SEAS 1800: Exploring Engineering Sciences
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1- Bulletin Description:

This course is a hands-on project and experiment-based introduction to the various disciplines within engineering and applied science. Students will learn to apply their existing math and science knowledge to engineering and applied science problems and learn new tools along the way.

2- Learning Objectives:

- Explore a range of engineering topics through lectures and experiments/modules.
- Learn to maintain notes associated with designs, analyses, questions, experiments, observations, thoughts, conclusions, and ideas for further development and experimentation.
- Learn to develop intuition about engineering principles through experimentation.
- Apply your math and physics skills to engineering problems.
- Locate and use literature resources to learn new materials.
- Offer an oral technical presentation while utilizing appropriate visual aids.
- Write a technical report associated with a project.

3- Religious Holiday Policy:

Please notify us during the first week of the semester of your intention to be absent from class on days of religious observance. We will extend to you the courtesy of absence without penalty on such occasions, including permission to make up examinations. The list of religious holidays most frequently observed by members of the GW community can be found on the Office of the Provost's website. The policy associated with such holidays may be found at https://registrar.gwu.edu/university-policies#holidays.

4- Student Disabilities:

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 (Rome Hall, Suite 102) to establish eligibility and to coordinate reasonable accommodations.

5- Textbook:

There is no required textbook for this class. We will use a variety of web and printed resources.

6- Logistics:

The class is a course-bearing class where notetaking, problem solving, and reporting is expected. Each student may be expected to have a notebook, pens/pencils, a ruler and a calculator during the classes. Each student will have remote access to a desktop where some software assignments and web-access may be accessed/secured.

Students are expected to return quantitative assignments through the blackboard system – preferably using engineering papers (may be ordered online: https://www.amazon.com/TOPS-Engineering-Computation-Punched-35502/dp/B001E6BXM8) that may be scanned and sent via online resources. The assignments may be grouped in a binder/folder for better archiving.

7- Meeting Times and Places:

Dates: Monday June 7, 2021 – Friday June 25, 2021 (3 weeks)
Times: Synchronous Lectures: Monday-Friday 10:00 AM -12:00 PM US Eastern Times
                     Synchronous Modules: Monday-Friday 1:00 PM – 3:00 PM US Eastern Times

Notes:
- There will be no classes on Monday June the 14th, 2021 (observed as National Flag Day) – Office hours for assignment/project/module assistance provided.
- Students should make sure they have a GWID number, an email, a username and a password to access different software/online modules.
- Students should have a laptop/desktop to perform different tasks.
- The synchronous 2-hour duration of the module should allow the students to start the corresponding work. Asynchronous individual work is expected to be performed by the students afterward. There will be daily office hours between 7 pm and 8 pm (US Eastern Time) held by the graduate assistants/instructor for answering questions. To attend such office hours, you can visit the grader's Webex Room address: https://gwu.webex.com/meet/mohaiminul
- When you access the course blackboard room, you can press the link associated with "Virtual Classroom". A "Course Room" tab should be presented to you. Press on the tab and this should take you to where the first session will be initiated.
- The initiated "Blackboard Collaborate Ultra" sessions will be accompanied by Webex sessions allowing smooth sharing of presentations. These sessions will be provided

through the instructor's personal Webex room at the link:
https://gwu.webex.com/meet/hamdar
· The sessions will be recorded and available.
· Students should order the materials specified at the end of the syllabus to be delivered prior to the start of the course.

8- Topics/Detailed Schedule:

Week 1; June 7 – June 11, 2021: Computer and Mechanical Engineering – Theme: Programming, Robotics and Electricity

- June 7: Introduction and Engineering Ethics
  - § 10:00 AM: Introduction
  - § 10:15 AM: Engineering and Engineers
  - § 11:15 AM: Reading and Writing in Engineering (Reading Assignment Explanation)
  - § 12:00 PM: Break
  - § 1:00 PM Engineering Ethics (Case Studies – In Class Exercise and Assignment)

- June 8: MATLAB
  - § 10:00 AM: Computer Science/Engineering Presentation + General Programming Presentation
  - § 11:00 AM: MATLAB - Basic Lecture on Syntax and Logic
  - § 12:00 PM: Break
  - § 1:00 PM: Module: Data Input/Output, Functions and Plotting

- June 9: Python
  - § 10:00 AM: Object Oriented Programming and Artificial Intelligence: Python Presentation
  - § 12:00 PM: Break
  - § 1:00 PM: Python Module: Artificial Intelligence Functions/Tools in Python

- June 10: Introduction, Robotics Assembly, Programming and Competition
  - § 10:00 AM: Mechanical Engineering Presentation + Introduction to Robotics Presentation
  - § 12:00 PM: Break
  - § 1:00 PM: Robotics Module - Exploring/Building Robotics Kit - Basic Control Application - Object Avoidance -Tracking – Wireless Communication - Competition: Racing (Video Recording)

- o June 11: Electricity Basic Laws and Module
  - § 10:00 AM: Electrical Engineering Presentation + Ohm' Law
  - § 12:00 PM: Break
  - § 1:00 PM: Module: Building Circuit

Week 2; June 14-18, 2021: Systems Engineering – Theme: Social Media, Mobility and Health

- o June 15: Information Systems and Data Analytics
  - § 10:00 AM: Probability and Statistics and Data Analysis
  - § 11:30 AM: Visualization in Engineering
  - § 12:00 PM: Break
  - § 1:00 PM: Geographic Information Systems and Decision Support

- o June 16: Social Networks and Engineering
  - § 10:00 AM: System Engineering Presentation
  - § 10:30 AM: The Role of Social Networks and Social Media in Shaping Engineering Problems and Decisions
  - § 12:00 PM: Break
  - § 1:00 PM: Studying Twitter Trends and Natural Language Processing

- o June 17: Virtual Reality for Data Collection and Gamification
  - § 10:00 AM: Introduction to Unity 3D (Virtual Reality Platform)
  - § 11:00 AM: 3D Demo Exercise
  - § 12:00 PM: Break
  - § 1:00 PM: Complex 2D Example + Example on Behavioral Applications

- o June 18: Traffic and Congestion
  - § 10:00 AM: Engineering Management and Systems Engineering Presentation
  - § 10:30 AM: Traffic Signal for Conflict Analysis
  - § 12:00 PM: Break
  - § 1:00 PM: Module: Introduction to VISSIM + VISSIM Competition: Build a Simple Roadway Segment and Analyze Resulting System Patterns

Week 3; June 21-25, 2021: Biomedical and Civil/Environmental Engineering – Theme: Health, Structure and Infrastructure

- o June 21: Sensors and Health
  - § 10:00 AM: Introduction to Biomedical Engineering + Accelerometer/Cell Phone Data
  - § 12:00 PM: Break
  - § 1:00 PM: Ambient Sensor Module for Step Detection and Analysis

- o June 22: Drawing and Coordinate Systems (Possible Case of Highway Alignment)
  - § 10:00 AM: CAD System and Coordinate Systems (setting specifications and maps)
  - § 12:00 PM: Break
  - § 1:00 PM: Module: AutoCAD/CIVIL3D for Engineering Drawings

- o June 23: Trusses – Module: Bridge Competition
  - § 10:00 AM: Introduction to Civil/Environmental Engineering
  - § 10:30 AM: Presentation – General Engineering Concepts/Forces and Motion/ Truss/Equilibrium
  - § 12:00 PM: Break
  - § 1:00 PM: Bridge Drawing

- o June 24: Video Recognition for Extraction Data
  - § 10:00 AM: Development of Video Recognition and Role in Engineering
  - § 12:00 PM: Break
  - § 1:00 PM: Module: Autonomous Video Detection for Count Data (Training and Application)

- o June 25: Final Exam and Evaluation
  - § 10:00 AM: Final Exam and Evaluation
  - § 12:00 PM: Break
  - § 1:00 PM: Project Presentations and Summary

9- Grades:

You will be graded based on your oral presentations, written reports, and home-works. All work must be original in that you are not simply recycling someone else's work and claiming credit for it. However, it is entirely appropriate to use information from other sources, provided you cite them properly.

Points	Letter	Description
4	A	Excellent Work
3	B	Well Done, but with minor difficulties
2	C	Failure to show a good grasp of a topic
1	D	Serious misunderstanding or major omission
0	F	No Submission, or the submission was completely off target

Item	Weighing
Participation and Involvement	5%
Assignments (Reading/Written) (A)	20%
Computer Programming (C)	20%
Exam (E)	20%
Hands-On Modules (M)	25%
Projects (P) (VISSIM)	10%

Points	Letter Grade
90 ≤ ⋯	A
80 ≤ … < 90	B
70 ≤ … < 80	C
60 ≤ … < 70	D
60 ≤ … < 70	E
< 60	F

10- Miscellaneous:

Please consult the George Washington University Code of Academic Integrity for specifics of the university's policies on academic integrity. It defines some forms of academic dishonesty, including cheating, fabrication, plagiarism, falsification and forgery of University academic documents, and facilitating academic dishonesty.

11- GW Minimum Time Expectations:

Average minimum amount of out-of-class or independent learning expected per week: students are expected to spend a minimum of 100 minutes of out-of-class work for every 50 minutes of direct instruction, for a minimum total of 2.5 hours per week. A 3-credit course includes 2.5 hours of direct instruction and a minimum of 5 hours of independent learning, or 7.5 hours per week.

12- Contacting the Instructors/Professors

Professor Samer H. Hamdar
Email: hamdar@gwu.edu

Prepared by Prof. Samer H. Hamdar: March 2021

<u>Materials, Deliverables and Due Dates:</u>

Materials:

Robotic Kit
https://www.amazon.com/OSOYOO-Controlled-Educational-Programming-Mechanical/dp/B07XXPW9XP/ref=sr_1_19?dchild=1&keywords=robot+car+kit&qid=1586719230&sr=8-19
Circuit Kit:
https://www.amazon.com/Make-Electronics-Component-Educational-Electronic/dp/B01EKO6FYQ/ref=sr_1_2?keywords=Make%3A%2BElectronics%2B2nd%2BEdition%2BComponent%2BPack&amp%3Bqid=1553692561&amp%3Brefinements=p_85%3A2470955011&amp%3Brnid=2470954011&amp%3Brps=1&amp%3Bs=gateway&amp%3Bsr=8-2&th=1
Sensor:
https://mbientlab.com/store/wristband-sensor-research-kit/

Deliverables and Due Dates:

Assignments (delivered on engineering papers after scanning and posting as single pdf file):
<u>Written:</u>
·   A0 - Assignment 0: Ethics and Engineering Concepts (Due June 15, 2021)
·   A1 - Assignment 1: Probability and Statistics (Due June 21, 2021)
·   A2 - Assignment 2: Circuit Design (Due June 21, 2021)
·   A3 - Assignment 3: Trusses (Due June 24, 2021)
<u>Reading:</u>
·   R1 – Reading Exercise 1: Summary + Referencing (Two Papers 1 and 2) (Due June 15, 2021)
·   R2 – Reading Exercise 2: Objectives and Disciplines (Due June 21, 2021)

Computer Programming Exercises (delivered through blackboard):
·   C1 – Computer Programming Exercise 1: MATLAB (Due June 15, 2021)
·   C2 – Computer Programming Exercise 2: Python (Due June 15, 2021)

Hands-On Modules:
·   M1 – Hands-On Module 1: Robotics Building (video link uploaded on blackboard) (June 15, 2021)
·   M2 – Hands-On Module 2: Circuit Building (video link uploaded on blackboard) (June 21, 2021)
·   M3 – Hands-On Module 3: CAD Drawing – individual (delivered through blackboard on June 23, 2021)

Project: Presentation & Reporting:
·   P1: VISSIM Software - individual (answers collected on June 18, 2021) + Project: Highway Segment Evaluation (evaluated after group oral presentation on June 25, 2021)