San José State University
Department of Mechanical Engineering
ME 243 – Vibration of Mechanical Systems, Spring 2022

Course and Contact Information

Instructor: Dr. Amir Armani

Lecture: Mo We 18:00-19:15

Classroom: Eng 303

Telephone: (408) 924-8354

Email: amir.armani@sjsu.edu

Office Hours: Mo We 16:30-17:30

Prerequisite: BSME or BSAE & Consent of the instructor (Must have a course in Vibrations - ME147 or Equivalent**, and Applied Engineering Analysis - ME130** or Equivalent**)**

Course Format and Classroom Protocol
The course relies on lecture materials presented in class. Class participation and attendance are strongly encouraged. Students should attend all classes and take class notes to support their reading assignments.

Course Materials
Copies of the course materials including the syllabus, homework solutions, slides, and MATLAB codes will be available on Canvas.

Course Description
Introduction to Mechanical Vibrations, Free and Forced Response of Single-Degree-of-Freedom Linear Systems, Two-Degree-of-Freedom Systems, Multi-Degree-of-Freedom Systems, Equations of Motion for Linear Systems, Matrix Formulation, Harmonic Excitation, Frequency Response, Damping. Distributed Parameter or Continuous system, One-dimensional continua (rods, strings, Euler-Bernoulli Beams, Rayleigh Beams, Timoshenko beams). Two-dimensional continua (plates, membranes). Equations of Motion and solution to free and forced vibrations.

Required Text books (book is available online via our SJSU library):
Engineering Vibrations, *William J. Bottega*, *Second Edition, CRC Press/Taylor & Francis Group, 2015*
Other Reference Books: (both Acoustics books are available online via our SJSU library): **Acoustics: An Introduction to Its Physical Principles and Applications**, *Allan D. Pierce, The ASA Press, 2019*
Acoustics-A Textbook for Engineers and Physicists: Volume I: Fundamentals, *Ginsberg, Jerry H, The ASA Press, Springer, 2018*
Wave motion of elastic solids, *Graff K.F., Dover, 1975 (optional)*

Elements of Vibration Analysis, *Leonard Meirovitch, Second Edition, McGraw Hill, 1986 (optional)*

Assignments and Grading Policy
Course grade will be based on homework assignments, exams, and class participation. Homework assignments consist of regular written assignments and a couple of computer projects with MATLAB coding

Homework: 20%
Exam-1: 30%
Exam-2: 30%
Final Project: 20% (5% - Presentation (video and slides), 5% - Codes & Simulation Model, 10% - Report)

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation, studying or course related activities including but not limited to internships, labs, clinical practical. Other course structures will have equivalent workload expectations as described in the syllabus.

Course Goals

1. To learn fundamental concepts of mechanical vibration and sound.
2. To learn fundamental concepts of vibrations for linear systems.
3. To learn fundamental concepts of discrete models of continuous systems.
4. To learn applications of analytical and numerical methods to solve problems in vibration of mechanical systems.
5. To develop numerical analysis solutions for linear mechanical systems.

Student Learning Objectives

1. To fully understand the method of solution for systems with one degree of freedom: damp and undammed systems.
2. To be able to apply techniques for solving systems with modeling and approximate methods for free vibrations.
3. To be able to apply techniques for solving linear systems with characteristics- approximate methods for forced vibrations.
4. To be able to apply techniques for solving linear systems with higher degrees of freedom- approximate methods for free and forced vibrations.
5. To know how to deal with modeling of mechanical systems for vibrations.
6. To be able to use numerical methods to solve vibration problems.

Dropping and Adding
Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic calendar web page located at

http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.
Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

University Policies
Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

Tentative Course Schedule

Week	Topic
1	Intro
2	Review of 1 DOF Systems
3	Multi-DOF Systems
4	Dynamics: Newtonian Mechanics, Lagrange's Equations
5	Review of Free Vibrations of Undamped Systems
6	Free Vibrations of Damped Systems
7	Review of Forced Vibrations Undamped Systems
8	Forced Vibrations of Damped Systems
9	**Exam 1**
10	Intro to Acoustics
11	1D Continua: Dynamics
12	1D Continua: Free Vibrations
13	1D Continua: Forced Vibrations
14	2D Continua: Dynamics
15	2D Continua: Vibrations
16	Project Presentations