ME 3070: Foundations of Mechanical Systems

Section 001

Fall Semester 2016
Professor: Lonny Thompson

Office: 221 Fluor Daniel Building
Tel: 656-5631
Email: lonny@clemson.edu
Class website: Blackboard

Office Hours in Dillard Hall: MWF 10:00 a.m. to 10:30 a.m.

Course Description: Introduction to physical elements and mechanisms that define basic mechanical engineering systems. Application of kinematic and kinetic analysis to mechanisms and the role of design in mechanisms.

Prerequisites: C or better in ME 2010, and ME 2040 (or concurrent enrollment in ME 2040 with department approval).

Required Course Notes (*there is no required textbook***):** Lonny Thompson, "**Kinematics and Dynamics of Mechanisms and Machines"**, Jan 5, 2016 (available for purchase from Campus Copy Shop: 384-1 College Ave., Clemson, SC 29631, Phone: 864-654-3863, Fax: 864-654-4070, Email: copyshop@bellsouth.net, Business Hours: Monday to Friday 8:00 am - 5:30 pm, http://www.campuscopyshop.com). Cost approximately $50 including Tax.

Course Structure:

Regular Class Lectures MWF 9:05 am - 9:55 am, Dillard Building, Room 201. Some in-class learning exercises will be used to practice concepts. There will be regularly scheduled reading from the required course notes. There will be several assignments due each week. The due date times will be posted for each assignment; assignments can be submitted early. All on-line submissions will be conducted using Blackboard. Help questions and discussions will be done at all hours using email and Blackboard Announcements. Midterm exams and final exam are given in-class.

Assignments:

- There will be several assignments due several times each week.
- Problem solutions should be of professional quality (clear, concise, correct, and conscientious).
- Include clear sketches and illustrations, annotations to describe work-flow, assumptions.
- Include enough space around problem solution for clarity; usually 1 or 2 problems per page.
- For assignments requiring Matlab, include copy of source code in report (not separate files).

- Problem sets and assignments will be posted on Blackboard (BB). If you do not have access to BB, it is your responsibility to ensure that these assignments are obtained from another student in the class or written request to instructor.
- Some assignments will be worked in groups of students, one assignment to be submitted per group. When group work is assigned, the number of students in a group will be specified.
- Analysis and design will usually involve symbolic variables in order to establish relationships, with numerical values for input parameters assigned for a particular instance during motion.

Submission of Assignments

- Assignments must be submitted Electronically as PDF file(s) directly using Blackboard. ***Only assignments submitted on Blackboard will be accepted for grading. Assignments sent by email or other means will not be accepted or graded, regardless of circumstances.*** Scan handwritten work as necessary as PDF Files (other file formats such as JPEG are not acceptable). Clemson photocopy machines in the Library can send as PDF file to your email account at no charge. Other options include: SmartPhone Apps: On iPhone, use apps such as "JotNot", "TinyScan" or "DocScanner". On Android phone you can also try "CamScanner." These apps will function as a scanner using the built-in camera phone. To use them you put your work on a flat surface with good lighting and the take a picture of it using the camera phone. The captured image can be cropped and then emailed or sent to Dropbox and other media as a PDF file. **Use the App and/or PDF software to combine multiple scanned pages into one file.**
- Here are some ideas on how to merge (combine) PDF files into one file.
- Many mobile apps have this feature already built-in.
- For Library copy machines, feed pages through tray, then all pages should be in same PDF file.
- On Mac computers, use Preview application provided by Apple.
- http://www.pdfmerge.com
- http://foxyutils.com/mergepdf/
- http://codesforus.blogspot.com/2010/06/software-for-attaching-pdf-files.html
- http://www.wikihow.com/Merge-PDF-Files-With-PDF-Merger
- http://www.wikihow.com/Merge-PDF-Files
- http://tv.adobe.com/watch/acrobat-xi-tips-tricks/how-to-combine-pdf-files-using-adobe-reader/

To combine PDF files into a single file on Mac; in Preview, View Thumbnails for both open files. Drag the Thumbnail in the left window pain from one file Prevew and drop in the thumbnail window pain of the second file Preview; this combines Thumbnails; when you close the Preview, the file is combined.

Project: There will be a design project with a written report.

Computer Usage:

Word processing (MS Office), and mathematical computation utilities including Matlab and Excel spreadsheets, and SolidWorks CAD software will be used by the students throughout the course for analysis, plotting graphs, and automation for design, and for documenting results. Students should have

Microsoft Word, Powerpoint, and Excel Spreadsheet loaded on there local computers. Matlab should be installed on your computer. A software mechanism is available using Virtual connection to Clemson Network (VPN) to access University software licences required by Matlab (use of a local student version of Matlab is another option). Students should have SolidWorks loaded on there local computers.

Weighting for Grade:

Description	**Weighting**
Class Participation (i-Clicker)	5%
Assignments	12%
Project	12%
Three Midterm Exams	3x(17)=51%
Final Exam	20%
Total	**100%**

Midterm exams and final exam are given in-class. The assignments are weighted; each assignment will have a different amount of points possible. The total number of points earned summing all assignments determines your Assignments score: Sum up the total number of points earned out of the number of points possible. Ignore any Total points column or Weighted Total column data which might be viewed on Blackboard Gradebook. The final exams will not be returned to students.

Course grades will be assigned as follows: A=90-100, B=80-89, C=70-79, D=60-69, F=0-59. No curving will be done based on class average. No make up tests will be given. There will be no "extra credit" work. **No final exam exemptions will be given**. Each instructor establishes their course policy on final exam exemption. There are several reasons why I have adopted this policy for my classes; a few that I will briefly articulate here, is that there are cases on the final exam where we would like to test the integration and synthesis of topics learned earlier in the course with topics learned later in the course, and visa versa, and/or to test concepts on a topic which we were not able to test understanding on earlier exams due to time constraints, or we wish to test understanding of a concept on an earlier topic in a more deeper level of maturity, based on what we learned in the later part of the course. By reviewing the earlier exam topics in preparation for the final exam, this can provide a means to think about how all the topics fit together in a larger context, and can reinforce these concepts for later courses in the curriculum and ultimately help prepare students for a successful career.

The Engineer's Creed:

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare. I pledge:

- to give the utmost of performance
- to participate in none but honest enterprise
- to live and work according to the laws of man and the highest standards of professional conduct
- to place service before profit, the honor and standing of the profession before personal advantage,

and the public welfare above all other considerations In humility and with need for Divine Guidance, I make this pledge.

Engineering Ethics (The Canons):

1. Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in areas of their competence.
3. Engineers shall continue their professional development throughout their careers, and should provide opportunities for the professional and ethical development of engineers under their supervision.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall associate only with reputable persons or organizations.
7. Engineers shall issue public statements only in an objective and truthful manner.
8. Engineers shall consider environmental impact in the performance of their professional duties.

Academic Integrity, Honesty and Ethical Issues:

- Ethical behavior and professional standards are expected in this class. All work submitted is to be that of the individual student unless cooperative effort is authorized in specific instances. The College of Engineering and Science Honor Code will be observed. Refer to your student handbook regarding University policies on academic dishonesty.
- As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.
- *During a test, any use of a cell phone or other wireless device, any discussion by any means, any copying or using unauthorized written sources constitutes cheating. Giving unauthorized aid to other students such as letting a student view your paper or communicating in any way is cheating. Discovery of cheating will result in immediately failure of the course (not just of a particular test) followed by making a charge of academic dishonesty with the University. There is NO Forgiveness of failures that are associated with academic dishonesty cases.*

Title IX: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/. Mr. Jerry Knighton is the Clemson University Title IX Coordinator and Director of Access and Equity, located at 111 Holtzendorff Hall, 864-656-3181 (voice) or 864-565-0899 (TDD).

Course Outcomes

1. Students will develop an understanding of basic element of mechanical systems, underlying principles and apply them to design problems.
2. Students will analyze the behavior of basic mechanical elements used to generate and convey motion by mechanical means, in particular gears and gear trains, cams, linkages, clutches and brakes, and classical mechanisms.
3. Students will employ these basic mechanical elements in the design of simple mechanical systems.
4. Students will demonstrate sound, rational approaches to the solution of engineering problems.
5. Students will demonstrate an ability to use techniques, skills, and modern engineering tools needed for engineering practice.
6. When presented with design problems, students will be able to apply knowledge of mechanical systems and reverse engineering techniques
7. Students will write technical reports and communicate how mechanical systems function, how they are made, and design improvements through technical reports

Topical Outline

1. Introduction to machine elements and mechanical systems – terminology, functionality, basic operation and application, design considerations.
2. Kinematic and force analysis of linkages.
3. Kinematic and force analysis and selection of gears.
4. Kinematic and force analysis of cams.
5. Kinematic and force analysis of belts and chain drives.
6. Kinematic and force analysis of power screws.
7. Power transmission shafting.
8. Mechanical springs selection and force analysis.
9. Dynamic force analysis - rotating equipment.
10. Rolling elements and bearings.
11. Braking and clutching systems.