

Step #7 (Executive Vice President/Provost): Date Received NOV 2 1998

Approved

NOT Approved If no, reasons are as follows:

Student Credit Hours _____

Faculty Load Hours _____

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) 4/26/98

Executive Vice President/Provost Signature [Signature]

Registrar

Date Approved Course Description Received _____

is Taxonomy and Course Number Assigned 01/20/98

Date/Signature of Registrar [Signature]

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Course Proposal

1. Details:

- a) **Course Title:** Advanced Mechanism Design
b) **Sponsor:** Dr. Jawaharlal Mariappan and College of Engineering Curriculum Committee
c) **Credit Hours:** 3 credit hours
d) **Course Level:** Graduate (0910.541)
e) **Curricular Effect:** Elective course for engineering graduate students
f) **Prerequisites:** Undergraduate Degree in Engineering or the consent of instructor
g) **Suggested Time/Scale of Implementation:** One section during fall/spring semesters
h) **Resources:** Faculty: Existing faculty can teach this course
Library: No library acquisitions will be used
Equipment: No laboratory equipment will be required
Computers: Computer laboratory access will be required and additional software will be acquired.

2. Rationale:

The proposed course is an additional engineering elective that would supplement the Engineering Curriculum Proposal approved by the College Senate in December 1994. The proposed course is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February 1995.

This course introduces the students to the design of planar and spatial mechanisms. A unique feature of this course is that it will use matrix methods as the single platform model, synthesize, analyze and simulate any mechanism. Some of the mechanisms covered in this course are general purpose four-bar and six-bar, dwell and window regulator, and suspension mechanisms. Advanced design techniques that include type synthesis, numerical optimization techniques as applied to mechanism design will also be covered. Branch defects and circuit defects that occur during mechanism synthesis will also be addressed. In addition, modeling and simulation of mechanical systems such as suspension and windshield wiper will be covered in-depth with the use of appropriate mechanism simulation software.

3. Essence of the Course:

a) Objectives:

1. To provide the students with the knowledge and tools necessary to design a mechanism from conceptual stage to detail dimensional synthesis.
2. To provide an understanding of type synthesis procedure for creative mechanism design.
3. To ensure the elimination of branch and circuit defects during the synthesis process.
4. To provide the ability to model and simulate a mechanism using matrix methods.
5. To enable the use of simulation systems to systematically create virtual prototypes of mechanical systems.

b) Topical Outline:

The topics to be covered are listed below. The instructor will supply the students with a syllabus during the first week of classes. The instructor will assess any technology advances in the subject matter prior to the course and make topic changes deemed to be appropriate to maintain the level and currency of instruction.

Creative Design of Mechanisms
Kinematic Chains and Inversion
Identifying Isomorphism

Topical Synthesis and Analysis
Characteristic Polynomial Method
Contact Graph Method
Code Based Representations

Kinematic Fundamentals
Links, Joints, Loops and Degrees of Freedom (DOF)
Mechanical Advantage and Transmission Angle
Understanding Redundant Degrees of Freedom and Paradoxes in DOF Count
Example Application: Suspension, Window Regulator and other Mechanisms

The Task of Kinematic Synthesis
Graphical and Analytical Methods
Path, Function and Motion Generation Problems

Matrix Method of Modeling and Analysis of Mechanisms
Elementary Transformation Matrices
Joint Modeling, Incidence Matrix and Number of Kinematic Loops
Loop Closure Matrix Equations

Mechanism Analysis
Position, Velocity, Acceleration and Force Analysis
Spatial Mechanisms
Spatial Transformations
Modeling and Analysis of Spatial Mechanisms

Defects During Mechanism Synthesis
Branch and Circuit Defects
Method for Identifying and Eliminating Defects

Numerical Optimization Methods in Mechanism Synthesis
Problem Formulation for Optimization and Design of Experiments
Integrated Approaches for Mechanism Synthesis, Analysis and Simulation
Knowledge-based Approaches in Mechanism Design
Mechanism Design Software Overview

c) Evaluation and Grading Procedure of Students:

Student grades will be determined on the basis of examinations, homework, laboratory assignments, projects and reports. A course syllabus with stated method of arriving at the final grade, e.g., number of exams, homework, projects, percentage of grade, will be distributed to the students during the first week of classes.

d) Course Evaluation:

The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:

The proposed course is an additional elective that would supplement the Engineering Curriculum Proposal approved by the Faculty Senate in December 1994. Consultations were submitted with original proposal as specified by the Curriculum Committee

Catalog Description:

Advanced Mechanism Design (0910.541)

Prerequisites: Undergraduate degree in engineering or the consent of instructor

This course presents an in depth coverage of the design of mechanisms using matrix methods as the platform to model, synthesize, analyze and simulate mechanisms. It covers advanced design techniques that include type synthesis, numerical optimization techniques as applied to mechanism design. It also covers branch defects and circuit defects that occur during mechanism synthesis and modeling and simulation of mechanical systems. Students will perform analysis and simulation using appropriate mechanism design software.