TENAS A&M UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
Spring 2015

MEEN 363, Section 501 Dynamics and Vibrations

Application of Newtonian and energy methods to model dynamic systems (particles and rigid bodies) with ordinary differential equations; solution of models using analytical and numerical approaches; interpreting solutions; linear vibrations. Three credit hours (2-2).

Instructor:

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Lectures:

TR 8 AM–9:15 AM at 118 C E

Recitations:

W 5:45 PM–7:35 PM at 114 RICH

Office Hours:

Dr. Kim: TR 9:15 AM–9:50 AM at 118 C E or 223 MEOB
Mr. Kwon: M 1–2:30 or R 10–11:30 or by appointments

Learning Outcomes and Course Objectives:

- Application of Newtonian and energy methods to model dynamic systems (particles and planar rigid bodies) with ordinary differential equations
- Solution of models using analytical and numerical approaches; interpreting solutions
- Linear one-degree-of-freedom and two-degree-of-freedom vibrations

On-Line Course Materials:

A course web page is being established at ecampus.tamu.edu. You should be able to access the web page if you are registered for the course. All course-related material you will need, e.g. Matlab handouts, homework sets, solutions, and other useful materials will be placed.
Text (required):


Prerequisites:

- Statics and Particle Dynamics (MEEN 221)
- Differential Equations (MATH 308)
- Engineering Analysis (MEEN 357 or CVEN 302), or registration therein.
- Mechanics of Materials (CVEN 305), or registration therein.

Grading:

- Five two-hour exams—0 to 100 each
- Final exam (Counts as one exam.)—0 to 100
- Six homework sets—will not be graded.
- Nine MATLAB assignments (Counts as one exam.)—0 to 100
  MATLAB assignments are due beginning of the lecture on the dates designated in the class schedule. No late submission will be accepted or graded.
- Total/7 = Course numerical grade from 0 to 100.
  A: greater than 90
  B: greater than 80 and less than 90
  C: greater than 70 and less than 80
  D: greater than 60 and less than 70
  F: less than 60

Policy on Grading Complaints:

If you feel a mistake was made in grading any material, please first contact the person doing the grading within a week after the graded paper is distributed. If you are not satisfied with the resolution of the matter then talk to me. *After the one week discussion period, we will not review your exams or change grades.* Make your complaint to me in writing and via e-mail. Be specific about your complaints. Please note I do not negotiate my partial-credit policy with students.

Exam Schedule:

- Thursday, January 29: Exam 1 on Particle Kinematics
- Thursday, February 19: Exam 2 on Particle Kinetics and 1-DOF Vibrations
- Thursday, March 5: Exam 3 on 2-DOF Vibrations
- Thursday, March 26: Exam 4 on Planar Kinematics
- Thursday, April 16: Exam 5 on Planar Kinetics
- Friday, May 8 (1 PM–3 PM): Final Exam on Planar Kinetics for Multi-Body Systems

All exams are closed books, closed notes.

Absences:

Work missed due to absences will only be excused for University-approved activities in accordance with TEXAS A&M UNIVERSITY STUDENT RULES (see http://student-rules.tamu.edu/rules/equality7.htm). Specific arrangements for make-up work in such instances will be handled on a case-by-case basis. In accordance with recent changes to Rule 7, please be aware that in this class any “injury or illness that is too severe or contagious for the student to attend class” will require “a medical
confirmation note from his or her medical provider” even if the absence is for less than 3 days (see 7.1.6.2 injury or illness less than three days).

ADA Statement:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.

Academic Integrity:

Aggie Honor Code: “An Aggie does not lie, cheat, or steal, or tolerate those who do.”

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: aggiehonor.tamu.edu

On all course work, assignments, and examinations at Texas A&M University, the following Honor Pledge shall be preprinted and signed by the student:

"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."

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Signature of Student

Schedule:

Following is a tentative schedule. The pace will be adjusted as the semester progresses.

**PART 1, PARTICLE KINEMATICS** (reading material—Sections 2.1-2.7)

Wk. 1 Motion in a plane using Cartesian coordinates, matrix algebra, Cramer’s rule, coordinate transformations. Polar coordinates. Path coordinates.

Wk. 2 Normal-Tangential coordinates. Moving between Cartesian, polar, and normal coordinate results using coordinate transformations.

**January 29, 6–8 PM at TBA:** Exam 1 on Particle Kinematics

**PART 2, PARTICLE KINETICS AND 1-DOF VIBRATIONS** (reading material—Chapter 1 on units, Sections 3.1-3.2d, 3.3a)

Wk. 3 Newton’s laws, constant acceleration, spring forces. 1-DOF undamped vibration, equilibrium, natural frequency, forced excitation.

Wk. 5  Excitation due to a rotating imbalance. Steady-state solution examples.  
*MATLAB assignment 1 (spring-mass-damper) due Tuesday 2/17*

**February 19, 6–8 PM at TBA: Exam 2 on Particle Kinetics and 1-DOF Vibrations**

**PART 3, 2-DOF VIBRATIONS** (reading material—Section 3.5)

Wk. 6  2-DOF vibration problems, spring-mass and double-pendulum examples. Eigenanalysis for 2-DOF vibration examples  
*MATLAB assignment 2 (simple pendulum) due Tuesday 2/24*

Wk. 7  Free and forced harmonic motion for 2-DOF examples. Solving for motion using modal coordinates.  
*MATLAB assignment 9 (frequency response) due Tuesday 3/3*

**March 5, 6–8 PM at TBA:  Exam 3 on 2-DOF Vibrations**

**PART 4, PLANAR KINEMATICS** (reading material—Chapter 4)

Wk. 8  Governing equation. Rolling without slipping.  
*MATLAB assignment 8 (double pendulum) due Tuesday 3/10*

Wk. 9  Planar kinematic examples.  
*MATLAB assignment 11 (slider crank) due Tuesday 3/24 (You may use EXCEL spread sheet.)*

**March 26, 6–8 PM at TBA:  Exam 4 on Planar Kinematics**

**PART 5, PLANAR KINETICS, 1-DOF Systems** (reading material—Sections 5.2, 5.3, 5.4, 5.5, 5.6, 5.7a)

Wk. 10 Planar mechanisms.  
*MATLAB assignment 10 (three-bar linkage) due Tuesday, 3/31*

Wk. 11 Inertia properties. Force and moment equations of motion. Kinetic energy of a rigid body.

*MATLAB assignment due on torsional pendulum due Tuesday 4/14*

**April 16, 6–8 PM at TBA:  Exam 5 on Planar Kinetics**

**PART 6, PLANAR KINETICS FOR MULTI-BODY SYSTEMS** (reading material—Sections 5.7b, 5.7c, 5.7d, 5.7e)

Wk. 13 Examples having more than one degree of freedom.  
*MATLAB assignment 6 (Half cylinder rolling on a horizontal plane) due Tuesday 4/21*

Wk. 14 2-DOF Torsional examples. 2-DOF examples with beam elements. Planar mechanisms.  
*MATLAB assignment 12 (A bar supported by a wire and a horizontal plane) due Thursday 4/30*

**Friday May 8, 1 PM–3 PM at 118 C E:  Final Exam on Planar Kinetics for Multi-Body Systems**