UNIVERSITY OF KANSAS

The Department of Mechanical Engineering

SYLLABUS

Course: **ME 320 Dynamics** (3).

Pre-requisites: ME 201/211, MATH 220, and MATH 290; by topic: statics, differential equations and linear algebra. You are expected to be proficient in Physics, Statics and math through Linear Algebra, and be able to sketch clearly. Proficiency in geometry, trigonometry and vectors is expected.

Time & Place: Lecture: Tu/Th, 11:00 am - 12:15 pm, Location: LEEP2-G415.

Instructor: Carl W. Luchies, Ph.D.
Office: 3135B LEA, 785-864-2993
Email: cluchies@ku.edu
Office Hours: Please see Bb for information; Other Times by Appointment.
(Email is the best way to contact the instructor.)

GTA: Please see Bb for GTA: 1) contact information and 2) schedules for weekly office hours and help sessions.

UGTA: Please see Bb for UGTA information.

Grader: Please see Bb for grader information.

WEB PAGE: Course documents will be posted on the KU Bb course website.

Text/Resources:

1. Engineering Mechanics: Dynamics by Hibbeler, 14th Ed, 2015 or earlier (etext or hardcopy).
2. MasteringEngineering (http://www.masteringengineering.com). Must be 14th Ed.
   Mastering will be accessed through Bb using the "Mastering HW" tab on the left.
3. Iclicker2 Device.

Course Description:

This course is a study of the dynamics of particles and rigid bodies. The material, based on a Newtonian formulation of the governing equations, is illustrated with numerous examples ranging from one-dimensional motion of a single particle to planar motions of rigid bodies and systems of rigid bodies. An equal emphasis will be placed on gaining an analytical understanding and an insight/intuition on the subject. The material presented will emphasize the analytical components of the subject.

Course Learning Objectives:

CHAPTER 12: Kinematics of a Particle	
LO 12.1-2	Find the kinematic quantities (position, displacement, velocity, and acceleration) of a particle traveling along a straight path.
LO 12.3	Determine position, velocity, and acceleration of a particle using graphs.
LO 12.4	Describe the motion of a particle traveling along a curved path.
LO 12.5	Relate kinematic quantities in terms of the rectangular components of the vectors.
LO 12.6	Analyze the free-flight motion of a projectile.
LO 12.7	Determine the normal and tangential components of velocity and acceleration of a particle traveling along a curved path.
LO 12.9	Relate the positions, velocities, and accelerations of particles undergoing dependent motion.
LO 12.10	Analyze the motion of particles using a fixed and a translating frames of reference.
CHAPTER 13: Kinetics of a Particle: Force and Acceleration	
LO 13.2	Write the equation of motion for an accelerating body.
LO 13.3	Draw the free-body and kinetic diagrams for an accelerating body.
LO 13.4	Apply Newton's second law to determine forces and accelerations for particles in rectilinear motion.
LO 13.5	Apply the equation of motion using normal and tangential coordinates.

Course Learning Objectives (continued):

CHAPTER 14: Kinetics of a Particle: Work and Energy	
LO 14.1	Calculate the work of a force
LO 14.2-3	Apply the principle of work and energy to a particle or system of particles.
LO 14.4a	Determine the power generated by a machine, engine, or motor.
LO 14.4b	Calculate the mechanical efficiency of a machine.
LO 14.5	Use the concept of conservative forces and determine the potential energy of such forces.
LO 14.6	Apply the principle of conservation of energy.
CHAPTER 15: Kinetics of a Particle: Impulse and Momentum	
LO 15.1a	Calculate the linear momentum of a particle and linear impulse of a force.
LO 15.1b	Apply the principle of linear impulse and momentum
LO 15.2	Apply the principle of linear impulse and momentum to a system of particles.
LO 15.3	Understand the conditions for conservation of momentum.
LO 15.4a	Understand and analyze the mechanics of impact
LO 15.4b	Analyze the motion of bodies undergoing a collision, in both central and oblique cases of impact.
CHAPTER 16: Planar Kinematics of a Rigid Body	
LO 16.1-3	Analyze the kinematics of a rigid body undergoing planar translation or rotation about a fixed axis.
LO 16.4	Determine the velocity and acceleration of a rigid body undergoing general plane motion using an absolute motion analysis.
LO 16.5a	Describe the velocity of a rigid body in terms of translation and rotation components.
LO 16.5b	Perform a relative-motion velocity analysis of a point on the body.
LO 16.6a	Locate the instantaneous center of zero velocity.
LO 16.6b	Use the instantaneous center to determine the velocity of any point on a rigid body in general plane motion.
LO 16.7a	Resolve the acceleration of a point on a body into components of translation and rotation.
LO 16.7b	Determine the acceleration of a point on a body by using a relative acceleration analysis.
CHAPTER 17: Planar Kinetics of a Rigid Body: Force and Acceleration	
LO 17.1	Determine the mass moment of inertia of a rigid body or a system of rigid bodies.
LO 17.2	Apply the three equations of motion for a rigid body in planar motion.
LO 17.3	Analyze problems involving translational motion.
LO 17.4	Analyze the planar kinetics of a rigid body undergoing rotational motion.
LO 17.5	Analyze the planar kinetics of a rigid body undergoing general plane motion.
CHAPTER 18: Planar Kinetics of a Rigid Body: Work and Energy	
LO 18.1-3	Define the various ways a force and couple do work.
LO 18.4	Apply the principle of work and energy to a rigid body.
LO 18.5a	Determine the potential energy of a conservative force.
LO 18.5b	Apply the principle of conservation of energy.

Class Schedule:

The course schedule with due dates is posted and maintained on Bb. Two 75 minute periods of classroom instruction/cooperative learning is scheduled for each week. The course will be taught using a combination of SCALE-UP and Team-Based-Learning pedagogies. The PowerPoint notes and pre-recorded lectures will be made available on the course Bb web-site. Regularly scheduled help sessions will be available as an opportunity for students to develop a better understanding of course concepts and problem solving techniques. The instructor and GTAs will hold office hours throughout the week to answer course related questions (see Bb for schedule).

Groups: Each student will be assigned to work in a team. Each team will be assigned to a table in the classroom. The teams will be maintained throughout the semester.

Class Preparation:

The student is expected to come to class prepared. This means the student should do the following before stepping into the classroom:

1. Study (i.e. read and understand) the assigned section(s) from the textbook. This includes all examples covered within the section assigned.
2. Study (i.e. listen, watch and understand) the recorded lecture(s) for the assigned section(s) from the textbook.
3. Work out the assigned HW problems that are due at class time.
4. Be prepared to discuss, investigate, and utilize the concepts during class time.

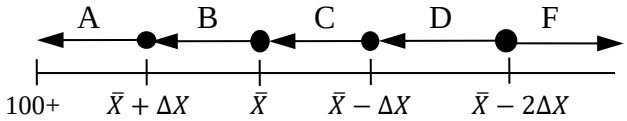
I-Clickers: I-Clicker technology will be utilized throughout this course. This includes quizzes, discussion questions, and some group work questions. Each student is responsible to bring their registered I-Clicker to each class. No I-Clicker = no credit. Not all questions presented during class using I-Clicker technology will be graded.

CATME: We will use the web based resource "Comprehensive Assessment of Team Member Effectiveness" (CATME, http://info.catme.org/), which provides several valuable tools useful in this course. This system allows the instructor to conduct an initial survey, the results of which will be used to accomplish student team formation and scheduling (e.g. help sessions, office hours, etc.). Additional surveys will be used to gather your assessment of the team members you will be working with during team-based learning throughout the semester. Please visit the CATME website (http://info.catme.org/) to learn more about CATME. Valuable information can be found under the "STUDENT SUPPORT" tab including FAQ, Help Text, and Videos. You should have already received an email with a link to a team info survey and completed the short survey.

Grading: Students are responsible for ALL material presented in class. This includes any announcements, changes, clarifications on assignments, or due dates. Grades will be based on homework, quizzes, group work, individual and group performance, exams, and the final exam performance. Note: the instructor will determine the overall "individual and group performance" score using information collected from the CATME peer assessment(s) and the instructor & GTA assessment of the individual performance within each team. All scores will be maintained on KU Bb gradebook (group work, Quizzes, & Exams). This will allow the student to monitor performance and should provide continuous feedback regarding performance in the course. Should you have questions regarding your scores, please contact the instructor or the GTAs. Specific score-related questions about homeworks/quizzes/exams must be raised within one week after receiving the score. If submitted homework does not appear to be graded (i.e. missing), please point this out to the instructor/GTA/grader within one week after the return of the corresponding set of graded homework/test. Your final grade will be calculated based on the following distribution:

Homework	15%
In-class quizzes	5%
In-class group problems	15%
In-class individual & group performance	5%
Semester Examinations (3 at 15% each)	45%
Final Examination	15%
Total:	100%

Grading Scale: The grading scale is relative to the mean, where $\bar{X} = mean\ score$. The mean score will be approximately the break point between a B and a C grade.



Plus/minus (+/-): This course (ME 320) will NOT utilize +/- grading this semester.

Two Stage Semester Exams:

Two Stage semester exams will consist of two parts: 1) individual work, and 2) group work. The goal of this design is to demonstrate that it is equally important to 1) individually understand and apply the course concepts to solve problems, and 2) to be able to discuss the possible solutions proposed by your group members and arrive at a correct solution.

1) Individual Work: you are not allowed to give and/or receive any help during this part of the exam. This is an opportunity to demonstrate your understanding of the course

materials through multiple choice questions by working out the problems using pencil, paper, and possibly a calculator. Answer sheets will be handed in at the end of the individual work. You will keep your written work to be used during the next part of the exam. Stage One is closed book and closed notes. Equation sheet(s) are allowed (see info below).

2) Group Work: your group will quietly discuss and decide on the correct solution and answer for each question, one set of which will be handed in by the group. All work must be shown to receive credit for each problem handed in by the group. Scratch cards will be used for each group to record and determine if they have arrived at the correct answer. Stage Two is open book (Hard Copy Only) but closed notes. Equation sheet(s) are allowed (see info below).

Questions for clarification are encouraged. An 8.5" x 11" sheet of paper with equations is allowed.

Equations Sheet Rules:

- No sentences, paragraphs or example problems allowed.
- Both sides of the sheet may be used.
- Hand written, typed and/or photocopied.
- The equation sheet(s) from the previous exam(s) may be used. For example, the exam #1 equation sheet may be used in addition to the exam #2 equation sheet during exam #2.

The best way to prepare for exams is to actively participate in class; learn the fundamental concepts as they are covered; understand the homework as assigned; re-do homework and example problems; review book chapters, course PPT and recorded lectures; and work extra credit problems. A review session will be held prior to each exam.

There will be no make-up exams. If you miss a semester exam as the result of a confirmed and documented illness or emergency, then your score on that semester exam will be the average of your other two semester exams; otherwise, the missed exam will be scored as 0. Only one such substitution is permitted. If a semester exam is missed, then the final exam will be required. Each semester exam will focus on the chapters as indicated on the schedule, but due to the nature of the course, each exam will be comprehensive.

EXTRA CREDIT semester exam points will be awarded to groups if all members within the group score at or above the class mean for that semester exam. Make sure everyone in your group understands the material as we move through the semester.

Final Exam: The final exam will be comprehensive, which means it will re-test the materials covered on the three semester exams. The final exam will only consist of individual work. The final exam is optional for students who have taken all three semester exams and have a B or better overall semester grade. The final exam will consist of multiple choice problems. All work must be shown to receive credit for each problem. The final exam will be administered in accordance with the University scheduled time.

Quizzes and Group Work:

Each class period will begin with an In-Class Reading Quiz using the I-Clicker2 system and will have a Group Problem Solving Assignment. Both will be routinely graded. Submitted group work must be legible and presented in a logical, easy-to-follow manner or it will be graded as zero.

1. **Reading Quiz**: this will be done at the beginning of the class period using the I-Clicker2 device and will cover the reading assignment to ensure that each student has properly prepared to discuss the material assigned for that class period. First, the quiz will be done individually, then it will be repeated after group discussion.
    - **Accountability Quiz.** This is an individual opportunity for reading quiz extra credit. Attending class prepared is very important and can be done by reading the assigned sections in the book, reviewing the PowerPoint slides

available on Bb, watching the lecture video available on Bb, or any combination of the above. You can earn 1 point of "reading quiz" extra credit for each time the class meets by documenting which of the above you have done to prepare for class. You can find the "Accountability Quiz" under "Lectures" in the appropriate chapter folder. You have until the beginning of class to document your chosen activity to prepare for that class. This is an honors system, so please be honest. If you did not prepare for class, you do not need to do anything regarding the accountability quiz.

2. **Group Problem Solving Assignment**: this will be done during the class period, it will be done collaboratively (i.e. discussions are encouraged within your group, across groups, with the GTAs and with the instructor), and it will cover the material discussed during class. No member within the group is allowed to leave the classroom until everyone within the group has completed the group activity. Each individual will hand in their own completed assignment, all of which or selected parts will be graded.

Homework: There will be regular reading and homework (HW) assignments. See Bb for additional details on the schedule.

- **Mastering Engineering (ME) Homework problems**. This is an individual based assignment which requires a structured solution written out. The required format can be found on Bb. Occasionally the structured solution for a problem will be handed in and graded for structure. Mastering will grade ME HW for accuracy. Two ME homework problems will be assigned for each class session. The ME HW problems will be available on ME and due at the beginning of each class session. After completing each ME assignment, adaptive follow-up will be available for 2 days after the assignment is due for continued learning.

  ME grading details include:

  - Six attempts are allowed for each question, a 3% deduction for incorrect answers.
  - A 2% bonus for each available hint not opened.
  - Units are usually required.
  - A penalty of 2% per hour will be assessed for late Mastering homework. This means that you have up to 50 hours after the due time/date to earn partial credit on ME homework.
  - Homework problems are assigned for each section covered in class (10 points/problem) and generally includes:
    - End-of-section problems.
  - EXTRA CREDIT ME problems: Two sets of extra credit Mastering HW problems are available for each chapter and are due at exam time for the chapters covered. For example:
    - Chapter 12a: available tutorial and coaching problems, and
    - Chapter 12b: fundamental problems.
  - Approximately 24 extra credit problems (2 points/problem) are available for each chapter. This represents a potential for more than 5% extra credit on the overall grade. The extra credit problems for a chapter will be available when we begin talking about that chapter and are due at exam time for that chapter. Working extra credit problems is highly recommended, because by doing so, the student will improve his/her understanding of the material covered in class, resulting in improved examination scores.
  - The structured solution to a Mastering problem that was due within the last 2 class periods will be randomly collect in class. Bring them to class to receive credit.
- **Structured Homework Assignments**. A structured HW problem in addition to Mastering will occasionally be assigned. The structured solution will be scanned and handed in via Bb by the due date indicated on the course schedule.

- **Team Manual Assignment**. This is a team based assignment. Students will add to a "Student Success in Team-Based Learning" manual that was created by students in the Spring 2017 and Fall 2017 semester of ME 320. This manual will continue to be shared with future students of ME 320 and other classes in the School of Engineering utilizing Team-Based Learning. The class will contribute to the entire manual, but each team is responsible for pulling together and finalizing a specific section. Assignment details will be available on Bb and the Class OneNote Notebook.
- **Tiered Mentoring Assignment**. This is a self-selected collaborative group assignment (maximum of 3 students/group). The goal of this assignment is to share knowledge and experience with students in an upstream (i.e. a prerequisite course to Dynamics, which is Statics) course, to integrate more vertical interaction between students in the department, and to improve content mastery and/or professional skills related to presenting information. Assignment details will be available on Bb.

Collaboration: Homework is a learning opportunity. Discussion and the exchange of ideas are important parts of the learning process, and such activities are encouraged in a community of scholars. **However, you must ensure that any work you submit for grading is your own.** You are allowed and encouraged to discuss the methods used to solve the homework with others with the goal of developing a better understanding of the concepts needed to do the homework. Copying the results of others work on an assignment or an exam will at the very least, result in a zero assigned to ALL involved. It is the School of Engineering's policy to remove students who demonstrate a pattern of academic dishonesty from the School and possibly to expel them from the university. Copying or deleting unauthorized disk files will have the same effect. Logging onto somebody else's computer account is not permitted. Students are expected to answer questions regarding any of the work they hand-in.

Help Sessions:

The GTAs will hold weekly help sessions and office hours to provide assistance in understanding course materials. The GTAs will not directly work the homework problems, but they will review the concepts needed to successfully work the homework problems. See Bb for the GTA help session and office hour schedules.

Attendance: Attendance at all class meetings is expected. All classes will include in-class work to be handed in and graded.

Calculators: All capability to communicate with other devices must be turned off during the exam.

Concealed Carry:

Individuals who choose to carry concealed handguns **are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy.** Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the carrier's custody and control.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position.
- Must have the safety on, and have no round in the chamber.

Diversity, inclusivity, and civility:

The University of Kansas supports an inclusive learning environment in which diversity and individual differences are understood, respected, and appreciated. We believe that all students benefit from training and experiences that will help them to learn, lead, and serve in an increasingly diverse society. All members of our campus community must accept the responsibility to demonstrate civility and respect for the dignity of others. Expressions or actions that disparage a person's or group's race, ethnicity, nationality, culture, gender, gender identity / expression, religion, sexual orientation, age, veteran

status, or disability are contrary to the mission of the University. We expect that KU students, faculty, and staff will promote an atmosphere of respect for all members of our KU community.

Wireless Devices:

Cell phones and pagers and other wireless devices must be set to silent mode or otherwise disabled before the start of class. **These devices must be left in your pocket, purse or book bag during class time.** The use of laptops, tablets or similar devices during class is prohibited **unless** it is being directly used for in-class activities.



Feedback: Students are encouraged to make constructive suggestions to the instructor about any aspect of the course. Please feel welcome to come and see me. Students are encouraged also to suggest projects, particular engineering problems or research topics of interest to the whole class.

Conduct: Professional and respectful behavior is required at all times. Anything less will result in the student being asked to leave the classroom. The scope and content of the material included in this course are defined by the instructor in consultation with the responsible academic unit. While the orderly exchange of ideas, including questions and discussions prompted by lectures and discussion sessions, is viewed as a normal part of the educational environment, the instructor has the right to limit the scope and duration of these interactions. Students who engage in disruptive behavior, including persistent refusal to observe boundaries defined by the instructor regarding inappropriate talking, discussions, and questions in the classroom may be subject to discipline for non-academic misconduct for disruption of teaching or academic misconduct, as defined in the Code of Student Rights and Responsibilities (CSRR), Article 22, Section C, and the University Senate Rules and Regulations, Section 2.4.6. Article 22 of CSRR also defines potential sanctions for these types of infractions.

Disability: Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact the course instructor personally as soon as possible so we can discuss accommodations necessary to ensure full participation and to facilitate the educational opportunity.

Acad. Integrity: The faculty in charge of this course supports and will follow the University policy on academic integrity. You are encouraged to read the Student Handbook in this regard. In general, any student or group of students who, in the opinion of the instructor, are guilty of cheating on examinations, homework, lab reports, etc. will receive a failing grade for the course.

Writing Support:

Most colleges and universities have a writing center, a place for students to talk about their writing with trained peer consultants. At KU, we have the "KU Writing Center." More information can be found at www.writing.ku.edu .

Homework and Exams (written and shared by Dr. Sara Wilson for ME department faculty use)

Different classes have different requirements about how much you are allowed to work together and communicate with your fellow classmates. Here are some guidelines:

1. It is your responsibility to find out what level of collaboration is allowed on **lab and homework** assignments. If you did not hear the instructor spell this out, check the syllabus, the assignment, or ask. Some homework and lab assignments do not allow students to work together or even discuss the assignment. Other homework and lab assignments are group projects where you are expected to work together and turn in one submission as a group. Many instructors will say you can work together, but the work you turn in should be your own. In this case, you can talk to friends about the problems and general guidelines of how one might approach them. However, your submission should not be copied from your friend. Two friends submitting the same homework solution done almost exactly the same way will often be regarded as copying and therefore cheating. My personal rule of thumb on homework that allows working together, but not copying, is that you should know and understand what you write and be able to show that you know what you submitted. You should be able to explain and reproduce your work if asked.

2. Unless the instructor says otherwise, **quizzes and exams** (both in class and take home) are solely individual work. You should not talk to anyone other than the instructor and GTAs about the exam.

3. Some textbooks have instructor solution manuals. These are legally only allowed to be sold to an instructor. While you may find a way to obtain a solution manual over the internet, instructors will regard the use of these manuals as cheating since they were illegally obtained and represent someone else's work. Homework assignments are not to exercise your ability to copy someone else but rather a way to practice the skills you are supposed to be learning.