ENGR-120: PRINCIPLES OF ENGINEERING TECHNOLOGY

Effective Term
Fall 2025

BOT Approval Date
12/17/2024

Discipline
ENGR - Engineering Technology
Course Number
120

Course Title
Principles of Engineering Technology

Short Title
Princip-Engr Technology

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
2.00

Lab Units
1.00

Total Units
3.00

Hours

Lecture Contact Hours
32-36
Out of Class Hours Lecture
64-72

Lab Contact Hours
48-54
Out of Class Hours Lab
0.00

Total Contact Hours
80 - 90

Total Out of Class Hours
64 - 72

Total Student Learning Hours
144 - 162

Is this an existing Extensive Lab?
No

Do you want to propose this for Extensive Lab?
No

Distance Education
Yes

Distance Education

Distance Education Type
Both Fully Online and Hybrid Online

Fully Online Delivery Requirements:
a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course
b. Any planned face-to-face meetings, such as an orientation or study session, must be optional
c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course

Are you using publisher content?
No

Regular Substantive Interaction
Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

Catalog Description
This course includes lecture and lab components and is for students interested in pursuing a career in Engineering Technology. Students will explore technology systems and engineering processes to learn how math, science, and technology impact society. Topics include the design processes, communication and documentation, engineering systems, energy and power, statics, properties of materials, materials testing, control systems, quality assurance and reliability.

Codes

TOP Code (CB 03)
0924.00* - *Engineering Technology, General (requires Trigonometry)

CIP Code
15.0000 - Engineering Technology, General.

Repeatability Code
No

Grading Option
Letter grade OR P/NP

Learning Objectives

Learning Objectives

Learning Objective
1. Compare the various education requirements and career opportunities for Engineering.
2. Organize all aspects of the design process with documentation of design ideas graphically and in writing.
3. Assemble the essential components contained in a basic mechanical system and compare the application of commonly used mechanisms, such as levers, wheels, pulleys, screws and gears
4. Compare and contrast various forms of energy sources, systems and applications.
5. Explain the basic components of statics.
6. Analyze a simple truss to determine types and magnitude of forces that act on the truss.
7. Evaluate the properties, characteristics and application of materials commonly used in manufacturing.
8. Examine materials commonly used in manufacturing using destructive and non-destructive means of testing.
9. Explain the effects that stress has on a material and explain how a particular material will react.
10. Construct and understand control systems using computer programming.
11. Compare, mathematically and schematically, pneumatic and hydraulic fluid systems.
12. Perform statistical and kinematic calculations as part of the research and development process.
13. Evaluate the role of diversity, equity, and inclusion (DEI) in engineering teams and analyze the impact of diverse perspectives on innovation, teamwork, and problem-solving in multinational engineering projects.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will accurately and precisely apply engineering principles to mechanical design.
2. Students will strive for accuracy in analysis of engineering problems.
3. Students will persist in problem solving and development of engineering designs.

Program Learning Outcomes

Learning Outcome
Students will demonstrate technical skills used in the industry for engineering technology disciplines such as advanced manufacturing, civil and architectural, and electronics.
Students will use the principles of engineering design to develop a solution, device, or process that resolves a problem or improves an existing solution.
Students will solve technical problems in engineering technology using a combination of mathematics, computer software, scientific principles, and relevant skills.

Institutional Learning Outcomes

Communication: The student will effectively express and exchange ideas through listening, speaking, reading, writing, visual works, and other modes of interpersonal expression.
Critical Thinking: The student will analyze problems, gather and synthesize relevant information, evaluate ideas, information, and evaluate alternative points of view to create, innovate and implement effective solutions.
Information and Technology Literacy: The student will access, interpret, evaluate, and apply relevant information sources and digital media effectively, and in an ethical and legal manner.
Scientific Awareness: The student will apply the scientific method of inquiry to assess potential solutions for real-life challenges by employing science-based knowledge and methodologies in daily life.
Civic
Personal
and Professional Responsibility

Content

Course Lecture Content

1. **Course Introduction**
   a. Overview of Engineering
   b. Course Orientation & Safety Guidelines
   c. Introduction to Diversity, Equity, and Inclusion within Engineering
      i. Understanding the importance of DEI
      ii. Impact of diverse teams on innovation, and teamwork
   d. Multinational Engineering
      i. Exploring the global impact of engineering practices
      ii. Challenges and opportunities in international engineering projects
2. **Fundamentals of Engineering**
   a. Engineering Education & Career Opportunities
   b. Communication & Documentation Skills
      i. Emphasis on culturally competent communication
   c. Technical Writing for Engineers
3. **Data and Analysis**
   a. Data Representation & Presentation
   b. Use of Computer Tools in Engineering
4. **Statistics in Engineering**
   a. **Basic Statistical Concepts**
      i. Calculation of central measures: mean, median, and mode.
      ii. Introduction to hypothesis testing with practical examples relevant to engineering.
   b. **Essential Probability and Analysis**
      i. Overview of fundamental probability and its application in risk assessment.
   c. **Statistical Tools**
      i. Brief introduction to using common software tools for statistical analysis.
   d. **Kinematics**
      i. Understanding Bodies in Motion, Projectile Motion, and Associated Equations
5. **Engineering Design Process**
   a. Problem Identification and Design Brief
   b. Information Gathering Techniques
   c. Development of Alternative Solutions and Optimization
   d. Modeling and Simulation
6. **Testing and Evaluation**
   a. Testing Protocols and Methodologies
   b. Evaluation and Analysis of Test Results
   c. Presentations of Findings and Solutions
7. **Mechanical Systems**
   a. Introduction to Mechanisms: Gears, Levers, Linkages, Sprockets, Pulley Systems, Screws
   b. Concepts of Redirection of Energy, Manipulating Force, Speed, and Distance
   c. Understanding Mechanical Advantage Ratios: Work Input vs. Output
8. **Energy Systems**
   a. Overview of Energy Sources: Nonrenewable, Renewable, Inexhaustible
   b. Energy, Work, and Power Fundamentals
   c. Electricity and Electrical Components
   d. Energy Applications: Source Efficiency and Accessibility
9. **Thermodynamics**
   a. Principles of Energy Transfers and Calculations
   b. Thermodynamic Laws and Applications
10. **Materials Science**
    a. Properties of Materials: Centroid Location, Moment of Inertia, Modulus of Elasticity
    b. Material Selection: Mechanical, Thermal, Electromagnetic, and Chemical Properties
    c. Material Testing: Reliability, Safety, and Predictability in Function
11. **Control Systems**

   a. Basics of Machine Control and Reliability
   b. Control System Schematics and Protocols
   c. Introduction to Closed and Open Loop Systems
12. **Fluid Mechanics**
    a. Fundamentals of Fluid Power (Hydraulic and Pneumatic Systems)
    b. Fluid Power Components: Reservoirs, Pumps, Valves, and Cylinders
    c. Fluid Dynamics Theory and Applications

Course Lab Content

1. **The Design Process**
   a. Introduction to the product and invention lifecycle.
   b. Group projects to conceptualize, design, and plan a simple product or invention.
2. **Mechanisms**
   a. Design, sketch, build, test, and evaluate simple mechanical systems.
   b. Focus on gears, levers, and linkages, culminating in a class competition or showcase.
3. **Forms of Energy**
   a. Experiments to measure mechanical and electrical energy.
   b. Analysis of energy conversions and efficiency.
4. **Energy Application**
   a. Projects involving the design and testing of small-scale renewable energy models.
   b. Exploration of renewable power sources and insulation materials.Engineering Systems
   c. Use of kits like Fischertechnik to build and test engineering systems such as marble sorters.
5. **Statics and Strength of Materials**
   a. Use of software like Bridge Builder or Solidworks for creating diagrams and performing calculations.
   b. Building small-scale models and testing them to failure, to understand load-bearing and structural integrity.
6. **Material Properties**
   a. Testing of household and construction materials to determine properties like tensile strength and compressibility.
   b. Comparative analysis to understand material selection in different engineering contexts.
7. **Reliability & Testing**
   a. Case studies on product failures and successes.
   b. Practical testing sessions to understand the importance of reliability in engineering design.
8. **Control Systems**
   a. Design and implementation of basic control systems using microcontrollers and sensors.
   b. Testing and optimization of control systems in simulated environments.
9. **Fluid Power**
   a. Design and construction of systems using hydraulic and/or pneumatic power.
   b. Tests to evaluate efficiency and responsiveness. Adjust settings and measure responses.
10. **Kinematics**
    a. Design, build, and test projects that involve motion analysis, such as vehicles, mechanical arms, or projectiles.

Methods of Instruction

Method

Directed Study

Integration

Problem solving team projects with group presentations of problem solving exercises will be made regarding manufacturing processes, safety, quality assurance, energy & power, materials & structures, and control systems.

DE Adaptations for MOI

Each team will create multimedia presentations, incorporating accessible video, slides, and other digital content (e.g., Discord, Zoom, Microsoft Teams for collaboration; Google Docs, Google Slides, Loom, and/or OBS) to showcase their solutions. These presentations will be uploaded to the CMS and submitted as recorded accessible videos, allowing for peer feedback and instructor evaluation. Students will access have links to all collaboration and video-making tools through the CMS, ensuring that all resources are readily available and accessible. Additionally, all materials and tools used comply with accessibility standards to support diverse learning needs. This approach supports Learning Objective 2: Organize all aspects of the design process with documentation of design ideas graphically and in writing by enabling structured and documented team-based problem-solving.

Method

Lecture

Integration

Multimedia presentation and computer simulations introducing safety, trends, communication, documentation, design process, skills, engineering systems and related science course topics/material.

DE Adaptations for MOI

Multimedia presentations and computer simulations will be delivered through the CMS, allowing students to access lectures at their convenience. These presentations will utilize free and accessible software tools (e.g., Google Slides, Canva for presentations; PhET Interactive Simulations, GeoGebra for computer simulations) to introduce topics such as safety, industry trends, effective communication, documentation practices, the design process, essential engineering skills, and various engineering systems. All lecture materials will be available on the CMS, ensuring that students can view and interact with the content asynchronously. This approach aligns with Learning Objective 1: Compare the various education requirements and career opportunities for Engineering by providing comprehensive and flexible access to foundational knowledge, enabling students to explore and understand the diverse pathways and opportunities within the engineering field.

Method

Projects

Integration

Analyze and describe the engineering design process, including comprehensive research and data collection, with findings presented to the class. This will be conducted both individually and collaboratively within teams, focusing on real-world engineering challenges related to manufacturing processes, safety protocols, quality assurance, energy systems, materials selection, and control mechanisms.

DE Adaptations for MOI

Students will engage in projects that analyze and describe the engineering design process through comprehensive research and data collection, addressing real-world challenges in manufacturing processes, safety protocols, quality assurance, energy systems, materials selection, and control mechanisms. These projects will be conducted both individually and collaboratively using virtual collaboration tools (e.g., Discord, Microsoft Teams, Google Docs) and research platforms accessible through the CMS. Students will compile their findings into detailed reports and multimedia presentations (e.g., Google Slides, Loom) and upload them to the CMS for asynchronous peer review and instructor evaluation. All project guidelines, research resources, and collaboration tools are accessible via the CMS. This approach directly supports Learning Objective 3: Assemble the essential components contained in a basic mechanical system and compare the application of commonly used mechanisms by enabling students to engage in comprehensive, documented project-based learning that mirrors real-world engineering tasks.

Methods of Evaluation

Method

Class Participation

Integration

Participation in topical discussions, problem solving activities and demonstrations (computational or non-computational), and simulated exercises within the design process. Evaluation based on level of participation, reasoning processes, demonstrated skill set and accuracy of results.

DE Adaptations for MOE

Class participation will be conducted asynchronously through the CMS's discussion boards. Students will engage in topical discussions, contribute to problem-solving activities, and complete simulated exercises related to the design process. Their participation will be evaluated based on the frequency and quality of their contributions, the depth of their reasoning, the demonstration of relevant skills, and the accuracy of their solutions.

Method

Exams/Tests

Integration

Quizzes will be periodic short objective tests of course related concepts. A mid-term and final examination will be given which show student understanding of terminology, knowledge of subject matter, and ability to contrast and evaluate why certain design processes are most effective and identification of machines and materials. Test and quiz question format may include multiple choice, short answer/essay, and diagram identification.

DE Adaptations for MOE

Quizzes and examinations will be administered asynchronously through the CMS, allowing students to complete assessments at their convenience within designated time frames. Periodic Quizzes will consist of short, objective tests covering key course concepts and will include multiple-choice, short answer, and diagram identification questions. Mid-term and Final Examinations will evaluate students' understanding of terminology, knowledge of subject matter, and their ability to contrast and evaluate the effectiveness of various design processes, as well as identify machines and materials used in engineering technology. These assessments will be created using the CMS's built-in tools to ensure secure and accessible testing environments

---

Method

Group Projects

Integration

Group oral presentations of problem solving exercises will be made regarding the design process, engineering systems, statics, properties of materials, quality assurance, materials testing, and engineering for reliability with a clear demonstration of the relationship of these topics.

DE Adaptations for MOE

Group presentations will be conducted asynchronously through the CMS, allowing students to collaborate using virtual tools such as Discord, Zoom, Microsoft Teams, Google Docs, Google Slides, and Loom. Each group will create multimedia presentations that incorporate Google Slides for slide decks and Loom for video recordings to showcase their solutions to problem-solving exercises related to the design process, engineering systems, statics, properties of materials, quality assurance, materials testing, and engineering for reliability. These presentations will be uploaded to the CMS for peer review and instructor evaluation, enabling feedback without the need for live sessions.

Method

Other

Integration

Laboratory Reports-In written format, students will describe and report on the major stages involved in design process, demonstrating effective communication and documentation. This is evident by clarity, organization, thoroughness of content, with appropriate application of course material to processes used, as well as correct grammar and spelling.

DE Adaptations for MOE

Lab reports will be submitted to the Instructor through the CMS and evaluated for understanding and clarity about the design process. Written feedback will be provided to the students through rubrics built into the CMS, marked/commented lab reports provided back to the student through the CMS and/or comments and dialog on the chatrooms and/or discussion boards.

Assignments

Assignment Type

Reading

In-class and/or outside of class

In-class

Formative or Summative
Formative

Assignment
Renewable Energy In-Person Discussion

Objective: Explore and understand the current landscape and potential of renewable energy technologies as presented by authoritative sources.

Preparation:

Reading Material: Visit the U.S. Department of Energy's website and read the section titled "Renewable Energy Explained". This resource offers a comprehensive overview of various renewable energy sources, their usage, advantages, and challenges. It's designed to be accessible and informative for those new to the topic.

Task:
In-Person Discussion Preparation:

Types of Renewable Energy: Focus on the different types discussed, such as solar, wind, hydroelectric, and bioenergy.

Advantages and Challenges: Highlight the benefits each type offers and the obstacles they face in widespread adoption.

Technological Innovations: Take note of any recent advancements that enhance the viability of these energy sources.

Discussion Points: Prepare to answer and discuss the following questions in class:

How do various renewable energy sources contribute to energy sustainability?
Which renewable energy source do you think is most vital for your local community's energy future, and why?
Discuss the technological or infrastructural challenges that need to be addressed to increase the adoption of renewable energy.
In-Class Activity:
Group Discussion: You will be grouped with peers to discuss your findings and viewpoints based on the DOE article.
Group Presentation: Each group will present a summary of their discussion, emphasizing insights on potential impacts and challenges of renewable energy adoption.

How assignment will be adapted in online format
For this course, we'll adapt our discussions to an online format using the course's discussion board instead of in-person meetings. This change allows students to engage with the material and each other more flexibly and inclusively. Students will read the specified materials on renewable energy from the Department of Energy's website and then share their insights and responses on the discussion board. This format encourages ongoing interaction, as students can post their thoughts, respond to peers, and explore different perspectives throughout the week, all within a structured online environment. This approach not only maintains but enhances student engagement by leveraging the accessibility and convenience of digital communication.

Assignment Type
Writing

In-class and/or outside of class
In-class
Outside of class

Formative or Summative
Summative

Assignment
Lab Report Assignment: Gearbox Design and Analysis
Objective: Apply principles of mechanical systems by designing, constructing, and evaluating a gearbox that alters rotational speeds under defined constraints.

Lab Activity:

Design and Build: Design and build a gearbox using gears. The gearbox should be capable of changing the input rotational speed to two different output speeds based on gear ratios.

Constraints:
The gearbox must achieve a gear ratio that results in at least a 2:1 speed reduction and a 1:2 speed increase.
All gears used must be standard sizes available in the lab kit.

Testing: Conduct tests to evaluate the efficiency and effectiveness of the gearbox in achieving the desired speed changes. Document input and output speeds, noting any losses due to mechanical inefficiencies such as friction.

Lab Report Guidelines:
Title Page: Include the report title, your name, date, and course details.
Abstract: Provide a brief summary of the purpose, key findings, and conclusions of your gearbox design.

Introduction:
Explain the significance of gear ratios and mechanical advantage in gearbox design.
State the objective of your gearbox to achieve specified speed changes under the given constraints.

Materials and Methods:
List materials used, focusing on the gears and any structural components.
Describe the design process with detailed diagrams or CAD drawings of the gearbox.
Outline the testing procedures, specifying how speed measurements were taken.

Results:
Present data in a clear format, possibly using tables or graphs to illustrate speed changes.
Discuss the performance of the gearbox and any deviations from expected outcomes.

Discussion:
Analyze the implications of your results in the context of gear ratio theories.
Identify any unforeseen challenges encountered during testing and their possible solutions.
Suggest improvements for enhancing gearbox efficiency and versatility.

Conclusion:
Summarize the project’s successes and areas for future exploration.
Reflect on the learning outcomes and potential real-world applications of your gearbox.

How assignment will be adapted in online format

To adapt the gearbox design lab to an online environment while maintaining hands-on experience, students will be required to use a specific lab kit available for check out at the makerspace. Alternatively, students can purchase their own kits. This kit includes various gears and other mechanical components necessary for constructing the gearbox. Students will design their gearbox using the constraints provided in the assignment, assemble it at home, and conduct the necessary tests to evaluate its performance. They will document their process using photos and videos to capture the setup and testing phases, which will be included in their lab reports. Students will submit their reports digitally through the course’s learning management system. This method ensures that even in a remote learning scenario, students engage directly with physical components, thereby reinforcing their understanding of mechanical systems in a tangible way.

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

Writing Assignment: Arduino LED State Machine Design

Objective: Design, implement, and document a state machine using an Arduino to control various light modes on five LEDs. The state transitions will be triggered by a button press.

Project Description:
Functionality: Create a state machine that manages five different LED light modes: chase, blink, alternate, all on, and all off. Each mode should be accessible and switchable via a single button press.
Assignment Tasks:
System Design:

Define Light Modes:
Chase: LEDs light up one after the other in a sequence.
Blink: All LEDs blink on and off simultaneously.
Alternate: LEDs alternate between on and off states in a checkerboard pattern.
All On: All LEDs are turned on together.
All Off: All LEDs are turned off.
Sketch the State Diagram: Draw a diagram detailing the states (light modes) and the transitions triggered by the button press.
Arduino Setup and Programming:

Hardware Assembly: List the components (Arduino board, LEDs, resistors, button, wiring) and describe how they are connected.
Programming: Develop the code to control the LEDs based on the state machine design. Ensure that the button press leads to a change in the LED state according to the diagram.
Testing and Refinement:

Test the System: Systematically test each light mode to ensure accurate functioning. Record the behavior and any deviations from expected outcomes.
Iterate: Modify the setup or code as necessary based on testing feedback to ensure all modes work correctly and reliably.
Report Guidelines:
Introduction:

Explain the concept of a state machine and its application in controlling LED light modes.
State the purpose of your specific project.
Materials and Methods:

Provide a detailed account of the materials used and the assembly process.
Include the state diagram and annotated snippets of your Arduino code.
Results:

Describe how each light mode performed during tests.
Include observations or measurements taken during testing.
Discussion:

Evaluate the performance of your state machine in terms of responsiveness and accuracy.
Discuss challenges faced during the project, particularly any issues with state transitions or hardware setup.
Suggest improvements or additional features that could enhance the project.

Conclusion:

Summarize the achievements of the project and the key learnings.
Reflect on the process and outcome of implementing a state machine with Arduino.

How assignment will be adapted in online format

To adapt the Arduino LED state machine project for an online course, students will need to purchase an arduino project kit, including all necessary components. Instructional videos will guide the assembly and programming process. Students will document their projects through detailed reports and video demonstrations, submitted digitally, with virtual presentations allowing for real-time feedback and peer interaction. This setup ensures that the hands-on learning experience is preserved and adapted effectively for a remote learning environment.

Videos of the equipment working as intended will be required along with all code.

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

Journal Entry: The Role of Diverse Teams in Engineering

Objective:
Reflect on how diverse teams can impact engineering projects, particularly in fostering innovation, effective problem-solving, and improved outcomes. Connect the value of diversity in team composition with real-world engineering challenges.

Assignment Description:
Write a short journal entry about the importance of having diverse teams in engineering. Consider how different types of diversity —such as cultural background, gender identity, fields of study, professional expertise, nationality, socioeconomic status, and life experiences—can bring unique perspectives and skills that enhance innovation and problem-solving. Connect your reflection to topics discussed in class, such as the design process, energy systems, or materials selection, and think about how diverse teams could influence these areas.

Disc:
Prompt:
"Reflect on the importance of diverse teams in engineering. How can having team members with different backgrounds, perspectives, and experiences—such as differences in ethnicity, gender, academic major, department, or nationality—lead to better outcomes in engineering projects? Choose one aspect of our course content—such as the design process, energy systems, or materials selection —and discuss how diversity within a team could enhance the approach to this topic. What unique strengths can diverse teams bring to problem-solving and innovation in engineering? Use an example from our course materials or a real-world engineering project to support your reflection."

Instructions:
Length: Write a 200-300 word journal entry.

Focus: Discuss how diverse teams can impact a specific area of engineering, such as the design process or energy systems, and how these diverse perspectives contribute to innovation and better problem-solving.

Examples: Use one example from our course discussions, such as the benefits of diverse perspectives in designing more inclusive energy solutions, to support your reflection.

How assignment will be adapted in online format

In an online format, this journal entry assignment will be adapted into a discussion board activity on the course's CMS. Students will post their reflections on the discussion board, allowing them to share their insights on the importance of diverse teams in engineering with their classmates. This setup fosters a collaborative environment where students can engage in meaningful conversations, read different perspectives, and respond to each other's reflections. The asynchronous nature of the discussion board enables flexibility, allowing students to participate at their own pace and in their own time zones. All resources and instructions will be accessible through the CMS, ensuring compatibility with screen readers and other assistive technologies, thereby supporting an inclusive and equitable learning experience.

Course Materials

Textbooks

Eide, Arvid; Jenison, Roland; Northrup, Larry; Mickelson, Steven (2022). Engineering Fundamentals and Problem Solving 8th Edition McGraw Hill. ISBN10: 1264153554 | ISBN13: 9781264153558

Moaveni, Saeed (2024). Engineering Fundamentals: An Introduction to Engineering, 7th Edition Cenage Learning. ISBN: 9780357684412

Class Size Information

Class Size

32

Class Size Category

G - Large lab 32

Diversity and Inclusion

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

The course integrates diversity and inclusion by beginning with a dedicated segment on the importance of diverse perspectives in enhancing innovation and teamwork within engineering. This theme extends through modules like Multinational Engineering, which highlights global challenges and cultural nuances, and Communication & Documentation Skills, emphasizing culturally competent communication. Group projects encourage collaboration among diverse peers, mirroring real-world environments, while statistical modules utilize varied data sets to demonstrate the impacts of inclusive analysis. These elements, combined with case studies and testing protocols that consider diverse user groups, ensure students appreciate and apply DEI principles in their engineering practices.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

This engineering course supports diverse learners by offering varied assignments, including hands-on Arduino projects, written reports, and collaborative discussions, catering to different learning styles. Instruction combines live and recorded videos with subtitles, along with interactive simulations, to accommodate varied educational needs. Evaluations mix practical demonstrations, peer reviews, and exams to assess a broad range of abilities. Global engineering examples and interactive elements like discussion boards and group projects enrich the learning experience, ensuring all students—regardless of their backgrounds—can engage meaningfully and equitably.

Interactions

Explain how the course will incorporate student-to-student interaction.

Student-to-student interaction includes collaborative problem-solving and project-based activities. For example, students will work together on designing a control system using simulation software such as TinkerCAD, or OrCAD. They will use virtual tools like Google Docs for shared research notes and discussions boards. Peer reviews on discussion boards will enable feedback on design proposals and analysis of materials testing results, fostering a collaborative environment for applying engineering concepts.

Explain how the course will incorporate instructor-to-student interaction.

Instructor-to-student interaction involves weekly video demonstrations of concepts like stress analysis in materials or control systems for energy projects. Detailed feedback is provided on lab reports, such as virtual materials testing or energy system simulations. Virtual office hours on via video conferencing such as Zoom to offer individualized support, and announcements keep students updated on deadlines for projects and upcoming lab activities.

Explain how the course will incorporate student-to-content interaction.

Students engage with content through interactive simulations, virtual lab exercises, and multimedia presentations. Activities include a virtual materials testing lab to explore properties like tensile strength using simulation tools, and interactive modules where students model energy flow through renewable systems. Recorded lectures on topics such as energy efficiency and control systems complement these hands-on experiences, allowing for flexible, self-paced learning.

Explain how the course will incorporate student-to-self interaction (metacognitive).

This course emphasizes metacognitive practices through assignments that prompt students to reflect on their learning process and adjust their strategies. For example, after completing the virtual lab on control systems, students will write a short reflection on how they applied theoretical concepts to configure a virtual system and what challenges they faced. These reflections encourage students to consider how their approach could be improved in future projects. Self-assessment quizzes, such as those covering key formulas in statics or efficiency calculations for different energy sources, help students gauge their understanding before moving on to more complex concepts. Additionally, as students progress through a multi-step design project—such as designing a prototype for a sustainable building energy system—they will have opportunities to revise their work based on instructor feedback, fostering a mindset of continuous improvement and deeper engagement with the engineering design process.

Key: 1485