San José State University
Department of Mechanical Engineering
ME 147 – 03 (30629)
Dynamic Systems Vibration and Control
Spring 2022

Instructor: Dr. S.H. Zaidi
Lecture: TTh 9:00am to 10:15am, Class Code: 30629, Section-3 Classroom: ONLINE/ TBD
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Office Hours: TTh 4:15 pm to 5:15 pm (By appointment only)
Location: Class Room/online
Prerequisite: Grade of "C-" or better in ME130 (Undergraduate Students)

Course Description

Introduction to dynamic systems vibration and control including problem formulation, mathematical representation, and analysis. Damped and Undamped free and forced vibrations of single and multi-degree of freedom systems. Transient and forced response analysis. Vibration control and isolation. Discrete and continuous mass system formulation and dynamic response analysis. Dynamic system transfer function determination. Transient and Frequency response analysis. Stability Criterion. State Variable method. Feedback and feed forward compensation. Emphasis on engineering problems involving analysis & design.
Required Text Dynamic Systems Vibration and Control, By Fred Barez, Spring 2019
Reference Books
Rao V. Dukkipati and J. Srinivas, Textbook Of Mechanical Vibrations (Kindle pdf version).
Dorf R.C., Bishop R.H. 'Modern Control systems', Pearson Prentice Hall
Kelly, S. G., 'Fundamentals of Mechanical Vibrations'
Nise, N. S., 'Control Systems Engineering'

Assignments and Grading Policy

Homework 15% Due on Wednesday before lecture
Quizzes 15% on Wednesdays, look at the Course Schedule/Outline for dates
Test 1 20%
Test 2 20%
Final Exam 30%

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 Control Systems.
2. To learn fundamental concepts of vibrations & control for the linear systems.

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

Student Learning Objectives

1. To fully understand the method of solution for dynamic system vibrations with one degree of freedom: damp and undammed systems.
2. To be able to apply techniques for modeling of dynamic systems and controller design applying classical and modern control approaches.
3. To be able to apply techniques for analyzing stability of the linear dynamic systems.
4. To be able to apply techniques for designing controllers for dynamic systems.
5. To know how to deal with modeling of mechanical systems for vibrations and Control.
6. To be able to use numerical methods to solve control systems and vibration problems.

Classroom Protocol

Students should attend all classes and take class notes to support their reading assignments. No use of Cell phone is allowed in the class during the instruction.

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.

Week #	Topics Covered	Quizzes and Exams
1	Course organization. Principles of Mechanics. Intro to Vibrations Equation of Motion. Free Vibrations	
2	Natural Circular Frequency. Period of Oscillations	
2	Energy Method. Damped Systems	
3	Forced Vibrations. Undamped and Damped Vibration. Transmissibility	Quiz 1 (20 min)
3	Forced Vibrations. Undamped and Damped Vibration. Transmissibility	
4	Multi-degree of Freedom System	
4	Eigenvalues and Eigenvector	Quiz 2 (20 min)
5	Vibration Isolation. Vibration Absorbers	
5	Vibration Isolation. Vibration Absorbers	
6	Design for Vibration Control	
6	Test No.1 in class	Test No 1 (75 min)
7	Distributed Mass Systems	
7	Wave equation. Longitudinal & Transverse	
8	Vibrations, Flow-Induced Vibrations	
8	Vibrations, Flow-Induced Vibrations	Quiz 3 (20 min)
9	Intro to Control Systems. Open-loop and Closed-loop system transfer systems	
9	Open-loop and Closed-loop system transfer systems. Transfer Function	
10	Spring Break	
10	Spring Break	
11	Mathematical Modeling of Physical Systems. Mechanical, Hydraulic, Electrical, S-Plane	
11	Pole and Zero. System Stability Analysis. Routh-Hurwitz Criterion	Quiz 4 (20 min)
12	Time Domain Analysis. Transient and Steady-State Responses. Root Locus	
12	Time Domain Analysis. Transient and Steady-State Responses. Root Locus	
13	Test No.2 in class	Test No 2 (75 min)
13	State-Variable Method. Controller Types and Control Laws. Controller Design	
14	State-Variable Method. Controller Types and Control Laws. Controller Design	
14	Frequency Analysis. Nyquist Stability Analysis	Quiz 5 (20 min)

15	Frequency Analysis. Nyquist Stability Analysis	
15	Revision	
16	Revision	
16	Final Exam	2 hours and 15 minutes