

ME 4501 Vibrations & Controls Lab (Section 01 and 02)

Fall 2023

Instructor

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**KENNESAW STATE
UNIVERSITY**

SOUTHERN POLYTECHNIC
COLLEGE OF ENGINEERING AND
ENGINEERING TECHNOLOGY
Department of Mechanical Engineering

Student Lab Assistants: Ujjwal Purimetla. upurimet@students.kennesaw.edu

Course Description

Catalog Description (Credit Hours: 1-0-3)

This is a laboratory course designed to complement the vibrations and controls topics also covered in lecture courses. Experimental study of one, two, and more degrees of freedom vibration, including effects of damping, free and forced vibrations, translational and torsional vibrations. Implementation of proportional, integral, and/or derivative control of dynamic systems.

One 3-hour lab/week

Prerequisites

- ENGR 3125: Machine Dynamics & Vibrations
- ME 3501: System Dynamics and Control Theory (can be taken concurrently)

If you do not meet the prerequisite requirements, you are expected to withdraw from this course. If it is discovered that a student is lacking in prerequisites (at any time during the semester), the instructor reserves the right to remove the student from the class and assign a grade of W (or WF if past the drop date).

Course Details

Term: Fall 2023

Course name: Vibrations & Controls Lab

Course number: ME 4501

Section number: 01

Meeting times: Tuesday 3:30—6:15pm

Room number: Q217 (Dynamics Lab)

Section number: 02

Meeting times: Monday 3:30—6:15pm

Course Learning Outcomes

By the end of this course, students should have demonstrated:

1. An ability to design and conduct experiments, as well as to analyze and interpret data.
2. Assess the validity of the experimental results and compare with theory.
3. An ability to communicate effectively by writing and submitting laboratory reports.
4. Calibrate sensors and understand the signal path and relationship to the physical variable.

Performance Indicators for Assessment of ME Program Student Outcomes:

Upon completion of the course, the students in ME 4501 should have

3. An ability to communicate effectively with a range of audiences. [*Reinforcement* of Communication Skill Area]
 - 3.1. Follow appropriate format for scientific (technical) writing and reporting about mechanical engineering topics.
 - 3.2. Utilize appropriate grammar and effectively articulate mechanical engineering design ideas or experiments.
 - 3.3. Deliver an oral presentation of professional quality and incorporate appropriate mechanical engineering concepts with supporting graphics in a clear and logical manner.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. [*Reinforcement* of Design Skill Area]
 - 4.2. Identify instances where mechanical design codes/standards/regulations or test standards may be used in the professional engineering context.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. [*Reinforcement* of Lab and Team Skills Area]
 - 5.1. Explicitly contribute to team processes such as providing leadership, collaborating with others, and seeking inclusive participation from all team members.
 - 5.2. As part of a team, establish design or experimental goals and objectives which are addressed by specific planning tasks.
 - 5.3. Complete assigned tasks to meet objectives in a timely manner using milestones or a Gantt chart.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. [*Assessment* of Lab and Team Skill Area]
 - 6.1. Carry out practical mechanical engineering experiments and acquire data, to complement previously learned engineering concepts and theory.
 - 6.2. Develop an experiment using appropriate measurement tools.
 - 6.3. Use Engineering judgement to draw conclusions or predications based appropriate analysis and interpretation of data.

Textbook

Any textbooks you used in ENGR 3125 and ME 4501 are good reference books. There are also online textbooks on these subjects available with KSU access through our Library.

A Lab Notebook is strongly recommended. This could be traditional paper lab books, custom made binders, or digital notebook (e.g., iPad with Good Notes App). Numbered pages are best (or # the pages yourself), a Table of Contents section, and a date on each page. Some find a 3-ring binder works well so they can add lab handouts and other real papers easily.

Important Dates

First day of class: Classes begin on Monday, August 14, 2023

Add/drop Period: Monday August 14 – Friday August 18

Last day to withdraw: Thursday, October 10

Last day of classes: Monday, December 4

Holiday & Break: Sep 4th and Nov 18—26

Final Exams: There is no final exam for this course. ☺

Course Delivery

KSU may shift the method of course delivery at any time during the semester in compliance with University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

Technical Requirements

Access to D2L is essential for the course material and instructions.

PC, Mac, or laptop required with a Web Camera for if classes were to move to online mode.

Grading Policy

Team Lab Report and Design Experiment Lab	45%
Individual lab assignments	45%
Peer Evaluation	5%
Attendance & Class Participation	5%
Total	100%

Grade Conversion: A: (90-100), B: (80-89), C: (70-79), D: (60-69), F: (0-59)

* Severe team performance deficiency can cause even lower grade or failing.

* A grade reduction will be assigned if any lab assignments are missed, or not turned in. (See section below about excused absences due to illness, etc., and how they can be made-up.) Same for not participating in team assignments (a peer evaluation average of less than 60%) will also drop your grade. I will work with you to make-up missed labs due to illness, etc.

* **A Failing grade (F) will be given if two or more of any assignments are not turned in, or two or more unexcused absences.**

Course Expectations

Attendance Policy

Students are expected to attend all classes for their full length. See section below on *Staying Home When Sick*.

Lab attendance is of paramount importance in this class, as it is difficult to make-up a lab. However, because of COVID I will work with you to makeup missed labs. You need to notify the professor ASAP for a missed lab. It is the student's responsibility to contact the Professor *prior* to the lab if s/he cannot attend the lab at the regular scheduled time. If you have a legitimate reason to miss the lab, see if you can attend a different lab section during the same week, or a makeup lab time if possible. See the instructor(s) ahead of time for their approval if

that is your plan. Missing 1 labs and/or assignment with unexcused absences (and not made-up) will result in a grade reduction. **Missing more than 2 labs (and no make-ups) will result in failing the course.** You may be able to make up one or two labs for illnesses, etc.

Students are expected to attend all classes for their full length. However, when your team has completed the experiment and have the data, you may leave early with permission.

Lab Safety

Review the full lab safety instruction for Q217, Dynamics Lab. A permanent copy will be attached near the door. A fire extinguisher is attached to the wall near the south door entrance of Q217, and the first aid kit is nearby. Never operate the motors on the ECP model 210 translational plant, ECP model 205 torsional plant, or wind-turbine simulator, without an instructor or lab assistant there. With the wind turbine apparatus, always use safety glasses (near first aid kit) when running, and stay clear of the rotating parts and turbine blades.

Final Exam

There is no final exam for this course.

Course Communication

Course material will be disseminated in D2L including lecture notes, lab handouts, lab report format, etc. All official course announcements, including instructions when class may be cancelled, will be posted in the D2L course news. Be sure to check D2L regularly.

Course Outline

* Note that **the instructor may update the schedule any time. See online version on D2L for updates.** See *Assignments* and Announcements on D2L for specific homework problems that may be collected for grading and their due dates. Dates are show all sections.

Lab #	Date	Description
	Aug 14-15	<i>No Lab (1st week drop and add)</i>
1	Aug 21-22	Instrumentation and Calibration of 1 accelerometer sensors and time domain analysis. Excel/MATLAB individual assignment.
2	Aug 28-29	SDOF Free undamped Vibration – 3 system changes – Team Report – due in 2 weeks –
	Sep 04-05	No Lab (Labor Day September 4th)
3	Sep 11-12	SDOF Torsional System – turned in on paper at end of lab.
4	Sep 18-19	Lab 4 – TBA
5	Sep 25-26	2-DOF Modes of Vibration
6	Oct 2-3	Free & Forced Vibration with mass-damper systems (SDOF) & Resonance
	Oct 9-10	No Lab
7	Oct 16-17	DC Servomotor System Identification (using Quanser Qube)
8	Oct 30-31	DC Servomotor Position Control (using Quanser Qube)
	Oct 30–31	No Lab

9	Nov 6-7	Steady-State Error of a DC Servomotor (using Quanser Qube)
10	Nov 13-14	PID Control of Rigid Body Motion
	Nov 21-22	<i>Thanksgiving and Fall Break!</i>
11	Nov 27-28	PID Control of a 2 nd Order System
		<i>Make-up Labs and time to complete final lab report</i>

KSU Academic Integrity Statement

Every KSU student is responsible for upholding the provisions of the [Student Code of Conduct](#), as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university’s policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an “informal” resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct’s minimum one semester suspension requirement.

Help Resources

Contacts to get Help

Student Help Desk: email studenthelpdesk@kennesaw.edu or call 470.578.3555 or go to this webpage for the [KSU Service Desk Portal](#) or go to: <https://uits.kennesaw.edu/>

All Federal, BOR and KSU Student Policies, and COVID-19 Policies

<https://cia.kennesaw.edu/instructional-resources/syllabus-policy.php>

KSU Student Resources (including Wellness and Academic)

<https://cia.kennesaw.edu/instructional-resources/syllabus-resources.php>

KSU Coronavirus (COVID-19) Information and Recourses

<https://coronavirus.kennesaw.edu/>

SPCEET College Tutoring Center

The Southern Polytechnic College offers drop-in tutoring at its Peer Mentoring Center, located in room Q 306. Tutors are available for a dozen subjects, including Graphics, Dynamics, and others. Online tutoring support may also be available. The complete list of supported courses, as well as a schedule of availability for each subject, can be found on the college website at engineering.kennesaw.edu/peer-mentoring-center. The center is open from 8 AM to 9 PM, Monday through Saturday. Email questions to peermentoringcenter@kennesaw.edu.

Basic Needs Security Statement

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact CARE Services (care.kennesaw.edu). The Campus Awareness, Resource and Empowerment (CARE) Services offers support to students who have experienced homelessness, food insecurity and/or the foster care system. Contact them at 470-578-5260 or careservices@kennesaw.edu for help.



KSU CARES

CAMPUS PANTRY

KSU CARES provides food for ANY KSU student. Pantries located on both campuses.

CASE MANAGEMENT

Case Managers provide students with individualized plans intended to empower the student to work towards their daily living needs.

KENNESAW CAMPUS

Carmichael Student Center, Room 172

MARIETTA CAMPUS

JMW Student Center, Room 184

care.kennesaw.edu | 470-578-5260

CARE always Cares



KENNESAW STATE UNIVERSITY

EMERGENCY ASSISTANCE PROGRAM

ELIGIBILITY

Open to all currently enrolled KSU students with a FAFSA on file.

FINANCIAL ASSISTANCE

Financial assistance is available on a case-by-case basis to assist students in overcoming unforeseen hardships.

CONNECTION TO RESOURCES

Beyond financial assistance, staff work to connect students with on-campus and off-campus resources to relieve financial burdens.

emergencyassistance.kennesaw.edu

CARE always Cares



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