SAN JOSÉ STATE UNIVERSITY
Department of Mechanical Engineering

**ME 101 Dynamics**
**Spring 2020**

**Prerequisites:** CE 95 or CE 99 and Math 32 (with a grade of C- or better in each)

**Credit Units**: 3 units

**Instructors and Meeting Rooms**:

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|---|---|---|
| Section 1 (22255) | TR 1330-1445 | Room ENG 327: Prof. R. Agarwal, Office: E310 D |
| Section 2 (21806) | TR 1500-1615 | Room ENG 327: Prof. R. Agarwal, Office: E310 D |
| Section 3 (22825) | TR 1030-1145 | Room ENG 327: Prof. V. Viswanathan, Office: E310 E |
| Section 4 (23432) | MW 1200-1315 | Room ENG 327: Prof. P. Boylan-Ashraf, Office: E233 I |
| Section 5 (23433) | TR 1330-1445 | Room ENG 401: Prof. R Tsou, Office: E348 |

**Course Coordinator: Prof. R. Agarwal,** E310 D, email: raghu.agarwal@sjsu.edu

**Instructors Contact Information**
**Prof. R. Agarwal**, E 310D, email: raghu.agarwal@sjsu.edu
**Prof. V. Viswanathan**, E 310E, email: vimal.viswanathan@sjsu.edu
**Prof. P. Boylan-Ashraf**, E 233I, email: peggy.boylan-ashraf@sjsu.edu
**Prof. R. Tsou**, E 348, email: rctsou123@gmail.com

**Dr. Agarwal's Office Hours**: TR 1630 to 1730 and other times by appointment, E 310D

**Course Description:** Vector mechanics. Motion of particles and rigid bodies. Force, energy, and momentum principles applied to particles and rigid bodies.

**Required Text:** Vector Mechanics for Engineers – Dynamics, 12th Edition, McGraw Hill Education, by Beer, Johnston, Cornwell, and Self

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| **Grading Metrics**: | Homework | 5% (from Connect) |
| | Midterms | 25% (Particle Dynamics) |
| | Pre-Class Quizzes | 18% (Quizzes) |
| | Pre-Class Videos | 1% (Watch Video and Take a Quiz) |
| | In-Class Problems | 12% (Problem Solving and Quizzes) |
| | Clicker Quizzes | 1% (During Lecture Session) |
| | Learn Smart Reading | 3% |
| | Final Exam | 35% (Comprehensive) |

**Grading Scale**
95-100 A+, 90-94 A, 87-89 A-, 85-86 B+, 80-84 B, 77-79 B-, 75-76 C+,70-74 C, 67-69 C-, 65-66 D+, 60-64 D, 57-59 D-, Below 57 F

**Course Goals**
1. To learn fundamental concepts and principles of particle and rigid body motion kinematics.
2. To learn fundamental concepts and principles of particle and rigid body kinetics.
3. Application of Newton's Second Law to solve problems in particle and rigid body Dynamics.
4. Application of energy methods to solve problems in particle and rigid body Dynamics.
5. In the context of B.S. Mechanical Engineering program assessment, this course is intended to help students achieve ABET Student Outcome 3a: "an ability to apply knowledge of mathematics, science, and engineering." For more information on ABET Student Outcomes, please see http://www.abet.org/eac-criteria-2016-2017/.

**Student Learning Objectives**

Upon successful completion of this course, the student should be able to:
1. Distinguish kinematics and kinetics in Dynamics of solids.
2. Develop analytical models for a given dynamic situation using particle and rigid body Dynamics theories.
3. Characterize a motion to be rectilinear, curvilinear, planar rigid body Dynamics.
4. Describe the motion of a particle in terms of kinematics for general curvilinear motion as well as in moving reference frames.
5. Apply Newton's Second Law in solving particle and rigid body Dynamics problems.
6. Apply principle of energy and momentum principles in solving problems involving particles; application of energy method for 2D rigid bodies in motion.

**University Policies:**

Office of Graduate and Undergraduate Programs (GUP) **maintains university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc.**" You may find all syllabus related University Policies and resources information listed on GUP's Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/.

**Other Useful Information**

1. The passing grade in this course, for students majoring in Mechanical Engineering, is a C-. Those receiving a grade lower than C- will be placed on probation and will be allowed another attempt to pass the course with a grade of C- or better. Failure to pass this course in two successive attempts will result in disqualification from the ME program.

2. The online Canvas/McGraw Hill Connect pre-class activities and quizzes are an important part of learning the subject and an integral part of this course. You must complete the assigned activities to pass this course successfully.

3. Success in this course is also based on the expectation that students will spend, a minimum of nine hours per week. Since Dynamics is much more challenging, you would need to spend more time, depending on your fundamental understanding of math and physics courses.

4. There are two ME 180 Workshops scheduled to provide help with your homework and any questions you might have related to the concepts. The attendance is mandatory for those who have failed this course once before. The workshops are open to all sections. You are strongly encouraged to register and attend any one or more scheduled workshops that fit into your schedule. The add code for the workshops is available in the ME office. It's a one-unit CR/NC course; credit for the course will be given only if you attend 50% of the scheduled workshop meetings.

5. College of Engineering Student Success Center is a good source for getting advice on learning and career opportunities. You can get more information on their web site at: http://engineering.sjsu.edu/students/success-center.

6. Schedule is subject to change with fair notice via announcement in class or via course website.

***NOTE: The assignments are time-sensitive and should be completed and submitted by the due date. There are no credits given for any work submitted after the due date.***

## Overview of the Course Structure: This course has three main components:

### a. Pre-Class Activities

To be successful in this course (and in general, any course), you must come prepared in the regularly scheduled classes; you will better understand the material being covered in the class. The pre-class activities will require you to spend about **an hour** of reading and working on the quizzes (depending on your math and physics background, it may take less or more time). You will be asked to read the assigned material via McGraw Hill's Connect LearnSmart System before coming to the class, along with answering quiz questions. You are not expected to learn everything by the Pre-Class assignment but expected to get familiar with the basic concepts outlined in the material. The pre-class quizzes are mostly consisting of the conceptual questions from your Dynamics textbook, and some additional questions added by your instructor. The

questions are simple and designed to quiz your basic understanding of the material, which will be covered later in the class.

**b. In-Class Activities**

There are no formal lectures in the class. The goal of the class activities is to discuss and clarify the basic concepts and apply the theory by working on problems individually and in small groups. Also, you get the opportunity to ask the instructor questions and get help on the problems being presented in the class. This session also includes the scheduled Clicker Quizzes and midterm exams.

**c. Post-Class Activities**

You will be assigned two or three problems to be worked on individually. You can get help on this homework or for any other questions by attending one or both of the scheduled Dynamics workshops.

NOTE: The activities described above are intended for you to get familiar with the subject and learn the concepts. They are intentionally designed to encourage you to learn the material without getting discouraged and reward you with easy scoring for your effort. However, to master the material, you must spend substantial amount of time outside the class to go over the concepts discussed in the class and then work the assigned homework problems. The example problems in the text are excellent source of learning and checking your problem-solving skill. ***Since the midterm and final exams are closed-book and closed- notes, they aren't as easy to score high marks as the pre-class and in-class activities; they are much more challenging and require you to have thorough understanding of the material***.

# ME 101 Dynamics

## *Course Schedule Spring 2020*

***(The weekly schedule is tentative and subject to change)***

**Homework will be assigned in the McGraw Hill Connect website. Access code must be purchased to use the website. All the assignments will be posted in Canvas.**

| **Lectures: Monday - Week of** | **Topic** | **LS** | **Quiz** | **HW** |
|---|---|---|---|---|
| January 23 | Introduction | | | |
| January 27 | Chapter 11.1: Rectilinear Motion of Particles | | | |
| | Chapter 11.2: Uniformly Accelerated Motion | | | |
| February 3 | Chapter 11.2: Motion of Pulleys | | | |
| | Chapter 11.3: Graphical Method | | | |
| February 10 | Chapter 11.4: Curvilinear Motion - Motion of Projectiles | | | |
| | Chapter 11.5: Tangential and Normal Coordinates | | | |
| February 17 | Chapter 11.5: Radial and Transverse Coordinates | | | |
| | Chapter 12.1: Newton's 2nd Law, Rectilinear Motion | | | |
| February 24 | Chapter 12.1: Newton's 2nd Law, Curved Motion | | | |
| | Chapter 12.2: Angular Momentum | | | |
| March 2 | Chapter 13.1: Energy method | | | |
| | Chapter 13.2: Conservation of Energy method | | | |
| March 9 | Chapter 13.3: Impulse and Momentum | | | |
| | Chapter 13.4: Impact, Direct Central Impact | | | |
| March 16 | Chapter 13.4: Impact, Oblique Impact | | | |
| | **Midterm Exam** | | | |
| March 23 | Chapter 15.1: Translation and Rotation of Rigid Bodies | | | |
| | Chapter 15.2: Absolute and Relative Motion of Rigid Bodies | | | |
| March 30- April 3 | **SPRING RECESS** | | | |
| | **SPRING RECESS** | | | |
| April 6 | Chapter 15.2: Absolute and Relative Motion of Rigid Bodies | | | |
| | Chapter 15.3: Instantaneous Center | | | |
| April 13 | Chapter 15.4: General Plane Motion, Acceleration | | | |
| | Chapter 16.1: Kinetics of Rigid Bodies | | | |
| April 20 | Chapter 16.1: Kinetics of Rigid Bodies | | | |
| | Chapter 16:2: Constrained Plane Motion | | | |
| April 27 | Chapter 16:2: Constrained Plane Motion | | | |
| | Chapter 16:2: Constrained Plane Motion | | | |
| May 4 | Chapter 17: Energy Method | | | |
| | Review | | | |
| May 11 | **Last Day of Instructions** | | | |
| May 20 | **Final Examinations - Comprehensive: 8:00 – 10:00 AM** | | | |

***IMPORTANT NOTE: The Final Exam is closed-book, closed-note, and common to all the sections and is scheduled for May 20, 2020***

**Important Dates:**
January 23: First day of instruction
February 11: Last day to add a course
March 30 – April 3: Spring Recess
May 11: Last day of Instructions
May 20: Final Exam

NOTE 2: The final exam is common to all sections and will be given on the Final Exam Make-up day: May 20, 2020. ***You must plan your travel and other commitments accordingly. A make-up exam is allowed only for the university approved excuses. An "I" grade will be assigned to those who do not qualify for the approved excuses and are unable to take the exam as scheduled.***

NOTE 3: **Extra Help**: There are two workshops (ME 180) scheduled to help you with your both homework assignments and the fundamental concepts of Dynamics. You can attend one or both the workshops, and also, get help on one-on-one with the tutors by making an appointment.

NOTE 4: You must satisfy the pre-requisites listed above. Submit a hardcopy of the courses that satisfy the requirement. Make sure to highlight the courses. Email attachment is not acceptable.