ME 206 Dynamics
Spring 2023

Catalog Data: ME 206 Dynamics - Lec 3 Hrs; Credit - 3 hrs.
Principles of systems in motion, Fundamental governing equations for particles and rigid bodies. Dynamics and the design problem. Vector representation of velocity and acceleration. Relative motion, work, energy, impulse, and momentum. Introduction to computer simulation techniques. Prerequisites: ME 205, MTH 126 (or concurrently), PHY 106(214).

Text: Vector Mechanics for Engineers - Dynamics, Beer, Johnston and Cornwell, 11th Ed, McGraw Hill, 2015 (ISBN-10: 0077687345 or ISBN-13 : 978-0077687342)

Instructor: Dr. Mohamed Seif, Ph.D., P.E.
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Class Times: 11:00 – 12:20 T & Th, Room: AJB Hall 119

Prerequisites by topic:

1. Trigonometric functions, identities and equations
2. Differentiation of algebraic, trigonometric, exponential and logarithmic functions
3. Applications of the derivative – maxima and minima problems
4. Integration of algebraic, trigonometric, exponential and logarithmic functions
5. Vectors – basic vector algebra, basic vector calculus and vector products
6. General Physics – application of Newton's Laws to simple problems in mechanics
7. Statics – Forces, moments and couples, free body diagrams, friction, equilibrium of rigid bodies and structures, centroids, and moment of inertia
8. Ability to visualize objects in three dimensions
9. Computer programming – MatLab, Fortran, Labview or other scientific language

Objectives:

Objective 1: To teach students the basic principles underlying the dynamics of particles and rigid bodies

Objective 2: To train students to identify, formulate and solve engineering problems in particle and rigid body dynamics

Objective 3: At the end of the course students are expected to learn at a level of analysis and synthesis, i.e. beyond repetition.

Topics:

1. Kinematics of particles – rectilinear and curvilinear motion
2. Kinetics of particles - Newton's second law
3. Kinetics of particles – energy and momentum methods
4. Systems of particles
5. Kinematics of rigid bodies -Translation, rotation, general plane motion, absolute and relative motion
6. Kinetics of rigid bodies - Plane motion: forces and accelerations
7. Kinetics of rigid bodies - Plane motion: energy and momentum methods
8. Introduction to computer simulation techniques to analyze dynamics problems

Course Learning Outcomes:

Upon the completion of the course, students will be able to

Course Learning Outcome	Program Outcomes	Assessment Tools
Understand rectilinear and curvilinear motion, Determine position, velocity and acceleration. Integration.	a, e	Homework, Quiz, Exam
Memorize and Apply Newton's second law	a, e	Homework, Quiz, Exams
Understand energy and momentum methods, analyze particle motions using these methods.	a, e	Homework, Quiz, Exams
Understand energy and momentum methods for system of particles.	a, e	Homework, Quiz, Exams
Understand rigid body motions. Determine, compute, and analyze translation and rotation.	a, e	Homework, Quiz, Exams
Analyze plane body motion, acceleration forces.	a, e	Homework, Quiz, Exams
Apply momentum and energy methods to analyze rigid body motion.	a, e	Homework, Quiz, Exams
Apply knowledge learned, design, evaluate, and analyze rigid body system	a, e	Project, Exams

Relation of course to Program Outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering	**X**
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs	
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	**X**
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	

Performance criteria:

Objective 1: Students will demonstrate knowledge by applying fundamental governing equations to aid in analysis and evaluation of particle and rigid body dynamic systems.

Objective 2: Students will demonstrate knowledge of the learning process at the level of system approach and synthesis through their homework, exams and open-ended project.

Instructional Methods:

(1). The instructor will present the materials through the use of lectures, visual aids, illustrations, and demonstrations, but the overall responsibility for learning falls upon each student.

(2) The instructor will offer free study sessions during his office hours to solve problems and review course material presented in class. These study sessions are not mandatory for students to attend. No new class material will be presented in these sessions.
(3) Attendance - Each student will be responsible for all class sessions. Absences from tests and other academic work may not be made up unless previous arrangements have been made with the instructor. Make-ups, if any, will be based on proven valid reasons.
(4) All assignments must be completed by the assigned deadline date. The assignments and deadline dates will be provided by the instructor.

Evaluation and Grading Policy:

1. Homework 25%. *Homework counts for 25% of the final grade. Homework is due by the second class meeting after it is assigned in class. All problems must be labeled, have the student's name at the right hand upper corner, beginning each problem statement at the top of a new page. The instructor may choose to select part or the complete set of problems assigned for each session. So each problem need to be clearly identified. All calculations must be done clearly stating the units of each variables, showing all the steps needed to arrive to the results. In this subject the procedure and the final result are both important. However, listing the "correct" answer without the correct supporting calculations will receive no credit. The final answer must be "boxed" and at the lower right corner of the paper. Homework will be accepted late the following day only once. Further late homework will not be accepted. In particular homework turned in after the official last day of classes will not be considered for grading. Homework is the student individual scholastic work, cheating and or plagiarism is an unethical conduct that will be subject of severe university disciplinary sanction if such behavior is demonstrated.*
2. Attendance: 5%. *Each student will be responsible for all class sessions. Absences from tests and other academic work may not be made up unless previous arrangements have been made with the instructor. Makeup, if any, will be based on proven valid reasons. Students are required to meet at class schedule and to sign the attendance sheet every class.*
3. Tests 40%. *Two tests of equal weight for 40% of the final grade. No make-up test will be given except under extreme circumstances and for proven valid reasons.*
4. Final Exam 30%.
5. *Grade Scale: A: 90-100, B: 80-89, C: 70-79, D: 60-69, a n d F: Below 60*
6. Honesty is expected in all work. Any indication of dishonesty will prove fatal with "F" grade in the final grade of the course.

Makeup: **No makeup exams/Labs allowed for unexcused absences.** For health-related absences, on provision of the medical excuse, a makeup exam may be arranged at the discretion of the instructor and with an Official University Excuse.