ENGR-185: ENGINEERING DYNAMICS

Effective Term
Fall 2024

BOT Approval Date
12/14/2023

Discipline
ENGR - Engineering Technology

Course Number
185

Course Title
Engineering Dynamics

Short Title
Engineering Dynamics

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

Units

Lecture Units
3.00

Total Units
3

Hours

Lecture Contact Hours
48-54

Out of Class Hours Lecture
96-108

Total Contact Hours
48 - 54

Total Out of Class Hours
96 - 108

Total Student Learning Hours
144 - 162

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.

C-ID (Admin Only)

C-ID ENGR 230

Catalog Description

This course explores particle and rigid body dynamics principles in engineering applications. Students learn kinematics, kinetics, vector mathematics, coordinate systems, Newton's laws, work-energy, impulse-momentum, moments of inertia, Euler's equations, and vibration analysis. The course emphasizes mathematical modeling, problem-solving, and real-world applications.

Requisites

Prerequisite(s)

Prerequisite(s) (must be taken before)
ENGR-181 (with a grade of C or better).

Codes

TOP Code (CB 03)

0901.00 - Engineering, General (requires Calculus) (Transfer)

CIP Code

14.0102 - Pre-Engineering. - 14.0102 - Pre-Engineering.

Repeatability Code

No

Grading Option

Letter grade OR P/NP

Learning Objectives

Learning Objectives

Learning Objective
1. Develop a strong understanding of the principles of particle and rigid body dynamics, including kinematics and kinetics, and their relevance in engineering applications.
2. Master the use of vector mathematics and various coordinate systems to analyze and solve complex engineering problems involving motion and forces.

3. Apply Newton's laws of motion, work-energy, and impulse-momentum principles to predict the behavior of particles, rigid bodies, and mechanical systems.
4. Analyze and evaluate the performance of planar mechanisms, including force analysis, static and dynamic balancing, and friction considerations.
5. Gain proficiency in analyzing vibrations, time response, and moments of inertia in engineering systems, enhancing the ability to design effective and efficient mechanical systems.
6. Apply strategies for assembling inclusive teams that respect and integrate gender, ethnicity, and cultural diversity, while addressing unconscious bias in engineering, to enhance innovation and problem-solving through a broad spectrum of perspectives and effective communication.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will demonstrate a strong understanding of particle and rigid body dynamics principles and their applications in engineering.
2. Students will effectively utilize vector mathematics and various coordinate systems to analyze and solve complex engineering problems involving motion and forces.
3. Students will apply Newton's laws of motion, work-energy, and impulse-momentum principles to predict the behavior of particles, rigid bodies, and mechanical systems.
4. Students will analyze the performance of planar mechanisms, including force analysis, static and dynamic balancing, and friction considerations, to optimize mechanical systems.
5. Students will proficiently evaluate vibrations, time response, and moments of inertia in engineering systems to enhance the design of efficient and effective mechanical systems.

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 or improve 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

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.

Content

Course Lecture Content

1. Introduction to Vector Dynamics and Diversity in Engineering
    a. Engineering Problem-Solving Methodology:
        i. Illustrations: Draw a clear, accurate diagram.
        ii. Givens: List all known values and information.
        iii. Unknowns: State what you are solving for.
        iv. Equations and Laws: List relevant equations and principles.
        v. Solution: Solve step by step, showing your work.
        vi. Reflection: Write a brief reflection on the problem-solving process.
    b. Basic concepts of vector dynamics
    c. Importance of vector dynamics in engineering
    d. Overview of diversity in engineering

        i. The role of diverse teams in fostering innovation and problem-solving
        ii. Importance of effective multinational communication in engineering projects
        iii. Addressing unconscious bias and promoting inclusive work environments
2. Vector Mathematics and Historical Contributions
    a. Vector addition and subtraction
    b. Scalar and vector multiplication
    c. Dot and cross products
    d. Coordinate systems: Cartesian, Normal and Tangential, and Polar
3. Kinematics of Particles and Katherine Johnson's Contributions
    a. Position, velocity, and acceleration vectors
    b. Rectilinear and curvilinear motion
    c. Relative motion analysis
    d. Katherine Johnson's work in orbital mechanics
4. Kinetics of Particles and Sophie Germain's Contributions
    a. Newton's laws of motion
    b. Work-energy principle
    c. Impulse-momentum principle
    d. Central force motion
    e. Sophie Germain's work in elasticity theory
5. Systems of Particles and Srinivasa Ramanujan's Contributions
    a. Systems of particles
    b. Conservation of linear and angular momentum
    c. Direct and oblique central impact
    d. Srinivasa Ramanujan's work in mathematical analysis
6. Kinematics of Rigid Bodies
    a. Rotation and translation
    b. Angular velocity and acceleration
    c. Coriolis acceleration
7. Kinetics of Rigid Bodies
    a. Equations of motion for rigid bodies
    b. Moments and products of inertia
    c. Euler's equations of motion
    d. Emmy Noether's theorem and conservation laws
8. Planar Kinematics of Mechanisms
    a. Mechanism types and classification
    b. Displacement, velocity, and acceleration analysis of mechanisms
    c. Graphical and analytical methods
9. Planar Kinetics of Mechanisms and Mary Jackson's Contributions
    a. Force analysis of mechanisms
    b. Static and dynamic balancing
    c. Friction in mechanisms
    d. Mary Jackson's work in aerospace engineering
10. Vibrations and Time Response
    a. Free and forced vibrations of particles and rigid bodies
    b. Damped and undamped vibrations
    c. Time response analysis
11. Three-dimensional Kinematics of Rigid Bodies
    a. Euler angles and rotation matrices
    b. Angular velocity and acceleration in 3D
12. Three-dimensional Kinetics of Rigid Bodies
    a. Equations of motion in 3D
    b. Angular momentum and kinetic energy in 3D
13. Engineering Applications, Problem Solving, and DEI
    a. Case studies of engineering problems involving vector dynamics
    b. Design considerations for mechanical systems
    c. Introduction to computational tools for vector dynamics analysis

d. Building inclusive teams and fostering collaboration in engineering
   i. Strategies for creating diverse and inclusive teams
   ii. Encouraging open communication and active listening
   iii. Addressing and mitigating unconscious biases in team dynamics
   iv. Promoting a growth mindset and continuous learning within the team

Methods of Instruction

Method

Lecture

Integration

The course will involve traditional lecture-style instruction to introduce and explain concepts, theories, and applications of vector dynamics in engineering.

DE Adaptations for MOI

Pre-recorded lectures will be made available online through the CMS with closed captioning and transcripts to ensure content is accessible to all students. Video materials will be screen reader-friendly, and interactive elements such as quizzes, polls, and short answer questions will be designed for full accessibility, including keyboard navigation and screen reader compatibility. This approach ensures that all students can engage with the course content and participate fully in the learning experience.

Method

Discussion

Integration

Group discussions will be conducted to encourage students to share their ideas, perspectives, and insights on the topics covered in the course. This will also provide an opportunity for students to engage with the DEI content and apply the strategies for building inclusive teams and addressing unconscious bias in engineering.

DE Adaptations for MOI

Discussion boards will be set up within the course management system (CMS) to facilitate asynchronous discussions on course topics. Instructors will provide prompts and questions to steer these discussions and may require students to engage with their peers by responding to a set number of posts. This structure is designed to promote active engagement and interaction among all students, with the CMS ensuring accessibility for a diverse range of needs.

Method

Group Projects

Integration

Group Projects: The course will involve group projects that require students to collaborate and apply their knowledge of vector dynamics to solve engineering problems. The projects will be designed to encourage diverse perspectives and inclusive practices, and to promote effective communication and problem-solving approaches.

DE Adaptations for MOI

Group projects can be managed asynchronously through the course management system (CMS), where students will be given detailed guidelines, expectations, and deadlines. The CMS can facilitate the creation of dedicated group spaces for collaboration and sharing of work. Additionally, virtual conferencing tools may be utilized for synchronous meetings as required, ensuring all students have the opportunity for real-time interaction and discussion.

Method

In-class Exercises

Integration

In-class exercises will be used to reinforce and apply the concepts covered in the lectures. These exercises will involve individual and group work and will help students develop problem-solving skills in vector dynamics.

DE Adaptations for MOI

In-class exercises will transition to asynchronous online activities, allowing students the flexibility to interact with course content at their convenience. This will include video demonstrations with closed captioning, simulations, and interactive modules, all tailored to be fully accessible via the course management system (CMS). The CMS will serve as a central hub for assignment submission, grading, and facilitating peer reviews and feedback, all within an accessible framework to guarantee that every student has an equal opportunity to engage and excel in the course.

Method

Reading

Integration

The course will require students to read relevant materials to gain a deeper understanding of the concepts covered in the course. The reading materials will include articles and case studies that address the DEI content and strategies for building inclusive teams and addressing unconscious bias in engineering.

DE Adaptations for MOI

Reading materials will be provided on the course management system (CMS) in multiple formats, including PDFs and web links, to accommodate diverse user needs. Accompanying the readings, accessible quizzes or short assignments will be available for students to complete, allowing instructors to gauge comprehension. These resources will be designed to ensure compatibility with various assistive technologies, ensuring all students can access and interact with the course content effectively.

Methods of Evaluation

Method

Exams/Tests

Integration

Exams and tests will be conducted periodically to assess students' mastery of the lecture material, including their ability to apply the concepts and principles covered in the course.

DE Adaptations for MOE

Exams and tests will be administered online through the course management system (CMS), utilizing a variety of question formats including multiple choice, short answer, and essay questions to accommodate different assessment strategies.

Method

Homework

Integration

Homework assignments will be assigned regularly to reinforce and apply the lecture material, and to develop problem-solving skills in vector dynamics. Homework assignments will be linked to the DEI content by providing opportunities for students to work in diverse teams, promote effective communication and collaboration, and appreciate the value of diversity in engineering.

DE Adaptations for MOE

Homework assignments can be submitted online via the course management system (CMS), supporting a range of file formats like PDFs, Word documents, or images. Instructors can utilize the CMS to deliver feedback and assign grades efficiently.

Method

Group Projects

Integration

Group projects will be assigned regularly to promote effective communication, collaboration, and problem-solving skills in vector dynamics. Group projects will be linked to the DEI content by encouraging diverse perspectives, promoting inclusive practices, and addressing unconscious bias in engineering.

DE Adaptations for MOE

Group projects can be assessed online through the course management system (CMS), employing rubrics or checklists to evaluate individual and collective contributions, work quality, and observance of deadlines. The CMS can also facilitate peer evaluations and feedback, fostering collaboration and active participation.

Method

Class Participation

Integration

Class participation will be assessed based on students' engagement in class discussions, activities, and exercises. Students will be encouraged to ask questions, provide feedback, and share their insights and perspectives on the lecture material. Participation will be linked to the DEI content by encouraging diverse perspectives and promoting effective communication and cultural sensitivity in class discussions.

DE Adaptations for MOE

Discussion Boards: Instructors can utilize the course management system (CMS) to establish discussion boards where students can post responses to prompts, share insights, and partake in asynchronous dialogues. These forums can be curated by the instructor to maintain focus and quality, encouraging diverse viewpoints, clear communication, and cultural awareness in line with DEI (Diversity, Equity, and Inclusion) principles.

Group Work: The CMS can also support group activities, allowing for both asynchronous and synchronous collaboration using tools like video conferencing software, project management platforms, and shared documents. Assessment can be guided by rubrics or checklists to evaluate contributions and work quality, with feedback provided through the CMS. Group tasks can further DEI goals by fostering an environment that values varied perspectives and effective teamwork.

Analytics: The CMS's analytics features can help instructors monitor student engagement with course materials, tracking metrics such as content interaction and participation levels.

Video Lecture Quizzes: Embedding quizzes within video lectures can be an interactive way for students to confirm their understanding of the material in real-time, promoting active engagement with the content.

Assignments

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

This assignment is a project that requires the students to apply what they have learned to model the motion of a rocket using numerical methods, and to write a report about it:

Assignment Title: Investigating Rocket Dynamics and Trajectory to Achieve Escape Velocity using Computational Software

Objective:
The objective of this assignment is for students to explore and analyze the dynamics of a rocket in three-dimensional space, utilizing computational software such as MATLAB, with the goal of achieving escape velocity. Students are expected to submit a report detailing their findings and the methods they used, covering all the required sections.

Assignment Instructions:

Introduction
Provide a brief overview of the rocket dynamics problem, the equations used to model the system, and the purpose of the investigation.

Equations and Assumptions
Present the force equation for the rocket as a function of time, along with any relevant assumptions made in the analysis. Include a description of how the equations were derived and how they relate to the principles covered in the course.

Force Equation:
$F(t) = F0 * (1 - t/T)$, where F0 is the initial force, T is the total burn time, and t is the time elapsed since the rocket ignition. This equation models a 2D force function that decreases linearly with time.

Rocket Parameters:

Mass (m): 25,000 kg
Total burn time (T): 120 seconds
Escape Velocity:
The escape velocity (v_e) from Earth is approximately 11.2 km/s (40,320 km/h). Calculate the initial force (F0) required to achieve escape velocity by the end of the burn time.

Computational Model
Develop a computational model using MATLAB or another suitable software. The model should take into account the force equation for the rocket, as well as any external forces, such as gravity. Discuss the numerical methods used in the simulation and their accuracy.
Tips for using MATLAB to solve the differential equation:

Use the ode45 function to solve the second-order differential equation that represents the rocket's motion. This function requires the differential equation to be rewritten as a system of first-order differential equations.
Define the force function F(t) as an anonymous function in MATLAB.
Calculate the acceleration of the rocket at each time step by dividing the force by the rocket's mass.
Integrate the acceleration twice to obtain the position of the rocket over time.
3D Trajectory Visualization
Use the computational model to simulate the rocket's path in 3D space until it reaches escape velocity. Create visualizations of the trajectory, including relevant plots and graphs that show the position, velocity, and acceleration of the rocket over time. Discuss the key features of the trajectory and any interesting patterns or behaviors observed.

Analysis and Discussion
Analyze the results of the simulation, comparing them to expectations based on the course material. Discuss any discrepancies between the simulated trajectory and theoretical predictions. Explain the factors that contributed to these differences, and suggest potential improvements to the computational model.

Conclusion
Summarize the main findings of the project, the challenges encountered, and the implications of the results for rocket design and engineering.

References
List all sources used in the development of the assignment, including textbooks, research articles, and online resources.

Submission Guidelines:

Ensure that your report covers all the required sections, with clear headings for each section.
Include relevant equations, tables, figures, and code snippets where necessary to support your analysis.
Use appropriate citation and referencing styles to give credit to your sources.
Ensure that your report is well-structured and easy to follow, with concise and clear explanations.

How assignment will be adapted in online format

In an online course, this course would be chunked into smaller milestone assignments to scaffold the students through to mimic the way the assignment would be scaffolded in a regular class setting.

The assignment would be very similar over all, simply uploaded to the CMS.

Assignment Type

Reading

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Formative

Assignment

Title: Reading Assignment and In-Class Discussion - Diversity, Equity, and Inclusion in Engineering
Objective: To help students understand the importance of diverse teams and inclusive work environments in engineering and engage in a thoughtful in-person discussion on the role of diversity, equity, and inclusion (DEI) in engineering.
Instructions for Students:
Read the following materials before the in-class discussion, focusing on the role of diversity, equity, and inclusion in engineering:
a. "Why Diversity is Key to the Future of Engineering" (University of Riverside MSE Blog)
URL: https://engineeringonline.ucr.edu/blog/why-diversity-is-key-to-the-future-of-engineering/
b. "The Importance of Diversity in Engineering" (EEWeb)
URL: https://www.eeweb.com/the-importance-of-diversity-in-engineering/
c. "Why Should I Care About Diversity in Engineering?" (National Society of Professional Engineers)
URL: https://www.nspe.org/resources/pe-magazine/july-2020/why-should-i-care-about-diversity-engineering
d. "Exploring the importance of diversity in engineering project teams (hatch)
URL: https://www.hatch.com/About-Us/Publications/Blogs/2022/04/Exploring-the-importance-of-diversity-in-engineering-project-teams

Reflect on the key takeaways, examples, and real-life stories presented in the readings.

Prepare to participate in an in-class discussion by considering the following questions:

a. What are the key benefits of diverse teams in engineering? Can you provide examples from the reading materials or your own experiences?
b. What strategies can be employed to create more diverse and inclusive engineering teams? Discuss any challenges you foresee and how they might be addressed.
c. How do you see the role of diversity, equity, and inclusion evolving in the engineering field in the future? What steps can individuals and organizations take to foster DEI in engineering?
Attend the in-class discussion session ready to share your thoughts, insights, and any questions you may have regarding the reading materials. Engage with your peers, listen actively, and contribute thoughtfully to the conversation.
Assessment:
The formative assessment will be based on your participation in the in-class discussion. Your instructor will evaluate your understanding of the reading materials, the thoughtfulness of your responses, your ability to connect the readings to real-life experiences, and your engagement in the discussion with your peers.

How assignment will be adapted in online format

The readings can be given through the CMS, and students will be given the chance to have their discussion through discussion boards. Requirements on initial posts, and replies to other students.

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

This course will contain a number of problem sets throughout that require students to analyze information given about a physical system, and then derive an equation motion, or determine an unknown physical property, or condition of a physical system. A few examples of such problems are given below:

A rotating platform is spinning counterclockwise with a constant angular velocity ω (rad/s). A particle is moving with a velocity v (m/s) along a radial path from the center of the platform towards the edge. The platform has a radius R (m). Determine the Coriolis acceleration of the particle at a distance r (m) from the center of the platform.

An aircraft is flying in a horizontal plane with a constant speed, v (m/s). The aircraft starts to change direction and enters a circular path with a radius, R (m). It takes the aircraft T (s) seconds to complete a 90-degree turn. Inside the cockpit, there is a small pendulum hanging from the ceiling, which acts as an indicator of the aircraft's movement. Determine the kinematic equations for the position, velocity, and acceleration of the pendulum's bob with respect to an observer on the ground.

Iron Man is flying horizontally at a constant speed of v0 (m/s) using his thruster boots. Suddenly, he needs to accelerate to save a falling airplane. To do so, he activates a new technology that ejects mass from his suit at a variable rate of m'(t) (kg/s) with an ejection speed of u (m/s) relative to the suit. Iron Man's initial mass is M (kg). Determine the velocity of Iron Man as a function of time after activating the new technology.

How assignment will be adapted in online format

Student submissions for problem sets can be digitized and uploaded to the course management system (CMS). Given the intricate nature of these problems, they are not suitable for standard quiz formats or automated grading systems within the CMS. It's essential for instructors to review the students' problem-solving approach and the clarity of their communication as demonstrated in their work. This process allows educators to assess not just the final answer, but the critical thinking and methodology applied by the student to reach their conclusion.

Course Materials

Textbooks

Engineering Mechanics: Dynamics, 6th Edition (2023), Anthony Bedford & Wallace Fowler |
9780138032944

Engineering Mechanics: Dynamics, 15th edition (2021) by Russell C. Hibbeler | 9780137514717

Class Size Information

Class Size

40

Class Size Category

A - Lecture/discussion 40

Diversity and Inclusion

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

The course content includes a section on DEI in engineering that covers the role of diverse teams in fostering innovation and problem-solving, the importance of effective multinational communication in engineering projects, and strategies for addressing unconscious bias and promoting inclusive work environments. The course also promotes diverse representation within engineering by highlighting the work of traditionally underrepresented groups in engineering, including sections on the historical contributions of Katherine G. Johnson, Emmy Noether, Mary Jackson, and Srinivasa Ramanujan to the field of engineering.

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

The instruction is designed to be inclusive and engaging for all students. For example, in-class exercises include discussions and activities that encourage students to reflect on their own cultural frameworks and biases and to appreciate the similarities and differences among cultures. Group projects require students to work collaboratively with individuals from diverse backgrounds, which provides an opportunity for students to engage with people who have different perspectives, beliefs, and values.

The assignments are designed to accommodate different learning styles and abilities, and provide multiple opportunities for students to demonstrate their understanding of the course material. The assignments within a class on vector dynamics have an emphasis on problem-solving and allow for creative paths to problem-solving.

Course Content: The course content is designed to be inclusive, and to provide examples and case studies that reflect the experiences of people from diverse backgrounds. The historical contributions of individuals from diverse backgrounds, such as Katherine G. Johnson, Emmy Noether, Mary Jackson, and Srinivasa Ramanujan, are highlighted in the course, promoting a sense of belonging among learners with diverse backgrounds.

Interactions between students and instructors are designed to be respectful, inclusive, and free from bias. Instructors model inclusive language and behavior, and encourage students to share their perspectives and experiences. Discussions and activities in the classroom provide opportunities for students to engage with one another and to learn from each other's experiences and perspectives. This is reinforced throughout the engineering program, as respectful communication and collaboration between diverse teams has been proven to drive innovation.

Interactions

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

The course will incorporate student-to-student interaction by incorporating group projects, peer review, and discussion forums. Group projects will allow students to collaborate on solving complex engineering dynamics problems, fostering teamwork and communication skills. Peer review of assignments and reports will give students the opportunity to learn from each other's strengths and weaknesses. Online discussion forums will provide a platform for students to ask questions, share resources, and engage in conversations about course content and real-world engineering applications.

Group projects provide opportunities for students to work collaboratively, share ideas, and learn from each other. The course will also have discussions (in person, or online through the CMS) where students can ask and answer questions, share their experiences, and provide feedback to each other.

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

Instructor-to-student interaction will be facilitated through lectures, office hours, and personalized feedback on assignments. In-person lectures will provide opportunities for students to ask questions and engage in discussions with the instructor. Office hours, both in-person and virtual (depending on modality), will allow students to seek clarification and guidance on course content and assignments. Instructors will also provide personalized feedback on assignments and reports, helping students identify areas for improvement and develop a deeper understanding of the course material.

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

Student-to-content interaction will be promoted through a variety of learning resources, including textbooks, lecture notes, video tutorials, and online simulations. Textbooks and lecture notes will provide the foundation for understanding engineering dynamics concepts. Video tutorials will offer step-by-step guidance on solving problems and using computational tools, such as MATLAB and C++. Online simulations will enable students to visualize and explore the behavior of dynamic systems, enhancing their understanding of the underlying principles. Regular quizzes and problem sets will also encourage students to engage with the content and apply their knowledge.

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

Student-to-self interaction will be fostered through self-assessment and reflective activities. The engineering analysis problem-solving method presented in this class requires students to break their analysis problems using the following steps, and methodologies. Course Lecture Content 1a details the engineering problem-solving methodology to be used for this course. This requires students to solve analysis problems with those steps. Most important to metacognition is a requirement that at the end of each problem, students write a reflection:

Reflection: After completing the problem, take a moment to reflect on your solution. Write one or two sentences discussing any challenges you faced, insights you gained, or connections you made to other concepts in the course. This reflection will help you reinforce your understanding and develop metacognitive skills that will benefit you in future problem-solving endeavors.

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