

ENGINEERING FOUNDATIONS
Fall 2020

Meeting Space: Zoom (Online)_____	Time: M-W 3:30 pm – 5:00 pm
Instructor: Dr. Susheela Shanta	Office: Online by appointment.
Email:shanta@roanoke.edu	Office hours: Tuesday/Thursday 4 pm to 5 pm

Required Materials:

- Laptop/computer with Microsoft Office products, & MATLAB
- Textbooks:
 - 1) **Thinking Like an Engineer (TLE): An Active Approach with MyLab**
By: Elizabeth A. Stephan; David R. Bowman; William J. Park; Benjamin L. Sill; Matthew W. Ohland
Publisher: Pearson
eText ISBN: 9780134639765, 0134639766
 - 2) **An Engineers Guide to MATLAB (EGM) – 3rd edition**
By: Edward B. Magrab; Shapour Azarm; Balakumar Balachandran; James Duncan; Keith Herold;
Gregory Walsh
<https://www.vitalsource.com/referral?term=9780133002614>
- Lined notebook paper.
- Mechanical pencils (HB or B lead)
- Basic ruler/straight edge

Instructional aspirations:

The goal of this course is to provide students with an introduction to the engineering profession, ethics and professional responsibility, engineering problem-solving procedures, computing tools (programming for engineering - use of spreadsheets, MATLAB and graphing), technical writing, and definition/identification/modeling of an engineering problem/system, teamwork and professional communication. This introduction can be beneficial for all students (not only those that progress into the engineering profession), as the 21st century STEM workplace demands include most of these traits/skills.

Expected learning objectives: Successful students will be able to –

1. Compare and contrast the contributions of different types of engineers in the development of a product, process, or system, by exploring 21st century innovations.
2. Identify characteristics of a successful practicing engineer.
3. Use a variety of online resources to identify and articulate holistic issues that impact engineering solutions, including social, global, environmental, economic, and ethical impacts of the solution.
4. Identify an authentic engineering design problem (in any STEM discipline) and relevant stakeholders, constraints, and needs of the solution to the problem. Select a design approach to systematically solve the problem. Develop a team-based proposal to solve the problem and make a pitch to stakeholders to obtain support and approval to proceed.
5. Design a model to communicate a solution to a human problem using software tools to display graphing and data modeling to represent the design solution.
6. Communicate engineering solutions to diverse audiences clearly.
7. Contribute effectively as a member of a team.

Online Instruction

I will be posting our lectures/PowerPoint slides (some through a video recording) on Inquire. All assignments are designed for completion by students remotely. Any team-based projects will be adjusted to work in small teams online or through limited contact. You will need to make sure you have internet connectivity to participate during class time via Zoom and other times when you wish to meet with me during office hours or your classmates/teammates for your projects. You will need to purchase access to the book “Thinking Like an Engineer” right away and be able to use Inquire’s MyLab. I will go over this and other policies during the first class period.

Attendance: Regular *attendance* and *participation* is key to your success; you are expected to attend every class and participate as needed. Due to the pace of this course with an intentionally diverse range of topics, missing a class will mean that you will not only fall behind, but you will also be letting down your team members (when there are team projects).

Your active participation in this course implies that you complete readings assigned, go through any content posted on Inquire for that week, and work on any assignments online, on paper or on your computer as needed. There may be a need to work with team members to complete any team-based projects. When you need clarifications or help, you must email me for an appointment for a Zoom consultation (outside my set office hours as I will be available via Zoom during office hours) *but only after trying to resolve the issue through research and your efforts*. I will set up to meet you online at the earliest possible time I have available (outside office hours). You are expected to work a minimum of 12 hours per week in and out of class.

Special considerations: If you have a temperature of 100.4° or higher or other coronavirus symptoms, do not come to any in-person class or team project scheduled. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. Do keep up with all online work, readings, assignments, and deadlines if you are able to do so. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about coronavirus symptoms. If Health Services informs you that you should not attend online-class for multiple days or weeks, inform me so that we can make a plan to keep you current in the course. All absences caused by consultation with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused.

For other absences, course policy is as follows: If you must miss a class (for legal excuses – court, illness, hospital, police, etc.), you are expected to notify me at the earliest possible time (*and any team-mates as well*). Late arrivals (beyond 10 minutes) will constitute an absence. After two unexcused absences, you will receive a warning and your advisor will be notified. *After the third such absence, you will be forced to withdraw from the course.*

Office Hours: By Appointment

Inquire: Inquire will be used routinely to facilitate your learning. I will post announcements, notes, assignments, and other communication. You are expected to check the course site once every day, so that you are aware of schedule, assignments, help-tips, etc. You may request an appointment to meet with me and I will try to meet you between 4 pm and 5 pm on a weekday when we do not meet for class.

Special policies for any in-person interactions between students or with faculty

Face coverings/masks must be worn over the mouth and nose by all students and instructors in classrooms and hallways of academic buildings. By wearing face coverings, we protect our college community and its most vulnerable members. Students who come to class meetings without a face mask that is being worn properly will be asked to leave and will be readmitted only after they are wearing one.

Academic Integrity: Maintaining academic integrity is a mutual responsibility for all of us. I will be respectful of your time in class, make sure I am available during my office hours as well as will communicate with you in a timely fashion. I expect the same in terms of your timeliness, honesty, and sustained effort. During this unusual time for all, you will be expected to participate in assignments and projects following all college rules regarding the COVID-19 situation. Honesty and integrity are essential in all your dealings with your peers and faculty. Plagiarism and cheating are **not acceptable** and also violate RC policies. Being aware of others such violations and not reporting it is also considered a contributing aspect of cheating.

“Academic Integrity” page on the RC website– https://www.roanoke.edu/inside/a-z_index/academic_affairs/academic_integrity

Included in this page is an explanation of how violations of the College’s academic integrity policy are handled.

GRADING:

Grades: Standard letter grades (A–F) are assigned according to the following scale for this course: “A”(92–100), “B+”(88–91), “B”(83–87), “B–”(80–82), “C+”(78–79), “C”(74–78), “C–”(70–73), “D”(60– 69), “F” (< 60).

Grades will be weighted according to the following percentages:

60% Assignments (each of first 3 units - 20%)

10% Participation

30% Final Exam

Policy on late work

There will be a 10% deduction for each day your work is late, after one week you will only receive a maximum of 50% for your late work upon submission, and after two weeks you will not be able to receive any credit for that work, as it will receive zero points.

COURSE OUTLINE/TENTATIVE SCHEDULE

1st unit – ENGINEERING PRACTICE (Objectives 1, 2, 3)

Text: *Thinking like an Engineer - online resources will be used*

Targeted Topics: Engineering fields & careers, communicating to diverse audiences.

Week #	Dates	Topic	TLE Chapter
1	August	19 Course Intro People Intro Why Engineering	1
		24 What is Engineering? Careers in Engineering	1
2		26 Engineering Design and communication, Ethics Team project	3,4
		31 Engineering Problem-solving	5,6
3	September	2 Project presentations	-

Projected Activities/Projects: Explore/Reflect Writing Assignment

- Introduction to the Engineering profession,
- Exploration of engineering disciplines, societies, ethics, and licensing.
- Exploration of career outlook for engineers

Team project - e.g. Select an innovation of interest – reverse engineer the process used in the innovation – develop an informative e-poster as a PowerPoint/Prezi presentation that identifies the various contributing disciplines, a possible timeline for innovation to become available, legal and ethical considerations involved, social/global/environmental/economic impact of the innovation, and future developments possible. Deliver the presentation in a timed environment.

2nd Unit – ENGINEERING PROFESSIONALISM & ETHICS (Objective 2, 3, 7)

Text: *Thinking like an Engineer - online resources will be used*

Targeted Topics: Professional Ethics, analysis of case studies, global considerations and various social impacts of engineering projects/innovations. Online Writing Lab @ Purdue will be used to introduce students to technical writing for engineering.

Week #	Dates	Topic	TLE Chapter
3	September	7 Everyday ethics & decision making Project assignment	2, 4
4		9 Practical Engineering Ethics, Communication, and forward thinking Presentations	2, 4

Projected Activities/Projects:

- Exploring various professional codes of ethics
- Technical writing in the professional environment
- Exploring report writing vs. technical memoranda

Team project: Students use case studies and asked to assume the role of a junior researcher in a “Think Tank” organization. The organization has been engaged to review the scenario provided, develop a technical memo to your department head, and also make an oral presentation in a staff meeting. Students must present plausible courses of action along with their analysis of effects & consequences. Each case study will be assigned to two/three students who will be jointly responsible to prepare their analytical memo and make a presentation.

3rd Unit – ENGINEERING COMPUTATIONS & PROBLEM_SOLVING (Objectives 5, 6) Text: *MATLAB Textbook*

Targeted Topics: Engineering Problem-solving skills using Excel Spreadsheet software, communicating using graphs and data tabulations within reports, Flowcharting, and MATLAB for problem-solving. Dates: 9/21, 9/23, 9/28, 9/30, 10/5, 10/7, 10/12, 10/14

Week #	Dates		Topic	TLE Chapter
4	September	14	Estimation, Solving problems	5,6
		16	Fundamental Dimensions	7
5		21	Universal Units	8
		23	Dimensionless units	9
6		28	Excel Spreadsheets	10
		30	Excel Applications	10
7	October	5	Excel Applications	10
		7	Applications in MATLAB	15+ & EGM
8		12	Applications in MATLAB	15+ & EGM
		14	Applications in MATLAB	15+ & EGM
		19	Graphical & Mathematical modeling	11 & 12

Team/Individual Project: Open-ended mini design challenge project, requiring the use of a mathematical approach as well as communicating the solution using the output from Excel and/or MATLAB. (100 points)

4th Unit – ENGINEERING PROBLEM SOLVING (cont.) AND ENTREPRENEURSHIP (Objectives 4, 5, 6)

Text: *No textbook - online resources will be used*

Targeted Topics: Problem-solving techniques and inter-personal communication on a team, engineering design process (including ideation, teamwork, documentation, journaling, and time management), developing a value proposition for innovations, data gathering, modeling and graphing to validate the engineering design problem.

Dates: 10/19 10./21, 10/28, 11/2, 11/4, 11/9, 11/11, 11/16, 11/18

Week #	Dates		Topic	TLE Chapter
9	October	19	Graphical Solutions	11
		21	Mathematical Modeling	11
10	October	28	Mathematical Models	12 & 13

Project: Students will be asked to identify a problem (something that affects their lives) and create an engineering design challenge (to solve the problem). Students will need to fit their challenge into the National Academy of Engineering Grand Challenges for the 21st Century. Students will also use the most recent Science News, Discover magazines, and other trade publications to pick an idea or an innovation that interests them. After a guided engineering design process, especially focusing on research and ideation, students will prepare a proposal to seek funding for R&D to create a market ready product or process. The proposal will comprise of a report, a pitch to “investors/funding entities” (a PowerPoint presentation with any demonstrable prototypes if needed) and an abstract (to be created like a brochure that succinctly summarizes the innovation and its benefits). This presentation will be delivered via Zoom in class as the final exam for this course. Evaluation will be by faculty/entrepreneurs not associated with this class.

Final Report/Presentations – Final Exam - Wednesday November 18, 2020 – 6:00-10:00 pm