerning cranes.
Nova Program on Amphitheater (if available).
Required Reading: see Ramage and Ramage ch. 5, Fig. 5.16 (R).

_____end of week 8

Tues., Mar. 13 Roman Architecture and Engineering cont.
Roman Baths and Bathing Culture
Required Reading: Taylor ch. 3, 92-132; Robert J. Forbes, *Studies in Ancient Technology*, 1958, ch. 5, "Roman Hypocausts," 36-43, and ch. 6, "Speculations and Experiments," 43-57; Janet DeLaine, *The Baths of Caracalla*, 1997, 103-194 (WebCTVista).
Recommended Reading: Kleiner ch. 11, 152-169; review MacKendrick ch. 10, 314-341 (WebCTVista).

Fri., Mar. 16 Presentation of a Problem concerning heat and numerical estimates.
Nova Program on Building a Roman Bath (if available)
Required Reading: Janet DeLaine, *The Baths of Caracalla*, 1997, 195-226 (WebCTVista).

_____end of week 9

Tues., Mar. 20 Hadrian's Architecture: His Villa at Tivoli, the Pantheon, the Roman Dome
Required Reading: Taylor ch. 5, 174-211 (WebCTVista); MacKendrick ch. 11, 342-373 (WebCTVista); Sear ch. 8, 154-184 (WebCTVista).
Recommended Reading: Ramage and Ramage ch. 7, 180-207 (R).

Fri., Mar. 23 Presentation of a Problem on the dome.
Required Reading: review Taylor ch. 5, 174-211 and read ch. 6, 212-255.
Recommended Reading: Kleiner ch. 12, 170-185; review MacKendrick ch. 11, 357-373 (WebCTVista).

_____end of week 10

Tues., Mar. 27 Hydraulics and Watering the Roman City
Introduction to Roman Aqueducts
Required Reading: K.D. White, *Greek and Roman Technology*, ch. 12 "Hydraulic Engineering," 157-173 (WebCTVista); Deane Blackman and A. Trevor Hodge, *Frontinus' Legacy*, 2001, Intro, ch. II, and ch. III, 1-24 (WebCTVista).

Recommended Reading:, W.F. Jashemski, "The Use of Water in Pompeian Gardens," 51-57 and Paul Kessener, "Incrustations at the *Castellum Divisorium*, at Nimes," 169-177 in N. De Haan and Gemma Jansen, *Cura Aquarum in Campania*, *BABESCH*, 1996 (WebCTVista); review Kleiner ch. 7, 88-101, especially 91-96.

Fri., Mar. 30 Presentation of a Problem on water flow.
Required Reading: Jan B.M. Wiggers, "The Urban Water Supply of Pompeii," 29-32 in N. De Haan and Gemma Jansen, *Cura Aquarum in Campania*, *BABESCH*, 1996 (WebCTVista).

_____end of week 11

Passover Spring Recess: No University exercises Saturday, March 31 to Tuesday, April 10

Tues., Apr. 3 No class, Passover Spring Break
Fri., Apr. 6 No class, Passover Spring Break

_____end of week 12

Tues., Apr. 10 No class, Passover Spring break

Fri., Apr. 13 Roman Sculpture and Wall Painting: Learning and Refining Technologies from the Greeks
Required Reading: TBA
Recommended Reading: review Kleiner ch. 10, 138-151 and ch. 13, 186-201; Ramage and Ramage ch. 5, 134-161 (R).

_____end of week 13

Tues., Apr. 17 Roman Military Strategies, Defenses and Machinery
Guest speaker: TBA (Prof. AOK-O in Greece)
Required Reading: TBA
Recommended Reading: Kleiner ch. 16, 230-245 and ch. 17 246-261; Ramage and Ramage chs. 8-10, 208-267 (R).

Fri., Apr. 20 Presentation of a Problem concerning catapults.

_____end of week 14

Tues., Apr. 24 Back to the Big Picture: Slavery, Plagues, Wars, and Other Challenges
Required Reading: MacKendrick chs. 12-13, 374-445 (WebCTVista).
Recommended Reading: Kleiner ch. 18, 262-277, ch. 19, 278-289, and ch. 20, 290-306; Ramage and Ramage chs. 11-12, 268-304 (R); Sear chs. 9-11, 185-254 (WebCTVista); review Shelton ch. 8, 168-189 and read ch. 9, 190-205.

Fri., Apr. 27 Presentation of a Problem that addresses what was accomplished in a quantitative sense in the Roman world and how much was done by sheer manpower.
Required Reading: review Janet DeLaine, *The Baths of Caracalla*, 1997, 195-226 (WebCTVista).

Recommended Reading: Sear ch. 12, 255-276 (WebCTVista).

_____end of week 15

Tues., May 1 Course Wrap-up—Concluding Thoughts from a Humanist and a Scientist

Final Research Project due

_____end of week 16