



California State University, Chico  
 Mechanical and Mechatronic Engineering and Advanced Manufacturing  
**MECH 424: Mechanical Vibrations**  
 Fall Semester 2021

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**Instructor:** Dr. Dennis O'Connor

**Office Hours:** O'Connell 417, Tuesday and Thursday, 10AM - Noon

**Contact:** 530-898-4829, [dmoconnor@csuchico.edu](mailto:dmoconnor@csuchico.edu)

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**Prerequisites:** MECH 320 Dynamics.

**Textbooks:** *Mechanical Vibrations* (6th Edition) by Singiresu S. Rao, Pearson 2017.

**Lecture:** Langdon 104, Tuesday and Thursday, 8:00 - 9:15AM.

**Grading:** Overall course grade will be based on homework and activities, project, and exams. Letter grades will be assigned according to the following table.

- ❖ Homework and Activities 20%
- ❖ Vibration Project 20%
- ❖ Exams 60%

[90,100]	A
[80,90)	B
[70,80)	C
[60,70)	D

**Homework:** Problem sets will be posted on the Blackboard class site and will be collected at the START of the class period on the due date specified. Late homework, including after the start of class, will not be graded. Work should be legible and the final answer of each problem enclosed in a box.

**Activities:** Each topic covered in class may have one or more associated activities in the form of an in-class paper assignment or take-home computer based simulation. All homework and activities will be of equal worth.

**Vibration Project:** The vibration project in MECH 424 will be a self-directed group assignment requiring the practice of developing a mechanical model and experimental validation. That is, groups will approximate the dynamic motion of a system/part with an equation of motion and observe its motion through simulation and experiment. Groups will have access to professional vibration instrumentation and equipment on a first come first serve basis. Additionally, most smart phones are equipped with vibration measuring sensors and may offer sufficient accuracy and data collection.

**Exams:** There will be two standard class exams and a two-hour final exam for the semester, all of equal worth, 20%. Exams will be open-book and open-note, paper only. For full credit, each answered question must demonstrate sufficient work and maintain correct units.

**Course Schedule:** The following table is a tentative course schedule outlining the chapters covered and approximate time for the Tests.

Week	Dates	Topics	Readings
1	Aug 23 - Aug 27	Ch.1 Fundamentals of Vibration	1.1 – 1.6
2	Aug 30 - Sept 3	...	1.7 – 1.12
3	Sept 6 - Sept 10	Ch.2 Free Vibration Single-DOF	2.1 – 2.6
4	Sept 13 - Sept 17	...	2.7 – 2.12
5	Sept 20 - Sept 24	Ch.3 Harmonically Excited Vibration	3.1 – 3.8
6	Sept 27 - Oct 1	...	3.9 – 3.15
7	Oct 4 - Oct 8	Exam 1 (Ch. 1,2,3)	
8	Oct 11 - Oct 15	Ch.4 Vibration Under General Forcing	4.1 – 4.5
9	Oct 18 - Oct 22	...	4.6 – 4.10
10	Oct 25 - Oct 29	Ch.5 Two-Degree-of-Freedom System	5.1 – 5.4
11	Nov 1 - Nov 5	...	5.5 – 5.9
12	Nov 8 - Nov 12	...	5.10 – 5.12
13	Nov 15 - Nov 19	Exam 2 (Ch. 4,5)	
14	Nov 22 - Nov 26	Thanksgiving	Break
15	Nov 29 - Dec 3	Special Topics	
16	Dec 6 - Dec 10	Special Topics	
17	Dec 13 - Dec 17	Final Exam (Comprehensive)	

**Course Objectives and Description:** Students will learn to develop mathematical models of mechanical systems to analyze and predict system performance in vibration response. Course coverage will include modeling of free and forced vibration in single and multiple degree-of-freedom systems, stability, resonance, equation solving, parametric investigations, vibration monitoring and control. Additionally, coverage will include vibration measurement and digital signal processing techniques to characterize system response and validate mechanical models. Students are expected to have an adequate working knowledge of computer programming and simulation such as with MATLAB.

**Academic Integrity:** Students are expected to be familiar with the University's Academic Integrity Policy. The policy on academic integrity and other resources related to student conduct can be found at: <http://www.csuchico.edu/sjd/integrity.shtml>.

**Americans with Disabilities Act:** If you need course adaptations or accommodations because of a disability or chronic illness, 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. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations. Accessibility Resource Center (530-898-5959) and Student Services Center ([arcdept@csuchico.edu](mailto:arcdept@csuchico.edu)).

**Student Learning Center:** The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The SLC is online at <http://www.csuchico.edu/slc>.

**Reminder:** The CSU requires students to be fully vaccinated against COVID-19 by September 30, 2021, unless you have an approved exemption. Currently, Chico State is requiring everyone on campus to wear an approved face covering in all indoor campus spaces. Accordingly, all students are required to wear an appropriate face mask covering the nose and mouth in order to participate in this course. Policies and requirements regarding COVID-19 are subject to change pursuant to campus, local, state and/or federal guidelines.

Please note that dishonesty relating to the vaccination policy and/or your failure to comply with any other COVID-19 related safety policy or mandate, including the face covering requirement, may result in disciplinary action against you through the office of Student Conduct, Rights and Responsibilities, which can include suspension or expulsion from the California State University system.

Individuals unable to wear a face covering due to a medical condition should contact the Accessibility Resource Center by phone at (530) 898-5959 or by email at [arcdept@csuchico.edu](mailto:arcdept@csuchico.edu).