San José State University
Department of Mechanical Engineering
ME 243 – Vibration of Mechanical Systems, Spring 2019

Course and Contact Information

Instructor: Dr. Feruza Amirkulova

Lecture: Tu Th 4:30PM - 5:45PM

Classroom: DMH 160 **(**Dudley Moorhead Hall 160)

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Office Hours: Tu Th 3:15pm to 4:15 pm in E310J

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. Use of cell-phones is not allowed except during taking quizzes using iClicker (see https://www.iclicker.com/students for instructions). Laptop computers and tablet are allowed for taking lecture notes on the front row only.

Course Materials
Copies of the course materials including the syllabus, homework solutions, slides, and MATLAB codes will be available on course webpage at 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
Engineering Vibrations, *William J. Bottega, Second Edition, CRC Press/Taylor & Francis Group, 2015*

Other Reference Books
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

Class participation: 5%

Homework: 20%

Midterm: 30%

Final: 45%

Homework will be assigned weekly on each Tuesday and is due on next Tuesday.
Homework will be graded and retuned the following week.
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.

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/.
Last Day to Drop Class: Tuesday February 5, 2019
Last Day to Add Class: Tuesday February 12, 2019
Holidays: April 1 2019 (Cesar Chavez Day) & April 1-5 2019 (Spring Recess)
Last Day of Instructions: Monday May 13, 2019

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.

Clicker Technology:

In this course, we will be using clicker technology to collect student responses to questions posted in class. Points will be awarded based on participation. Please do not purchase any clicker technologies, as they are free to SJSU students from iClicker.

Students are responsible for creating a free student account at www.iClicker.com, and adding this course to their account. Detailed instructions are available on the SJSU eCampus website. Please contact eCampus with any questions or issues with the iClicker technology.

ME 243 Vibration of Mechanical Systems
Spring 2019 Course Schedule/Outline

Week	Date	Lecture Topics	Sections in Text
1	1/24	Course organization. Introduction to Vibrations	
		REVIEW OF SINGLE DEGREE OF FREEDOM SYSTEMS	
2 - 3	1/29, 1/31, 2/05, 5/07	Equivalent systems, Free vibrations, Forced vibrations	Chapters 1-4
		DISCRETE MULTI-DEGREE OF FREEDOM SYSTEMS	
4	2/12, 2/14	Dynamics: Newtonian Mechanics, Lagrange's Equations	Chapter 6
5	2/19, 2/21	*Free vibrations:* (Review of) Undamped Systems	Chapter 7 Sections 7.1-7.3
6	2/ 26, 2/28	*Free vibrations:* Systems with General Viscous Damping Evaluations of Amplitudes and Phase Angles	Section 7.4 Section 7.5
7-8	3/05, 3/07, 3/12	*Forced Vibrations*: (Review of) Undamped Systems, Systems with Rayleigh Damping	Sections 8.2-8.6 Section 8.7
8-9	3/14, 3/19, 3/21	*Forced Vibrations*: Systems with General Viscous Damping	Section 8.8
		MIDTERM EXAM	
		ONE-DIMENSIONAL CONTINUA	
10	3/26, 3/28	*Dynamics*: of rods, strings, Euler-Bernoulli Beams and beam-columns, Rayleigh Beams, Timoshenko Beams, translating strings and beams. Hamilton's Principle	Chapter 9
11	4/02, 4/04	**NO CLASS, SRING RECESS**	
12-13	4/09, 4/11 4/16, 4/18	*Free vibrations*	Chapter 10
14	4/23, 4/25	*Forced Vibrations*	Chapter 11
		TWO - DIMENSIONAL CONTINUA	
15	4/30	*Dynamics:* membranes and plates	Chapter 12
15-16	5/02, 5/07	*Vibrations*: membranes, Von Karman plates, Kirchhoff plates	Chapter 13, 14
16	5/09	Mindlin Plate Theory	Chapter 13, 14
		FINAL EXAM	

NOTE: This is not a firm list. There may be additions or deletions during the semester