ENGR 400 Principles of Systems Engineering

Winter 2024

ONLINE COURSE: Dec 11, 2023 – Jan 13, 2024

INSTRUCTOR: Manohar Chidurala, PhD

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LECTURES: Recorded lectures will be posted on Blackboard

LOCATION: Blackboard (WEB)

OFFICE HOUR: Email is the best way to contact me.

COURSE DESCRIPTION:

Systems engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and reliability improvement while considering the complete problem including operations, performance, test, manufacturing, cost, and schedule. This course emphasizes the links of systems engineering to the fundamentals of decision theory, statistics, and optimization. The course also introduces the most current, commercially successful techniques for systems engineering.

PREREQUISITES: Junior standing in an engineering discipline; EE 210 or EM 221, or EM 222 and STAT 301 or ME310.

COURSE GOALS:

The goal of this course is to provide the student with an introduction to systems engineering with an emphasis on the following topics: the systems engineering process, requirements, design fundamentals, subsystem fundamentals, trade studies, integration, technical reviews, case studies, and ethics. The course is also intended to prepare the student for their senior design course (CE498, ENGR490, and ENGR491).

COURSE OUTCOMES:

- Develop a system engineering perspective of how complex systems are conceived, developed, and implemented.
- Establish and mature the knowledge and comprehension of the value and purpose of systems engineering.
- Establish a working knowledge of the methods and tools systems engineers use.
- Understand the roles of systems engineers and develop the ability to contribute to the development of complex systems.

Knowledge, Skills, and Abilities Students Should Have Before Entering This Course: Communicate technical information accurately and concisely– both orally and in writing, use analysis, computer software, word processors, etc., to define and develop solutions to technical problems in engineering.

Knowledge, Skills, and Abilities Students Gain from This Course: This course will give students initial exposure to the field of systems engineering as it applies to complex systems. The students will also be exposed to concepts regarding team organization, design fundamentals, and work ethics. These topics will be in preparation for their senior design course experience. They will learn that systems engineering is iterative and will develop judgments that will allow them to compare and evaluate engineering alternatives. They will learn to discuss systems engineering methods and processes as well as engage in systems thinking.

TEXTBOOK:

Currently, a single textbook is not available for this class. Lecture materials will be provided, and additional materials will be distributed on the course Blackboard website. Additional reading assignments and reference materials will also be provided throughout the course.

OTHER ITEMS NEEDED:

- Access to a computer (preferably your own) with a reliable Internet connection.
- A working webcam with a working microphone (you will do a Media Site/zoom video)
- Microsoft Word in doc file format.
- Adobe Acrobat Reader (a free download from Adobe.com).
- Additional technical requirements can be found in the Technical Requirements course menu link in the Blackboard course.

BLACKBOARD:

Blackboard will be used extensively throughout this course.

- Homework will be posted in the Announcement Section of the Blackboard site and due dates in the course calendar.
- The course schedule will be available in the SYLLABUS folder.

- Class material will be posted in the CONTENT folder.
- Exams will be posted and collected in the EXAMS folder.
- Student grades will be posted in the Grade Center.

Make Sure You Know How to Use Blackboard

Bb Student User Training:
If you have not used Blackboard as a student, or if this is your first online class, I highly recommend signing up for and completing the Blackboard Student User Training. These are topical modules that even those who have used Blackboard a lot have told us are helpful. To sign up, go to Blackboard and sign in, and click the IT TRAINING tab (top, toward the right, black with white writing). Look for IT Blackboard Student User Training… you will gain instant access upon signing up. This is not required, but it could be very helpful for you and important for your success!

WKU Online Student Resource Center
You may also want to visit the WKU Student Resource Center:
http://www.wku.edu/online/src/

Blackboard Help/WKU IT Help Desk
270-745-7000

COURSE POLICIES:

- Use of Technology
  This is an online course where all required work (Homework and exams) will be completed online using Blackboard and the Internet. If you do not know how to use Blackboard, tutorials are available online (see the links above).
- Attendance Policy
  While there is no formal attendance policy, you must complete assignments according to the course schedule. The course schedule is posted on Blackboard under Syllabus folder.
- Email and Blackboard Announcements
  We will use Blackboard Announcements as a way of communicating with the whole class during this course. All Blackboard Announcements will also be sent via email. Therefore, please watch your email, or Blackboard Announcements, for course communication.
- Evaluation
  Your course grade will be based on the work outlined in this syllabus and schedule. Grades are always available on Blackboard (My Grades). To complete this course, you must successfully complete each assignment and activity on the Syllabus.
- Late Work
  As in a typical online class, you are expected to complete assignments by the scheduled due date. If circumstances beyond your control arise, contact me as soon as possible. No work will be accepted after the end date of the course. I strongly recommend that you do

not wait until the last minute to submit your work. If your work does not meet the criteria, you may not have time to improve your submissions prior to the end date of the course.

- Work Submission
  Work for this course will take happen on your Blackboard course site. Assignments submitted to the Thermodynamics course must be submitted in docx or pdf or ppt file format, or else I cannot open/grade them. Assignments not submitted in one of those file formats will not be graded.
- Failure of Technology
  Blackboard can sometimes have issues. If you have issues with Blackboard, please contact the IT Help Desk at 270-745-7000.

COURSE GRADE:

The final course grade will be determined as follows:

Assignments (10):	30 %
Quizzes (2):	40 %
Final Exam:	30 %

Scores for work will be based on the following rubric:
A > 90% Exemplar; no to minor mistakes.
B > 80% Proficient; several minor mistakes; almost no conceptual mistakes.
C > 70% Apprentice; several mistakes, some major; conceptual mistakes.
D > 60% Novice; many significant mistakes and conceptual errors.
F < 60% non-response or completely incorrect response.

ASSIGNMENTS:

- All the assignments will be posted on Blackboard.
- You must read the instructions before you begin the assignments.
- No late homework will be accepted. Students will be given less than 2 days' time to complete assignments and ask questions prior to homework submission. DO NOT BEGIN your homework the night before it is due.
- Assignments will be weighted (i.e., some assignments will count more than others).
- Do not Email assignments to the instructor.
- PLEASE SEEK ASSISTANCE FROM YOUR INSTRUCTOR IF YOU NEED ANY HELP WITH THE ASSIGNMENTS.

QUIZZES:

- A total of **2 quizzes** (each may take up to 2 hours) will be given during the semester (remotely on Blackboard).
- The online Quiz 1 will be given on **Thursday, December 21st, 2023**.
- The online Quiz 2 will be given on **Thursday, January 11th, 2024**.
- You are allowed to take them at any time during the day and we will adjust the material covered on the quiz if we are ahead or behind schedule.

- You are allowed to use only the formula sheet (provided by the instructor), the property tables booklet, and the approved calculator (See Calculator Policy Above) for the quizzes, no phones/smartwatches or backpacks will be allowed.
- NO MAKEUP QUIZZES WILL BE GIVEN. NO EARLY QUIZZES WILL BE GIVEN.
- NO LATE QUIZZES WILL BE GIVEN.

FINAL EXAM:

- There is one two-hour, **online**, final exam.
- The online final exam will be given on **Saturday, January 13, 2024**.
- You are allowed to use only the formula sheet (provided by the instructor), the property tables booklet, and the approved calculator (See Calculator Policy Above) for the Final exam. No phones/smartwatches or backpacks will be allowed.
- NO MAKEUP EXAM WILL BE GIVEN. NO EARLY EXAM WILL BE GIVEN. NO LATE EXAM WILL BE GIVEN.

ACADEMIC DISHONESTY:

As an engineering student at WKU, you are expected to refrain from any form of academic dishonesty or deception such as cheating, stealing, plagiarism, or lying on assignments, homework, quizzes, tests, or exams. Furthermore, you understand and accept the potential consequences of punishable behavior, as stated in the WKU Catalog under Academic Dishonesty.

TITLE IX MISCONDUCT/ASSAULT STATEMENT:

Western Kentucky University (WKU) is committed to supporting faculty, staff, and students by upholding WKU's Sex and Gender-Based Discrimination, Harassment, and Retaliation (#0.070) and Discrimination and Harassment Policy (#0.2040). Under these policies, discrimination, harassment, and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment, and/or sexual misconduct, you are encouraged to report it to the Executive Director, Office of Institutional Equity/Title IX Coordinator, Ena Demir, 270-745-6867 or Title IX Investigators or Michael Crowe, 270-745-5429. Please note that while you may report an incident of sex/gender-based discrimination, harassment, and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and MUST report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

ADA ACCOMMODATION STATEMENT:

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, Room 1074. The SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu. Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

CHATGPT & GENERATIVE AI STATEMENT:
Artificial intelligence (AI) tools are not permitted for any type of work in this class. If you choose to use these tools, your actions will be considered academically dishonest and a violation of the WKU Student Code of Conduct.

OGDEN STUDENT COURSE ATTENDANCE STATEMENT:
The faculty and staff of Ogden College of Science and Engineering are committed to providing you with learning experiences and opportunities. You must assume ownership of your education and be an active participant in the classroom and laboratory to take advantage of these opportunities. **Active participation requires you to attend**. Scientific studies have shown that attendance during scheduled classroom and laboratory meetings is directly correlated to your performance on assignments and exams and the potential to earn higher grades. Additionally, if you do not regularly attend class, you are missing important information about course topics, due dates, and assignment details that are crucial to your success in the course. Therefore, as a student enrolled in an Ogden course, you are expected to attend every class meeting and inform your instructor regarding the reasons for any absences as soon as practical. **Your instructor may incorporate class attendance/participation as part of the grading criteria**.

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Tentative Schedule

Module	Lecture Topics
Module 1	Introduction to Systems Engineering
Module 2	Project Life Cycle (Waterfall Process Model, Spiral Process Model, "Vee" Process)
Module 3	Requirements: The Basics and Types of Interfaces
Module 4	Scope and Concept of Operations
Module 5	System Architecture
Module 6	Analytical Hierarchy Process
Module 7	Functional Analysis (IDEF Model, Functional Flow Block Diagram, Timeline Analysis)
Module 8	Robust Design (Taguchi Method)
Module 9	Robust Design (Taguchi Method)
Module 10	Design Margins
Module 11	Technical Performance Measures (N Squared Interface and Probability & Statistics)
Module 12	Economic Evaluation Cost Estimating - The Basics, Models, Probabilities
Module 13	Risk Management (Risk Matrix, Fault Tree, Failure Mode Analysis)
Module 14	Reliability (Inspection, Analysis, Demonstration, Test)
Module 15	Verification (Inspection, Analysis, Demonstration, Test)