

# University of Pittsburgh Course Syllabus: Engineering Perspectives of the Renaissance and Sustainability

**Semester and Year:** Summer 2023

**Course Number and Title:** ENGR 0034: Engineering Perspectives of the Renaissance and Sustainability

**Faculty Names:** Giovanni P. Galdi and Melissa M. Bilec

## Qualifications of the Instructors:

**Giovanni P. Galdi**, is Distinguished Professor of Mechanical Engineering and Materials Science, the Leighton E. and Mary N. Orr Professor of Engineering, and Professor of Mathematics at the University of Pittsburgh. He is also Honorary Professor in the TATA Institute of Fundamental Research, India, the Technical University of Darmstadt, Germany. He joined the faculty at the University of Pittsburgh in the fall semester 1999. Prior to that, in the years 1980-1985 he was Professor at the Department of Mathematics of the University of Naples (Italy) and, from 1985 until 1998, Professor at the Institute of Engineering of the University of Ferrara (Italy), where he founded the School of Engineering in 1989.

Dr. Galdi's research interest is mostly devoted to fluid dynamics and, in particular, Fluid-Solid Interaction problems. His contributions are characterized by a strict mathematical approach, aimed at furnishing a rigorous explanation of physical phenomena.

Dr. Galdi is a member of the Editorial Board of several scientific Journals, including *European Journal of Mechanics B/Fluids*, and *Nonlinear Analysis*. He is also co-founder and Editor in Chief of the *Journal of Mathematical Fluid Mechanics*, of the Series *Advances in Mathematical Fluid Mechanics*, and the more recent *Lecture Notes in Mathematical Fluid Mechanics*, published by Birkhäuser-Verlag, Basel-Boston. Dr. Galdi has (co) authored over 170 peer-reviewed journal articles, and 9 books, and (co) edited 18 books, mostly dedicated to fluid mechanics.

Dr. Galdi is also the three-time recipient of the Mercator Award from Deutsche Forschungsgemeinschaft (German Research Foundation) in the years 2003, 2009 and 2014 for his "outstanding contributions to Mathematical Fluid Mechanics".

**Dr. Melissa Bilec** is the William Kepler Whiteford Professor in Civil and Environmental Engineering and Co-director of the Mascaro Center for Sustainable Innovation. She is currently serving as the Special Assistant to the Provost for Sustainability. Dr. Bilec has published 139 peer reviewed articles and secured \$12 million in funding, including 15 National Science Foundation grants. Her research focuses on the sustainable built environment. She is committed to exploring how the built environment can be an integral part of climate change solutions. Using this view, she integrates critical built environment modeling approaches from building energy modeling to indoor air quality to develop robust strategies to mitigate climate change and deleterious environmental and human health impacts. Most recently, she is working to solve the global waste challenge through the advancement and development of circular economy principles, since the built environment is a major consumer of resources and producer of waste.

Dr. Bilec is committed to diversity, inclusion, and equity. She is working to advance the issues around and the solutions to environmental justice in the City of Pittsburgh. Dr. Bilec is co-leading her department's Inclusion, Diversity, Equity, and Access committee. She is also the co-faculty advisor for Pitt Society for Women Engineering. She was awarded the School of Engineering Diversity Award 2017-2018 and received Senior Vice Chancellor for Engagement's Partnerships of Distinction award in 2019. She has received four education excellence awards, and she developed the M.S. in Sustainable Engineering degree and co-developed a university-wide undergraduate certificate in sustainability. Dr. Bilec's work prior to academia focused on green infrastructure projects, including the conversion of a 100-year hot metal bridge into a pedestrian bridge. She has two amazing kids, a supportive partner, and two puppies that keep her active.

**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.

Class Participation, homework, quizzes: 15%

Midterm project 1: 20%

Midterm project 2: 20%

Final Project: 40%

**Office Hours**

**TBD**

**Course Description**

The objective of this course is many-fold. On the one hand, to review the main historical, technological and scientific events preceding the advent of the Renaissance. On the other hand, to introduce the students to the relevant engineering and technological achievements of the Renaissance period and place these achievements within the sociological and artistic context of that period. In particular, the course will focus on revolutionary advances in understanding of physics and engineering during the Renaissance, with particular emphasis on the contributions of Leonardo da Vinci and Galileo Galilei. We will introduce and demonstrate how concepts of sustainability were prevalent in the Renaissance and show parallels to modern day design. We will introduce and demonstrate how concepts of sustainability were prevalent in the Renaissance and show parallels to modern day design.

**Curriculum**

The components of the course will include classroom lectures as well as related museum/excursion/on-site visits-based learning.

## Course Syllabus

### 1. Brief Overview to the Renaissance

- Why Renaissance?
- Renaissance Man = Leonardo da Vinci
- Women at the time of Renaissance
- Contributions to Science and Engineering

### 2. A Short History of the Development of Western Science

- Babylonians, Assyrians and Egyptians
- Ancient Greeks
- Romans
- Muslim Empire
- Renaissance
- Reformation
- Enlightenment
- Romantic Era
- Modern Era

### 3. Ancient Greek Scientists and Philosophers

- Thales and Pythagoras,
- Euclid and Archimedes
- Aristotle
- Multi Millennial Aristotelian Influence on Science
- Aristotle Legacy: Ptolemy

### 4. First Signs of a New Breeze

- Nicolaus Copernicus
- Tycho Brahe
- Johannes Kepler

### 5. The Fathers of Modern Physics and the Dismissal of Aristotle's Theories

- Galileo Galilei
- Isaac Newton
- James Clark Maxwell
- Albert Einstein

### 6. Historical Events Leading to the Renaissance

- Roman Empire and its Fall
- Barbarian Invasion
- The Muslim Empire
- The Middle Age
- The Black Death
- The Birth of the Renaissance

### 7. Engineering at the Time of the Renaissance: Predecessors and Contemporaries of Leonardo da Vinci

- Konrad Kyeser,
- Mariano di Jacopo (Taccola),
- Roberto Valturio
- Francesco di Giorgio Martini

## 8. Leonardo Da Vinci's Contribution to Engineering

- Hydraulics
- Mechanics
- Design and Construction
- The Deflection of Beams and Columns

## 9. Leonardo Da Vinci's Contributions to Science

- The Laws of Friction
- The "Theory" of Flight
- The "Helicopter" and the Principle of Action and Reaction
- Fluid Dynamics
- Turbulence

## 10. Introduction to Sustainable Engineering and Connections with History

## 11. Urban Engineering in the Context of the Renaissance and Sustainability

- Development of Florence as an urban form (layout, river, infrastructure)
- Modern day sustainability practices in Florence
- Walking tour of Florence

## 12. Connections between Renaissance Architecture and Green Design

- Renaissance architecture
- Local materials
- Green design
- Passive design
- Tour two key buildings (e.g., Laurentine Library)

## 13. Sustainable Agriculture

- Concepts in sustainable food production
- Linking the Renaissance daily life to modern day practices
- Experiential day on a local Tuscan farm

## **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)

### **Academic Integrity**

*Include repercussions for failure to adhere to policy.*

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

To learn more about Academic Integrity, visit the Academic Integrity Guide for an overview of the topic. For hands-on practice, complete the Understanding and Avoiding Plagiarism tutorial.

### **Disability Services**

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, [drsrecep@pitt.edu](mailto:drsrecep@pitt.edu), (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

### **COVID-19 Statement**

During this pandemic, it is extremely important that you abide by public health regulations and University of Pittsburgh health standards and guidelines. While in class, at a minimum, you must wear a face covering that covers your nose and mouth; other requirements may be added by the University during the semester. These rules have been developed to protect the health and safety of all community members. Failure to comply with these requirements will result in you not being permitted to attend class in person and could result in a Student Conduct violation. For the most up-to-date information and guidance, please visit [coronavirus.pitt.edu](http://coronavirus.pitt.edu) and check your Pitt email for updates before each class.

### **Communication to Instructor Pertaining to Illness**

As in any situation regarding class absence (remote or in person), a student who becomes ill (albeit COVID-19 related or not) is responsible for communicating with me regarding course absences. Please contact me and provide documentation when absences affect quizzes/exams. This should be done via email as soon as possible.

### **Take Care of Yourself**

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep, and taking time to relax. Despite what you might hear, using your time to take care of yourself will actually help you achieve your academic goals more than spending too much time studying. All of us benefit from support and guidance during times of struggle. There are many helpful resources available at Pitt. An important part of the college experience is learning how to ask for help. Take the time to learn about all that's available and take advantage of it. Ask for support sooner rather than later – this always helps. If you or anyone you know experiences any academic stress, difficult life events, or difficult feelings like anxiety or depression, we strongly encourage you to seek support. Consider reaching out to a friend, faculty or family member you trust for assistance connecting to the support that can help.

The University Counseling Center is here for you: call 412-648-7930 and visit their website.

If you or someone you know is feeling suicidal, call someone immediately, day or night: University Counseling Center (UCC): 412 648-7930

University Counseling Center Mental Health Crisis Response: 412-648-7930 x1 Resolve Crisis Network: 888-796-8226 (888-7-YOU-CAN)

If the situation is life threatening, call the Police: On-campus: Pitt Police: 412-268-2121 Off-campus: 911

### **Accessibility**

The Canvas LMS platform was built using the most modern HTML and CSS technologies, and is committed to W3C's Web Accessibility Initiative and [Section 508](#) guidelines. Specific details regarding individual feature compliance are documented and [updated regularly](#).

### **Diversity and Inclusion**

The University of Pittsburgh does not tolerate any form of discrimination, harassment, or retaliation based on disability, race, color, religion, national origin, ancestry, genetic information, marital status, familial status, sex, age, sexual orientation, veteran status or gender identity or other factors as stated in the University's Title IX policy. The University is committed to taking prompt action to end a hostile environment that interferes with the University's mission. For more information about policies, procedures, and practices:

<https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/policies-procedures-and-practices>

I ask that everyone in the class strive to help ensure that other members of this class can learn in a supportive and respectful environment. If there are instances of the aforementioned issues, please contact the Title IX Coordinator, by calling 412-648-7860, or e-mailing [titleixcoordinator@pitt.edu](mailto:titleixcoordinator@pitt.edu).

Reports can also be filed online: <https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/make-report> You may also choose to report this to a faculty/staff member; they are required to communicate this to the University's Office of Diversity and Inclusion. If you wish to maintain complete confidentiality, you may also contact the University Counseling Center (412-648-7930).

### **Religious Observance**

The observance of religious holidays (activities observed by a religious group of which a student is a member) and cultural practices are an important reflection of diversity. As your instructor, we are committed to providing equivalent educational opportunities to students of all belief systems. At the beginning of the semester, you should review the course requirements to identify foreseeable conflicts with assignments, exams, or other required attendance. If possible, please contact us within the first two weeks of the semester to allow time for us to discuss and make fair and reasonable adjustments to the schedule and/or tasks.

### **Gender Inclusive Language Statement (from Pitt GSWS)**

Language is gender-inclusive and non-sexist when we use words that affirm and respect how people describe, express, and experience their gender. Just as sexist language excludes women's experiences, non-gender-inclusive language excludes the experiences of individuals whose identities may not fit the gender binary, and/or who may not identify with the sex they were assigned at birth. Identities including trans, intersex, and genderqueer reflect personal descriptions, expressions, and experiences. Gender-inclusive/non-sexist language acknowledges people of any gender (for example, first year student versus freshman, chair versus chairman, humankind versus mankind, etc.). It also affirms non-binary gender identifications, and recognizes the difference between biological sex and gender expression. Students, faculty, and staff may share their preferred pronouns and names, and these gender identities and gender expressions should be honored.

### **Copyright Notice**

These materials may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials.

See Library of Congress Copyright Office and the University Copyright Policy.

### **Statement on Classroom Recording**

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

### **Email Communication**

Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The University provides an e-mail forwarding service that allows students to read their e-mail via other service providers (e.g., Hotmail, AOL, Yahoo). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding, it does not absolve the student from responding to official communications sent to their University e-mail address.

### **Student Opinion of Teaching Surveys**

Students in this class will be asked to complete a *Student Opinion of Teaching Survey*. Surveys will be sent via Pitt email and appear on your Canvas landing page during the last three weeks of class meeting days. Your responses are anonymous. Please take time to thoughtfully respond, your feedback is important to me. [Read more](#) about *Student Opinion of Teaching Surveys*.

### **Turnitin**

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of Turnitin.com page service is subject to the Usage Policy and Privacy Pledge posted on the Turnitin.com site.