SYLLABUS: LEONARDO AND THE ART OF ENGINEERING

STS-UY 3904 Special Topic in Science and Technology Studies
(Also a Humanities and Social Sciences Elective), 4 Credits
Department of Technology, Culture & Society

SPRING 2017

Dr. Matthew Landrus and Dr. Maurizio Porfiri

Mondays & Wednesdays 12:30 – 2:20 pm, JAB 673

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Dr. Maurizio Porfiri, mporfiri@nyu.edu; Office: RH507; tel. 646-997-3681; Office Hours: Monday, 5:30-6:30 pm and by appointment

Prerequisites: Completion of first year writing requirements EXPOS-UA 1 Writing the Essay and EXPOS-UA 2 The Advanced College Essay

Description
This course frames Leonardo da Vinci’s work as an engineer and natural scientist within the context of activities among his notable engineering contemporaries. With particular attention to civil and military engineering, the course addresses pre-modern and early modern practical and theoretical solutions to problems in mechanics, engineering, early physics, and the natural sciences. In this manner, and with reference to Leonardo’s work, the course examines traditional and intellectual careers of “practical men” of the technical arts, expanding on their training in mathematics, geometry, the other arts, natural sciences and court culture, to assess their inventive and celebrated engineering strategies. The structure of the course will comprise of readings, lectures, hands-on demonstrations and discussions of Leonardo da Vinci’s work, while also assessing the approaches of his predecessors, contemporaries, and followers. Modern elements of mechanics and engineering will be presented to help evaluate Leonardo’s contribution and assess its value.

Course Objectives
The purpose of the course is to expand and develop your observational, analytical, research, and vocabulary skills when examining the investigative and inventive engineering and natural science projects of Leonardo, his predecessors, contemporaries, and followers. Beyond the study of technical and scientific contributions, the course will also introduce theories, purposes, and methods of the history and philosophy of early modern concepts of science. The main objectives of the class are:

- To understand and evaluate important materials and methods used by Leonardo and associated engineers and natural scientists to engage in a more scientific manner with their work and environments.
- To address assessments of meaning in works of early modern engineers and natural scientists that crossed disciplines, so that their methods compared with those of visual artists for painting or sculpture.
- To obtain a visual and intellectual knowledge of major works of early modern engineering and natural science – focusing on Leonardo’s work - that resulted from direct engagements with science-related methods and knowledge.
- To address the historical, social, political, and intellectual contexts of these works as a means of understanding the concepts shaping the approaches of engineers and natural scientists.
• To understand the reception of Leonardo’s work until the present time and develop an individual critical assessment on the basis of our current training in science and engineering.
• To reconstruct and reverse-engineer some of Leonardo’s inventions through rapid prototyping and computer aided design.

Required Readings
Selections of these texts will be provided in PDFs via the NYU Library or ‘NYU Classes’ (all reading assignments are available for free at NYU)


Exams
Your comprehension of this material will be assessed with exam essays, theoretical and hands-on technical engineering problems, and in-class presentations, which will also develop your research skills and promote the development of analytic and critical thinking. There will be two mid-term exams and one final project. The mid-term exams will be administered in class and will test the student’s comprehension and ability to apply material learned in class and through assignments. Mid-term exams are in-class, closed books, closed notes. Every page of every exam submission should have the student full name and section number. Illegible work and loose sheets will not be graded. Students must complete the exam on their own. The final project will consist of a written essay and an in-class presentation, featuring original prototypes built on the basis of Leonardo’s work. The presentation will last ten minutes, delivered extemporaneously. The essay should be based on rigorous bibliographic research and the prototyping component should demonstrate the overarching idea of the project. Before the day of your presentation you are required to email your presentation to mhl8@nyu.edu and mporfiri@nyu.edu, along with requisite computer files for generating the prototypes (possibly as a link). The presentation should be in a Keynote or Powerpoint format, and the attachment should be emailed with its suffix, ending in .key, or .pptx. The essay must consist of approximately 5000 words.

Class Attendance and Absences
You are expected to actively participate in class lectures (attendance is essential because lectures will cover topics and issues not addressed in the readings). An unexcused absence will result in the loss of half of your class participation grade. An absence may only be excused with an acceptable submission of a doctor’s note as evidence of the unavoidable circumstance, such as a hospital emergency room visit at the time of the class. You must earn the class participation grade, which is for genuine class discussions. An occasional brief comment or question is not sufficient engagement. This course component is assessed not simply on the volume of your participation but especially on the quality and thoughtfulness of your contribution in class. Questions and ideas are welcome. You should always be on time; late arrivals disrupt the class. There are no opportunities for extra credit. Arriving noticeably late to class, or leaving class early will cause the class participation grade to be reduced by a half. You should not use computers or cell phones in class, unless asked to do so.
Moses Center
If you are a student with a disability who is requesting accommodations, please contact New York University’s Moses Center for Students with Disabilities at 212-998-980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.

Honor System
The honor system is strictly enforced for this course. It is assumed that all work submitted by a student is done so under the honor system code.

Grading Policy
Participation: 10%
Mid-term 1: 25%
Mid-term 2: 25%
Final project: 40%

List of Topics

1) 23 Jan  Introductory and Overview
   (Monday, ML)

2) 25 Jan  Introduction to Leonardo and pyramidal law
   (Wednesday, ML), Read: Nanni, pp. 9-11 (Foreword); Kemp, pp. 1-21

3) 30 Jan  The disputation about the arts in the mirror of Angelo Poliziano’s Panepistemon
   (Monday, ML), Read: Cianchi, pp. 8-18, ff; Nanni, pp. 15-29

4) 1 Feb   Rapid prototyping
   (Wednesday, MP)

5) 6 Feb   Leonardo’s art and engineering in the 1470s and early 1480s
   (Monday, ML), Last day to drop/add, Read: Kemp, pp. 22-70

6) 8 Feb   Machinae ad majestate imperii and textile manufacturing machines
   (Wednesday, ML), Read: Nanni, pp. 31-53

7) 13 Feb  Statics
   (Monday, MP), Read: Hart, pp. 99-142

8) 15 Feb  Statics
   (Wednesday, MP), Read: Hart, pp. 99-142

9) 20 Feb  President’s day

10) 22 Feb  Statics and Scientific instruments
   (Wednesday, MP), Read: Hart, pp. 13-34, 99-142

11) 27 Feb  Leonardo’s engineering proposals at the Sforza Court
   (Wednesday ML), Read: Landrus, pp. 59-118; Kemp, pp. 71-106
11] 1 Mar Mid-term 1  
(Monday, ML)

12] 6 Mar Leonardo as court engineer at the Sforza Court  
(Monday, ML), Read: Kemp, pp. 106-161

13] 8 Mar Mechanics and machine models between the fifteenth and seventeenth centuries  
(Monday, ML), Read: Rosheim, pp. 21-68, 115-160; Nanni, pp. 87-133

14] 13, 15 Mar Spring recess

14] 20 Mar Kinematics of machines  
(Wednesday, MP), Read: Moon, pp. 66-76, 99-146

14] 22 Mar Kinematics of machines  
(Wednesday, MP), Read: Moon, pp. 303-345

15] 27 Mar Changes in the structure of the “practice of geometry” between Piero della Francesca and Leonardo  
(Monday, ML), Read: Nanni, pp. 55-85

13] 29 Mar Leonardo as court engineer in the 1490s  
(Wednesday, ML), Read: Kemp, pp. 161-203

14] 3 Apr Dynamics  
(Monday, MP), Read: Hart, pp. 75-95

15] 5 Apr Dynamics  
(Monday, MP), Read: Hart, pp. 75-95

16] 10 Apr Dynamics and Leonardo’s robots  
(Wednesday, MP), Rosheim, pp. 69-114; Read: Hart, pp. 75-95

17] 12 Apr The pluralism of conventions: drawing machines between the Middle Ages and the Renaissance  
(Wednesday, ML), Read: Moon, pp. 99-145; Nanni, pp. 135-161

18] 17 Apr Leonardo’s independent career as an engineer  
(Monday, ML), Read: Kemp, pp. 205-270

19] 19 Apr Leonardo’s later career, c. 1508-19  
(Wednesday ML), Read: Kemp, pp. 272-348

20] 24 Apr Mid-term 2  
(Monday, MP)

21] 26 Apr Flying machines  
(Wednesday, MP), Read: Hart, pp. 307-339

22] 1 May Leonardo’s Legacy  
(Monday, MP), Read: Moon, pp. 3-98, 146-302
23] 3 May Open discussion and take-home messages
(Wednesday, ML)

24] 8 May Final presentation

ABET a-k Criteria Compliance

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(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(1a) an ability to apply principles of engineering, basic science, and math to model, analyze, design and realize physical systems, components or processes
(1b) an ability to work professionally in both thermal and mechanical systems areas

Grading Scale

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<th>A: 90+</th>
<th>B+: 83+</th>
<th>C+: 73+</th>
<th>D+: 63+</th>
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<td>B-: 77+</td>
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Additional Resources (not required, though useful)

Monographs


**Anatomy and the Human Body**

**Arithmetic, Geometry, Physical Sciences, Engineering, and Technology**

**Physical Sciences**

**Engineering**

**Technology**

**Exhibition Catalogues**

**Additional Resources, specific to Art and Science**