

I. Department, Number, and Title of Course: Mechanical Engineering and Energy Processes, ME 309 (2), Mechanical Analysis and Design

Designation as a 'Required' or 'Elective' Course:

Required

II. Course (catalog) Description: To introduce students to kinematic and kinetic analyses of machinery. Conceptualization of machinery by skeleton representation, utilizing critical dimensions and parameters. Simple computer-based graphical techniques for design of planar mechanical systems.

Prerequisite(s):

Engineering 260

III. Textbook(s) and/or Other Required Material:

None

IV. Course Objectives: To introduce students to kinematic and kinetic analyses of machinery. Conceptualization of machinery by skeleton representation, utilizing critical dimensions and parameters. Simple computer-based graphical techniques for design of planar mechanical systems.

Topics Covered:

1. Introduction.....3 lectures
 - Introduction to planar chains: open and closed chains
 - Types of pairs: revolute, prismatic, roll-slide, and rolling pairs
 - Degree of freedom
 - Skeleton representation, critical dimensions
 - Basic mechanisms: four-bar and slider-crank mechanisms
 - Grashof theorem
2. Kinematic Analysis..... 8 lectures
 - Position analysis - vector loop
 - Cartesian components and complex variable approach
 - Determination of point path
 - Velocity analysis
 - Time differentiation of position equations
 - Primary kinematic coefficients
 - Instant center method
 - Acceleration analysis
 - Time differentiation of velocity equations
 - Secondary kinematic coefficients
 - Path curvature: center and radius of curvature
 - Newton-Raphson technique for numerical solution of position equations
3. Force Analysis 8 lectures
 - Static analysis
 - Mechanical Advantage
 - Dynamic Analysis
 - Steps in dynamic analysis of mechanisms
 - Breakdown of a mechanism into free-body diagrams
 - Application of Newton's second and third laws

4. Gear Trains..... 6 lectures
Fundamental law of gearing
- Gear types
 - Gear train kinematics
 - Kinematic coefficients, torque gain

V. Class/Laboratory Schedule:
Meet 2 times a week, 50 minute lecture

VI. Contribution of Homework, Quizzes, Tests, Laboratory Reports, or Research Papers:
Exams 70%: Exam1 = 10%, Exam2 = 20%, Exam3 = 20%, Exam 4 = 20%.
Homework 30%;
There will be no final exam.

Person(s) who prepared this description and date of preparation:
Dr. Kambiz Farhang, January, 2014

"We emphasize student achievement and success because achievement and success are essential if we are to shape future leaders and transform lives."

Syllabus Attachment

Spring 2014

<http://pvcaa.siu.edu/>

IMPORTANT DATES *

| | |
|---|-----------------------|
| Semester Class Begins..... | 01/13/2014 |
| Last day to add a class (without instructor permission): | 01/24/2014 |
| Last day to withdraw completely and receive a 100% refund: | 01/26/2014 |
| Last day to drop a course using SalukiNet: | 03/23/2014 |
| Last day to file diploma application (for name to appear in Commencement program) | 03/28/2014 |
| Final examinations:..... | 5/5 – 5/9/2014 |

* *Note: For outreach, online, and short course drop/add dates, visit Registrar's Academic webpage*

<http://registrar.siu.edu/>

SPRING SEMESTER HOLIDAYS

Martin Luther King, Jr.'s Birthday 01/20/2014

Spring Vacation 03/08—03/16/2014

WITHDRAWAL POLICY ~ Undergraduate only

Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit

<http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

INCOMPLETE POLICY~ Undergraduate only

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or *graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. *For more information please visit:*

<http://registrar.siu.edu/grades/incomplete.html>

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. *See full policy at*

<http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit <http://gradschool.siu.edu/about-us/grad-catalog/index.html>

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements.

<http://disabilityservices.siu.edu/>

STUDENT CONDUCT CODE http://policies.siu.edu/other_policies/chapter3/conduct.html

1 Southern Illinois University Carbondale. (2013). *Pathways to Excellence: A Strategic Plan* Retrieved from http://chancellor.siu.edu/common/docs/A_Strategic_Plan.pdf

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu, <http://salukicare.siu.edu/index.html>

EMERGENCY PROCEDURES

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the **SIU Emergency Response Plan** and **Build- ing Emergency Response Team (BERT)** programs. Emergency re- sponse information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website at www.dps.siu.edu (disaster drop down) and the Emergency Response Guideline pamphlet. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. *It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.*

INCLUSIVE EXCELLENCE

SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well an essential preparation for any career. *For more information please visit:* <http://www.inclusiveexcellence.siu.edu/>

MORRIS LIBRARY HOURS

<http://www.lib.siu.edu/about>

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

Tutoring : <http://tutoring.siu.edu/>

Math Labs http://tutoring.siu.edu/math_tutoring/index.html **WRITING CENTER**

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit <http://write.siu.edu/>

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY

Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. *For more information visit:* <http://diversity.siu.edu/#>

Additional Resources Available:

SALUKINET: <https://salukinet.siu.edu/cp/home/displaylogin>

ADVISEMENT: <http://advisement.siu.edu/>

PROVOST & VICE CHANCELLOR: <http://pvcaa.siu.edu/>

SIU ONLINE: <http://online.siu.edu/>

Spring 2014 R.O'Rourke