UNIVERSITY OF CALIFORNIA
UCMERCED

Syllabus for ME140-01: Vibration and Control

Spring 2018
Instructor: Michael Brokowski

Designation:	ME 140-01: Vibration and Control
Catalog Description:	Review of dynamics for particle systems and rigid bodies. Vibration analysis of discrete mechanical systems with finite number of degrees of freedom systems and continuous structures such as beams and plates. Concepts of resonance, anti-resonance, damping, and modal coupling. Modal analysis. Concepts of feedback controls. Classical proportional, derivative and integral (PID) feedback controls of vibratory systems. Stability concept. Root locus and frequency domain design of feedback controls. Introduction of modern and digital control.
Text Books and Other Required Materials:	1. Mechanical Vibrations (5th ed., 2011) by S. S. Rao, Pearson Prentice Hall. 2. Feedback Control of Dynamic Systems (7th ed., 2014) by G. F. Franklin, J. D. Powell, and A. Emami-Naeini, Pearson Prentice Hall. 3. Lecture notes by the instructor
Course Objectives/ Student Learning Outcomes:	1.Learn skill to model mechanical systems by applying Newton's law and Lagrange's equation 2.Understand the limitation of the physical laws used in the mathematical model 3.Understand resonance, damping and forced response of vibratory systems. 4.Apply vibration analysis to engineering applications such as vibration isolation and vibration absorber 5.Learn how to apply linear algebra to conduct modal analysis of multi-degree-of-freedom systems and continuous structures 6.Learn the effect of m-c-k parameters on the vibration response, and how to use feedback controls to actively change the system parameters 7.Learn basic concepts of PID feedback controls including stability, root locus design, state space formulation and design. Learn the basic skill of vibration testing and feedback control experiments. 8.Validate theoretical prediction in the labs.
Program Learning Outcomes:	
Prerequisites by Topic:	Calculus, Ordinary Differential Equations, Complex Analysis, Linear Algebra, Statics and Dynamics.
Course Policies:	Laptops and other electronic devices (except calculator) are not permitted during lecture. Cell phones should be turned off during class. Homework assignments are due before start of class. Late homework submissions are not accepted. Makeup exams and homework are not allowed (Exceptions for emergences with official documents). Students arriving late to an exam or quiz will not be allowed to take it. Quizzes can be unannounced. It is students' responsibility to check their email and Catcourse for any course announcements or material on timely manner. Assigned reading material is mandatory and can be the subject of a quiz even if we

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	did not cover it in class yet. Late arrivals and early leave will be considered as absence. Insufficient attendance will lead to an F grade. You may discuss homework problems with your classmates, but you are responsible for your own work. You are encouraged to read the sections in the textbooks related to the covered topics prior to the lecture as well as after. If you miss a class due to personal emergency or medical reasons, please be sure to inform the instructor by e-mail. After an assignment grade has been posted online, students must see the instructor within one week if they wish to discuss the assignment and their work. University's rules on academic honesty concerning exams and individual assignments will be strictly enforced.
Academic Dishonesty Statement:	a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work. b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action. c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.
Disability Statement:	Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.
Topics:	Review of mathematical foundation, Vibration of SDOF Oscillators, Free, damped and forced vibrations, Vibration Analysis of MDOF Systems, Vibration absorber and isolation, Resonant frequencies, Normal modes, Damped and forced response, and Vibration of continuous structures including string, rod, beam, and plate. Introduction to feedback controls, Stability concepts, Transfer function and block diagram, PID control, Root locus and state space design Experimental validations of vibration analysis, real-time implementation of feedback controls.
Class/laboratory Schedule:	Lectures: MW 8:00-9:15am in KOLLIG 209 Labs: 3 Hours per week as scheduled

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Midterm/Final Exam Schedule:	In-class quizzes and homework, three midterm exams, Third midterm: M 8:00-11:00am May 07, 8:00-11:00am KOLLIG 209
Course Calendar:	
Professional Component:	
Assessment/Grading Policy:	Homework (10%) Lab Reports (30%) 3 Midterms (60%)
Coordinator:	Jian-Qiao Sun
Contact Information:	Instructor M. E. Brokowski AOA 146, mbrokowski@ucmerced.edu
Office Hours:	Office Hours AOA 146, MW 9:30-10:30 am or by appointment TA Ms. Akram Gholami Pareh Office Hours: TBA Mr. Taymaz Homayouni Office Hours: TBA