

ENGR 3125 - Machine Dynamics and Vibrations

Instructor

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**KENNESAW STATE
UNIVERSITY**
SOUTHERN POLYTECHNIC
COLLEGE OF ENGINEERING AND
ENGINEERING TECHNOLOGY
Department of Mechanical Engineering

Course Description

Catalog Description (Credit Hours:3)

The analysis of motion, velocity, acceleration, and forces in mechanisms and machines. Emphasis is placed on the analytical methods suitable for computerized analysis as well as graphical methods for visualization and preliminary design studies. Also an introduction to vibration theory, including the modeling and analysis of oscillatory phenomena found in linear discrete and continuous mechanical systems.

Prerequisites

ENGR 3122, *Dynamics*, and ME 1311 MATLAB for Engineers with Application (or CSE 1321 and CSE 1321L)

Course Details

Course name: Machine Dynamics and Vibrations, ENGR 3125

Meeting Time: F-2-F, Please see the KSU Dynamic Schedule.

Learning Outcomes

By the end of this course, students should be able to:

1. Compute the natural frequency and analyze the free and forced responses of undamped and damped single-degree-of-freedom mechanical systems.
2. Compute the resonant frequency and predict the response for a machine with a rotating unbalance and /or base excitation.
3. Calculate the mobility of planar mechanisms.
4. Perform the kinematic analysis of vibratory systems, including linkages and geartrains.
5. Perform the kinetic analysis of mechanisms, and machines.

Topics covered

- Review kinematics and kinetics of particles.
- Vibration for mass-spring system, natural frequency.
- Rotational vibration (Systems involving pendulums).
- Finding the stiffness of complicated systems and real life components.
- Equation of motions for complicated vibratory systems.
- Damping in 1-DOF systems.
- Forced vibration (Applied force and also unbalanced rotation), and resonance.
- Forced vibration (Base Excitation)
- Fixed axis rotation kinematics and kinetics – wheels and gears.

- Geartrain kinematics, gear ratio.
- Kinematics of linkages – calculating instantaneous velocity – vector and scalar methods.
- Definition of linkages, mechanisms and machines.
- Mobility of links, and joints, and mechanisms.
- 4-bar mechanisms and Grashof condition.
- Velocity, and acceleration in linkages.

Textbook (OPTIONAL)

The lecture notes are provided and they are based on:

- Mechanical Vibrations by William J. Palm, 2007. ISBN: 9780471345558
- Dynamics and Vibrations, An introduction, by Magd Abdel Wahab, Wiley (2008) ISBN 978-0-470-72300-5.
- Engineering Mechanics, Dynamics, Hibbeler, any edition, and
- Design of Machinery, Robert L Norton, any edition.

Technical Requirements

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

Grading Policy

15-20%	Homework, Computer Project(s), Discussions
75-80%	Tests and Quizzes
5-7%	Attendance

Grade Conversion: [90 - 100% = A, 80 - 89% = B 70 - 79% = C 60 - 69% = D Below 60% = F]

Course Expectations

Attendance Policy

Attendance is mandatory. Attendance records are required by KSU (through early alerts and midterm grades), and excessive absences must be reported to the Office of the Registrar. Active class participation is also expected. Signing in for another student, or having another individual sign in on a student's behalf, constitutes a violation of the Academic Honesty Code.

Course Communication

Course material will be disseminated in D2L including lecture notes, video clips, etc. All official course announcements, will be posted in the D2L course news (announcements). Be sure to check D2L regularly. Review the Email/News Forwarding file in "Start Here" module. Review all other files which are placed there.

Assignments and tests' grades will be uploaded not later than 7-10 days. Students' emails will be replied within 24 hours. In case there is a delay in replying emails, please resend your email right away.

Tips for Effective Online Learning

For an online class, students can really enjoy the benefits of learning at your own pace and in whatever environment that you choose. Below are some tips for effective online learning:

- Check the D2L course website regularly. Always be aware of the current status of the course. It might be helpful to subscribe to the announcements within the News Tool, sign up for text message alerts, or subscribe to your posts within the Discussion Tool. By taking advantage of the tools within the environment and the posted learning material, you can maintain an enhanced learning experience.

- Work closely with your instructor. If you have any questions, please contact me immediately. The best way to contact me is via email, and you will be guaranteed to have a reply within 24 hours.
- Begin your work early. If you can start a task early, don't start late. Assuming you spend the same amount of time completing the task, starting later will be much more stressful than starting early. Never wait until the last minute to begin an assignment! You'll have no turnaround time if you need help or something happens.

Course Outline

This schedule is tentative; dates change based on the year and semester. Check this calendar frequently on D2L, as dates and assessments are subject to change. Please read the test descriptions on D2L before starting. For online assignments, quizzes, and tests, you must upload your handwritten solutions within the allotted time, or the assessment will not be graded.

Week- starting day	Chapters	Quiz/Computer Assignment/Test
Week1- Jan 6	Ch 1 of Palm's textbook	Review HW1 Problems (6, 11, 15). <i>Do "News Forwarding."</i>
Week2- Jan 13	Ch 1	Take Ch1- Assignment online quiz & submit Computer Assignment 1 (this week or next)
Week3- Jan 20	Ch 1- Ch 2	Review HW 2 Problems (20, 21, 26 and 28) Submit Assignment 2 (if any)
Week4- Jan 27	Ch 2	Beginning of this week Take Ch1 test (in class)
Week5- Feb 3	Ch 2	Take Ch 2 assignment (this week or next week)
Week6- Feb 10	Ch 2	
Week7- Feb 17	Ch 3 (Damped Vibration)	Take Ch 2 test (in class)
Week8- Feb 24	Ch 3	
Week9- March 3	Ch 3 (LD)	Ch 3 Test (in class) (This week or after the break)
Week10- March 10	Ch 4 (Forced Vibration)	Spring break
Week11- March 17	Ch 4 (Forced Vibration)	<i>Last day to Withdraw= March 28th</i>
Week12- March 24	Mobility, Kinematics of Linkages	Ch 4 Test (in class) (This week or next)
Week13- March 31	Kinematics of Linkages	<i>The order of the sections taught might get changed.</i>
Week14- April 7	Gears	
Week15- April 14	Gears/Kinetics of Linkages	
Week16- April 21	Kinetics of Linkages	
Week 17- April 28		Test 5 (online or in class) On Linkages, Gears & Mobility

COURSE OUTCOME MEASURES and ASSESSMENT

Measures and assessment of the outcomes will be made by:

- Exams and Quizzes
- 2-hour Final Exam (Might get omitted)
- Homework assignments, Computer Project(s), Discussions (Might be included)

QUIZZES & EXAMS

- Make-up exams or quizzes will be allowed *only* for excused absences. It is the student's responsibility to contact the Professor *prior* to the exam if s/he cannot attend the exam at the regular scheduled time.
- Quizzes may be announced or unannounced. There might be only tests from 5 chapters taught.

HOMEWORK

- Homework will be assigned but may or may not be graded.
- Late homework will be accepted but with a late penalty, 10-20% per weekday off. Plan to turn in all the problems, stapled together, even if only one problem was collected on the day it was due. If unable to go to class due to illness, etc., then scan and email, then turn in originals when possible--my office.
- It is your responsibility to do and understand the homework problems and concepts. Collaboration with other students is allowed, but copying is not. Seeing someone else's solution will not help you on the quizzes and exams.
- Homework will not be accepted unless it is printed neatly, in pencil. Another engineer should be able to follow your problem solution without the textbook, but it does not have to be a work of art.
- **Given:** Summarize the textbook problem statement, what is the problem about/for, redraw sketch in textbook if any, data
- **Find:** what are you trying to find/solve for
- **Solution:** draw model if needed, write equations first in variable form, any theory/assumptions, show your math. Include FBDs, MADs, Velocity Diagrams, etc., as needed. Cross out or erase mistakes.
- **BOX final numerical answer.** Include units. Don't have to box if "answer" is a graph or model/sketch.

EXPECTATIONS

- You are expected to check your email and D2L *daily*. I will communicate with you via your kennesaw.edu email account only.
- It is in your best interest to attend every class. Attendance records are required by the University (first 3 weeks) and excessive absences must be reported to the Office of the Registrar. Active class participation is also expected.
- **Kennesaw State has an Honor Code** and a procedure relating to when academic misconduct is alleged. All students should be aware of this.
- Questions regarding the grading of an exam, quiz, or assignment must be submitted *in writing* to the professor within *one week* from the date that the work was returned. Explain on post-it or cover sheet or on HW in different color pen where you think the grading error was made.

RECOMMENDATIONS

- Use a 3-ring binder for notes and homework. This will allow you to organize your lecture notes, homework,

quizzes and handout materials. Sometimes I will handout supplemental notes – in 3-hole punch when possible.

- As in every class, take comprehensive notes. Everything that the professor writes down, you should write in your notes. You should additionally take notes on some things that the professor verbalizes but does not write down. *Writing notes helps you learn!*
- Read the assigned readings *before* class and keep up with the homework problems.
- Visit the course website for important announcements, documents, reading and homework assignments, and other helpful information.

Institutional Policies:

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.

KSU Disruption of Campus Life policy:

All students are responsible for knowing the information, policies and procedures outlined in the Kennesaw State University Codes of Conduct. [Student Conduct and Academic Integrity \(SCAI\)](#) includes: the general Student Code of Conduct, the Residential Code of Conduct, and the Code of Academic Integrity.

KSU Web Accessibility:

Federal law Section 508 Subsection 1194.22 of the Rehabilitation Act and the Board of Regents (BOR) of the University System of Georgia (USG) Web Accessibility Guidelines require that all web content meet the federal government’s accessibility guidelines. As such, KSU complies with USG guidelines.

University accessibility assistance is provided by several offices as noted below. Staff in these offices work to accommodate requests for access or assistance with access as soon as possible in order to either accommodate the request or identify an effective alternative for the requester.

Request for Office Contact Number Contact Email

- Student Support Services Student Disability Services 470-578-2666 sds@kennesaw.edu
- Student Technology Assistance Student Technology Assistance
- University Information Technology Services 470-578-3555 studenthelpdesk@kennesaw.edu
- Third Party Technology Assistance University Information Technology Services 470-578-6999 service@kennesaw.edu

KSU Reasonable Accommodations:

Students with qualifying disabilities under the Americans with Disabilities Act (ADA) and/or Section 504 of the Rehabilitation Act who require “reasonable accommodation(s)” to complete the course may request those from Office of Student Disability Services. Students requiring such accommodations are required to work with the University’s Office of Student Disability Services rather than engaging in this discussion with individual faculty members or academic departments. If, after reviewing the course syllabus, a student anticipates or should have anticipated a need for accommodation, he or she must submit documentation requesting an accommodation and permitting time for a determination prior to submitting assignments or taking course quizzes or exams. Students may not request retroactive accommodation for needs that were or should have been foreseeable. Students should contact the office as soon as possible in the term for which they are seeking accommodations. Student Disability Services is located in Kennesaw Hall, Room 1205 on the Kennesaw campus and Building A in Suite 160G on the Marietta campus. Please visit the [Student Disability Services \(SDS\) website](#) for more information, or call the office at 470-578-2666 (Kennesaw campus) or 470-578-7361 (Marietta campus).

KSU Enrollment Management/Course Attendance:

Students are solely responsible for managing their enrollment status in a class; nonattendance does not constitute a withdrawal.

Copyright Law:

It is the responsibility of KSU faculty and students to respect the rights of copyright holders and complying with copyright law. The University System of Georgia recognizes that the exclusive rights of copyright holders are balanced by limitations on those rights under federal copyright law, including the right to make a fair use of copyrighted materials and the right to perform or display works in the course of face-to-face teaching activities.

The University System of Georgia facilitates compliance with copyright law and, where appropriate, the exercise in good faith of full fair use rights by faculty and staff in teaching, research, and service activities. The University System of Georgia ensure compliance with copyright law in the following ways.

1. The USG informs and educates students, faculty, and staff about copyright law, including the limited exclusive rights of copyright holders as set forth in 17 U.S.C. § 106, the application of the four fair use factors in 17 U.S.C. § 107, and other copyright exceptions.
2. The USG develops and makes available tools and resources for faculty and staff to assist in determining copyright status and ownership and determining whether use of a work in a specific situation would be a fair use and, therefore, not an infringement under copyright law;
3. The USG facilitates use of materials currently licensed by the University System of Georgia and provides information on licensing of third-party materials by the University System; and
4. The USG identifies individuals at the University System and member institutions who can counsel faculty and staff regarding application of copyright law.

Protecting Students’ Privacy (FERPA):

Students have certain rights to privacy. These rights are mandated by federal policy. [The Student Handbook](#) contains information regarding Rights Pertaining to Student Records, and FERPA specific details are available on the [KSU FERPA website](#).

A key requirement of the formal evaluation process is the protection of individual privacy rights concerning educational grading. The University's online learning system and email system is designed to prevent unauthorized individuals from gaining access to sensitive information or information protected by federal or state law. Consequently, faculty and students are strongly encouraged to only communicate regarding course matters through the University's designated technology learning system.

Information should not be made public in any way in which a student's grades, social security number, or other personal information may be identified. Grade information may be shared with members of the KSU community who also have a legitimate educational interest in student success (e.g. academic advisors or members of the Behavioral Response Team). Faculty may be asked to provide early alert information if there is a concern that a student is at risk, academically or otherwise.

KSU Sexual Misconduct:

In accordance with federal and state law including, Title IX of the Education Amendments of 1972 ("Title IX") and Title VII of the Civil Rights Act of 1964 (Title VII), the University System of Georgia (USG), including Kennesaw State University, prohibits discrimination on the basis of sex in any of its education programs or activities or in employment. The USG is committed to ensuring the highest ethical conduct of the members of its community by promoting a safe learning and working environment. To that end, Kennesaw State University follows USG Board of Regents Policy Manual, Section 6.7. [Visit Title IX.](#)

Withdrawal from Classes:

A student who officially withdraws from a course by the end of the last day to withdraw without academic penalty will receive a grade of "W" and receive no credit.

A student will receive a refund only when the student withdraws from ALL courses for the applicable semester and only by the schedule outlined in the University refund policy found in the Tuition, Expenses, & Financial Aid section of the undergraduate and graduate university catalogs. Students should be aware that a reduction in their hours might result in the loss of full-time student status and thus affect their financial aid, scholarships, athletic and ticket eligibility, University housing accommodations, use of University resources and access to University facilities, visa for international students, and Veterans Educational Benefits. Students should contact the appropriate office and their academic advisor with questions about the impact of their withdrawal from a course before initiating a withdrawal. Veterans and dependents of veterans who receive educational benefits must notify the Veterans Education Benefits Area in the Office of the Registrar of any course load reductions.

Hardship Withdrawals

If a student experiences significant personal hardship (e.g., medical or family emergency, prolonged illness), the Dean of Students can approve a hardship withdrawal from all courses in the term for which the student is currently registered. In the case of an approved hardship withdrawal from all courses, the Registrar will assign grades of "W" for those classes. The deadline for final approval of a hardship withdrawal by the Dean of Students is the last day of class for which the hardship withdrawal is sought. If the hardship withdrawal process is not complete by the last day of class for which the hardship withdrawal is sought, a student must appeal for a retroactive hardship withdrawal from the Academic Standing Committee.

Appeals for retroactive hardship withdrawals must be directed to the Academic Standing Committee. Retroactive hardship withdrawals are rarely granted if it has been more than one year since the last day of class for which the withdrawal is sought. Extraordinary justification must be shown. In the case of approved retroactive hardship withdrawals, the Registrar will assign a grade of “W.”

University Initiated Withdrawals

If a student is suspended by the Office of Student Conduct following a violation of the University’s Code of Conduct not related to academic dishonesty, the Office of Student Conduct may facilitate a University-initiated withdrawal from courses for which a student is registered for the term. The Registrar will assign grades of “W” for those classes.

Military Withdrawals

A student will receive a “WM” symbol for all courses and a full refund of tuition and mandatory fees and a pro rata refund of other fees for military and other service, as defined by [BOR Policy Manual, Section 7.3.5.3](#). To request a military withdrawal, the student must submit a copy of official orders to the Office of the Registrar.

Academic Feedback:

Institutional Chief Academic Officers will encourage faculty to clarify for students, at the beginning of each course, the basis on which grades will be determined and to provide timely academic feedback as the course progresses ([BOR Academic and Student Handbook Policy 2.18](#))

Netiquette: Communication Courtesies:

All members of the class are expected to follow rules of common courtesies in all email messages, threaded discussions and chats (link forthcoming).

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. Please refer to the Instructional Continuity statement included in each course syllabus for specific plans.

University Sponsored Academic Resources:

University Academic Resources:

- [Academic Tutoring Services](#)
- [Disability Resources](#)
- [Library](#)
- [Supplemental Instruction](#)
- [The Writing Center](#)
- [Virtual Smart Center](#)
- [Academic Advising](#)

Student Resources:

- [Student Support Links for Online Learning](#)
- [Student Success Resources](#)
- [Scholarships and Financial Aid](#)
- [Office of the Registrar](#)
- [Office of the Bursar](#)

Grade Appeals and Student Complaints:

KSU desires to resolve student grievances, complaints and concerns in an expeditious, fair and amicable manner. The [complaints and concerns webpage](#) was developed to assist current and prospective students in submitting complaints and appeals, and to direct them to the most effective venue for accurate information and resolution. The resources on the page will direct students to the specific venue to appropriately address the related student complaint. Complaints for online students are resolved following the same general procedures for students who attend classes on campus. However, for any process that requires a student appear in person, the university may make other arrangements. For processes that cannot be completed via telephone, email, or written correspondence, the university may set up a two-way video-conference site in place of a meeting on the KSU campus.

Technology Resources:

For issues with technical difficulties, please contact the Student Helpdesk:

[Fill out a service form](#)

Email: studenthelpdesk@kennesaw.edu

Call 470-578-3555

[New Students Technology Services](#)- Steps that will help you meet the technological requirements of the University.

Any request for make-ups due to technical issues MUST be accompanied by the ticket number received from UITTS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Additional Technology Resources:

- [1:1 Training Session](#)
- [Computer Labs](#)
- [Browser Checker](#)
- [My KSU Site for Accessing Online Tools](#)
- [USG Desire2Learn Help Center](#)
- [D2L Training Options & Resources for Students](#)
- [Owltrain Online Courses](#)
- [Check Service Outages](#)

Student Support and Wellness Resources:

YOU MATTER at KSU, and your well-being is a priority to us. College is exciting, but it can cause students to experience stress and feel overwhelmed. Through counseling, health education, addiction and recovery support, fitness and recreation activities, and access to basic needs, Wellbeing@KSU is here to help you do well and be well.

- [Department of Career Planning & Development](#)
- [Student Health Clinic](#)
- [Military and Veteran Services](#)