Sample Syllabus

ME 481 Introduction to Computer-Aided Analysis of Machine Dynamics, Spring 2019 - 11:15-12:05 M W F, 316 Leonhard

Faculty: H.J. Sommer 337 Leonhard hjs1@psu.edu www.mne.psu.edu/sommer/me481
Text: *Design of Machinery,* Norton, McGraw-Hill (reference)
Software: MATLAB, Working Model (WM), SolidWorks (SW)
Grading: homework=10 each, final project=50

Week	Date	Notes	Topic	Homework due
1	Jan 7	01_01	administration, introduction	
	Jan 9	01_01	topology, mobility	
	Jan 11	02_01,02_02	Working Model	H01 review
2	Jan 14	03_01	geometric kinematics	
	Jan 16	03_02	complex number kinematics	
	Jan 18	03_03	Newton-Raphson solution	H02 topology
3	Jan 21		no class – MLK Day	
	Jan 23	03_04	multiloop mechanisms	
	Jan 25	03_05	instantaneous centers	H03 WM kinematics
4	Jan 28	03_05	instantaneous centers	
	Jan 30	04_01,04_02	2D coordinate transformations	
	Feb 1	04_03,04_04	2D kinematics	H04 Newton-Raphson
5	Feb 4	04_04,04_05	joint constraint kinematics	
	Feb 6	04_04,04_05	joint constraint kinematics	
	Feb 8	04_04,04_05	joint constraint kinematics	H05 Wanzer
6	Feb 11	05_01,05_02	experimental kinematics	
	Feb 13	02_04	SolidWorks Motion	
	Feb 15		no class	H06 constraint kinematics
7	Feb 18	06_01	Newtonian mechanics for statics	
	Feb 20	06_02,06_03	Newtonian mechanics for statics	
	Feb 22	06_02,06_03	virtual work	H07 experimental kinematics
8	Feb 25	07_01	centroidal polar moment of inertia, radius of gyration	
	Feb 27	07_02	polygonal moment of inertia	
	Mar 1	07_03	experimental moment of inertia	H08 SW kinematics
9	Mar 11	07_04	vehicle inertial measurements	
	Mar 13	08_01	forward versus inverse dynamics	
	Mar 15	08_02	classical inverse Newtonian dynamics	H09 WM static, virtual work
10	Mar 18	08_03	d'Alembert's Principle, virtual work	
	Mar 20	08_04	shaking force	
	Mar 22	08_05	multiplanar balancing	H10 mass moment
11	Mar 25	08_05	multiplanar balancing	
	Mar 27	08_06	friction	
	Mar 29	08_06	friction and damping in vibration	H11 shaking force
12	Apr 1	09_02	forward dynamics, Lagrangian dynamics	
	Apr 3	08_11,08_12	differential algebraic equations (DAE)	
	Apr 5	10_01	state space models	H12 WM stick-slip
13	Apr 8	10_02	time integration	
	Apr 10		no class	
	Apr 12	10_02	time integration	H13 frequency content
14	Apr 15	10_03	simulating DAE, friction, backlash	
	Apr 17	10_04	collision	
	Apr 19	10_04	collision	H14 integration
15	Apr 22	10_04	collision	
	Apr 24	01_02, 11_01	intro to 3D	
	Apr 26	11_01,11_02	intro to 3D	H15 collision
			Pecha Kucha 15 slides x 20 sec timed presentations	final presentations

Course Objectives

1) Recognize constrained kinematic chains embedded in larger engineering systems
2) Identify forward and inverse dynamic problems
3) Plan, implement and debug an appropriate computer-based design tool to analyze kinematics and dynamics of 2D constrained mechanisms
4) Use numerical integration methods and other numerical solution techniques
5) Learn and understand the underlying algorithms and theory behind commercially available mechanism analysis software
6) Communicate well using verbal, written and electronic methods

Course Policy

1) Attendance at lectures is mandatory.
2) Homework are individual assignments.
3) Final project may be a team effort.
4) Students should know and understand these course policies in regard to College of Engineering policy on academic integrity available at **http://www.engr.psu.edu/faculty-staff/academic-integrity.aspx**.

Homework Policy

1) Homework is due by 5:00 PM on dates assigned in the syllabus. No late submissions will be accepted unless prior approval has been granted.
2) University Park students should submit **hardcopy** for all homework (except H02) in class or at 337 Leonhard. H02 should be submitted per instructions for World Campus students.
3) World Campus students should submit **PDF copy** for all homework via Canvas. Combine all files into a single PDF. Use filename convention "Lastname_Hxx.pdf" where xx = 01, 02, 03, etc.

Final Project Information

Final project topics are your choice and may be drawn from your research/teaching interests, industrial experience, hobbies or intriguing devices. ***Be creative.*** Your mechanisms may be open loop or closed loop, static or dynamic. The projects may range from design of novel mechanisms, to analysis of existing devices, to exemplar use of analysis packages, to modeling of biological motion, to construction of working prototypes (passive, motorized or instrumented).

The intent of this project is to provide some personal insight into kinematics and dynamics outside the content of the class. It is not intended as a burdensome requirement, rather as an opportunity for you to gain some practical experience on a topic of your choice. You may work with a partner on this project.

Final Project Deliverables

1) A short, one page proposal detailing your project concept and project team. The proposal should contain WHO comprises your project team, WHAT you wish to accomplish, WHY this topic is pertinent or interesting or valuable, and HOW you plan to complete this project (e.g. time plan, requisite resources)
2) A self-explanatory, high quality final report as PDF
3) A five minute oral presentation during final exam week
   a) modified Pecha Kucha format, 15 slides by 20 seconds each, automatically timed
   b) maximum size able to send by email attachment
   c) filename convention = lastname_partnerlastname.PPTX

World Campus technical support

Alex Zimmerman alz5051@psu.edu 339 Leonhard

Academic Integrity - http://www.engr.psu.edu/faculty-staff/academic-integrity.aspx

The University defines academic integrity as the pursuit of scholarly activity in an open, honest and responsible manner. All students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts (refer to Senate Policy 49-20. Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions (refer to Senate Policy G-9).

Disability - http://equity.psu.edu/ods/faculty-handbook/syllabus-statement

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: http://equity.psu.edu/ods/dcl . For further information, please visit the Office for Disability Services Web site: http://equity.psu.edu/ods .

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: http://equity.psu.edu/ods/doc-guidelines . If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Counseling & Psychological Services (CAPS)

CAPS can help students resolve personal concerns that may interfere with their academic progress, social development, and satisfaction at Penn State. Some of the more common concerns include anxiety, depression, difficulties in relationships (friends, roommates, or family); sexual identity; lack of motivation or difficulty relaxing, concentrating or studying; eating disorders; sexual assault and sexual abuse recovery; and uncertainties about personal values and beliefs.

You can contact CAPS by calling the Main CAPS number/Appointment Scheduling: 814-863-0395 (Please call between the hours of 8am and 5pm, Monday-Friday to schedule an appointment) or visit us at our office location, 5th Floor Student Health Center.