

University of Pittsburgh Course Syllabus: Engineering of the Renaissance

Semester and Year: Summer 2019

Course Number and Title: Pitt in Florence: Engineering of the Renaissance

Faculty Names: Giovanni P. Galdi and Anne M. Robertson

Qualifications of the Instructors:

Dr. Giovanni P. Galdi is Leighton E. and Mary N. Orr Professor of Engineering as well as Professor of Mathematics at the University of Pittsburgh. Prior to joining the University of Pittsburgh, he was professor at the University of Naples, Italy (1980-1985) and the University of Ferrara, Italy (1985-1998). In 1989 he founded the School of Engineering of the University of Ferrara where he taught a similar course. Incidentally, Nicolaus Copernicus, one of the most prominent scientists of the Renaissance, earned his degree at the University of Ferrara in 1503. Dr. Galdi is a world' renowned expert for his work on aspects of the mechanics of fluids and solid. He has authored or coauthored over 100 original research papers and five books, and edited or coedited 13 books dedicated to mathematical fluid mechanics. In 2003 he was awarded the Mercator Professorship by the Deutsche Forschungsgemeinschaft (German Research Foundation). He is cofounder with J.G. Heywood and R. Rannacher of Journal of Mathematical Fluid Mechanics.

Dr. Anne M. Robertson is William Kepler Whiteford Professor of Engineering, Professor of Mechanical Engineering and Materials Science and Professor of Bioengineering, all at the University of Pittsburgh. Dr. Robertson earned her PhD in Mechanical Engineering from the University of California at Berkeley, after which she was a President's Postdoctoral Fellow in the Department of Chemical Engineering, also at U.C. Berkeley. She joined the University of Pittsburgh in 1995, where she was the first female tenure track faculty member in Mechanical Engineering. She has held visiting research professorships at universities including the Politecnico di Milano (Italy), the University of Pisa (Italy) and RWTH University of Aachen (Germany). Her research is focused on understanding the relationship between biological structure and mechanical function of soft tissues with a particular focus on vascular tissues. She directs a multi-institution program on cerebral aneurysms that is supported by the NIH and is founding Director of the Center for Faculty Excellence in the Swanson School of Engineering (SSoE) at Pitt. This center takes the lead in developing and implementing programs to enhance the effectiveness of junior faculty in building outstanding academic careers. Dr. Robertson is a strong supporter of diversity-related initiatives and in 2007, she received the Robert O. Agbede Faculty Award for Diversity in the SSoE. In 2007, she was awarded the Beitle-Veltri Memorial Outstanding Teaching Award.

Prerequisite: This course is open to any students with a basic knowledge of algebra, geometry, trigonometry, introductory physics, and calculus.

Required Texts:

- Brunelleschi's Dome, How a Renaissance Genius Reinvented Architecture, Ross King

- Leonardo DaVinci, Carlo Pedretti, ISBN-10: 1844060365, 2005

Methods of Evaluation:

Team based projects and presentations, homework, class participation.

- Homework: 15%
- Class Participation: 20%
- Midterm Project: 25%
- Final Project: 40%

Course Description

The objective of this course is to introduce the students to engineering and technological achievements of the Renaissance period and place these achievements within the sociological and artistic context of that period. We will focus on revolutionary advances in understanding of physics and engineering during the Renaissance, with particular emphasis on architecture, mechanical inventions and biomedical engineering.

Curriculum

The components of Pitt in Florence: Engineering of the Renaissance will include classroom lectures as well as related museum/excursion based learning.

Course Syllabus

1. Introduction to the Renaissance
 - Florence at the time of the Renaissance
 - The Medici Family
2. Overview of Leonardo's Life and his Influence on the Renaissance
 - Leonardo's beginnings and early life in Florence
 - Leonardo in Milan
 - Leonardo's later life- the migratory period
3. Filippo Brunelleschi's Dome in Florence - above the church of Santa Maria del Fiore
 - Historical Overview
 - Winning the Commission: Brunelleschi versus Ghiberti
 - The Central Engineering Challenges
 - Hoisting machines- from here to there
 - Efficient worksite organization- Brunelleschi the Industrial Engineer?
 - Brunelleschi's legacy in Florence
 - Class outing- Tour and evaluation of the Cupola
4. Brief Overview of Key Periods and Figures in the History of Science and Engineering:
 - The Dawn of Western Science (Babylonians, Egyptians)
 - Ancient Greece Scientists
 - Fall of the Roman Empire, through the "Dark Ages"
 - Renaissance Period

- Scientific Revolution
- Modern Era of Science

5. Thermodynamics and Fluid Mechanics in the Renaissance

- Accademia del Cimento- Avoidance of speculation and Introduction of standards of measurement
- Hydrostatic Paradox
- Measurements of Pressure
- The Thermoscope and Invention of the Thermometer
- Case Study- The True Explanation for the Galilean Thermometer
- The Hyrometer and how to measure humidity with your hair
- Trip to the Museo Galileo

6. Leonardo Da Vinci's Contribution to Science Engineering

- Hydraulics
- Mechanics and the Laws of Friction
- The "Theory" of Flight
- The "Helicopter" and the Principle of Action and Reaction
- Design and Construction
- The Deflection of Beams and Columns

7. Brief History of Optics and Vision

- Timeline of Milestones in our Understanding of Optics
- Basic Principles of Optics
- The Microscope- a whole new world
- Steps to the invention of the telescope
- Optics in Renaissance Art

8. Brief History of Western Medicine

- Key Figures in the History of Medicine from Hippocrates to William Harvey
- Case Study- Understanding human circulation
- Case Study- Understanding the function of the heart
- Case Study- The Circle of Willis or the Emperor's New Clothes in the Brain

Possible Field Components of the Course (tentative) include

- Overview Tour of Florence
- Tour up into the Duomo - Cathedral of Santa Maria del Fiore
- Visit to the Duomo Museum (Museo dell'Opera del Duomo)
- Visit to the Museo Galileo- Institute Museum of the History of Science
- Visit to the Uffizi Gallery
- Visit to Palazzo Vecchio
- Attendance of an Opera at St. Mark's Anglican Church (evening)