ME 312 – DYNAMIC SYSTEMS AND CONTROL

Designation as a 'Required' or 'Elective' course
TYPE OF COURSE: Required for BSME Major

Course (catalog) description
COURSE DESCRIPTION: ME 312 Dynamic Systems and Control. 3 Hours. Dynamics of linear systems. Modeling of mechanical, electrical, fluid, and thermal systems. Analysis and design of feedback control systems. Analytical, computer and experimental solution methods. Time and frequency domain techniques.

Prerequisite(s)
PREREQUISITE(S): Phystics 142 General Physics II, 5 Hours. Math 220 Differential Equations, 3 Hours.

Textbook(s) and/or other required material

Course objectives
COURSE OBJECTIVES: This course introduces students to basic concepts in dynamic systems and control and associated mathematics, and theoretical and computational analysis tools. Half of the course is devoted to analysis of dynamic systems (50%). The second half is devoted to analysis and design of feedback control systems (50%).

Topics covered
MAJOR TOPICS: 
1. Course Introduction 1
2. The Laplace Transform 4
3. Mechanical Systems 4
4. Transfer Function Approach to Modeling Dynamic Systems 2
5. Electrical systems and electromechanical systems 6
6. Fluid systems and thermal systems 4
7. Time Domain Analysis and Design of Control Systems 10
8. Frequency Domain Analysis and Design of Control Systems 9
Examinations & Review for examinations 5
Total 45

Class/laboratory schedule, i.e., number of sessions each week and duration of each session
CREDIT HOURS: 3 Hours
TYPE OF INSTRUCTION:
<table>
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<tr>
<th>Type of Instruction</th>
<th>Contact Hours/Week</th>
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<tbody>
<tr>
<td>Lecture-Discussion</td>
<td>3</td>
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Contribution of course to meeting the professional component
This course introduces students to basic concepts in dynamic systems and feedback control and associated mathematics, and theoretical and computational analysis tools. Both analysis and
open-ended design problems are presented. The following fundamental concepts and techniques are also a part of this required course: linear algebra, matrix algebra, numerical and analytical calculations for the governing constitutive equations in mechanical, electrical, electromechanical, fluid power and thermal systems, solutions to ordinary differential equations.

**Relationship of course to program outcomes**
As shown in the BSME Course Outcomes Matrix:
- a. Ability to apply knowledge of mathematics, science and engineering
- c. Ability to design a system, component, or process to meet desired needs
- e. Ability to identify, formulate, and solve engineering problems
- k. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

**Person(s) who prepared this description and date of preparation**
Thomas J. Royston, Professor of Mechanical Engineering, January 2, 2007
Approved for continued use through Fall 2008 semester
Thomas J. Royston, Professor of Mechanical Engineering, September 15, 2008

**Comments on outcomes**
- a. Use of complex numbers, linear algebra; principles of dynamic systems, differential equations, graphical constructions, analytical formulations, and computer software.
- c. Several homeworks and computer projects require the design of feedback control systems. Evaluation criteria for designs are also discussed.
- e. Through homework and computer problems, students learn to formulate and solve control system analysis and design problems
- k. Course includes several homework problems that require use of a modern engineering computer language, such as Matlab®. Course also includes exposure to practical applications of control system analysis and design.