UNIVERSITY OF NORTH TEXAS
Department of Mechanical and Energy Engineering

MEEN 5600.006 Feedback Control of Dynamic Systems
Combined with MEEN 4800.006

Fall 2016

A. LOGISTICS

INSTRUCTOR: Dr. Suresh Rao
Office: F101R.1, Phone: 972-839-0984, email: suresh.rao@unt.edu

OFFICE HOURS: Tu. Th. 18:30 Hrs. - 19:00 Hrs. or by appointment.

CLASS SCHEDULE: Tu. Th. 19:00 Hrs. - 20:20 Hrs., Room: B140

TEXTBOOK: Modern Control Systems, 13/E by Dorf and Bishop.

REFERENCES: Feedback Control of Dynamic Systems, 7/E by Franklin and Powell.

Class handouts

B. CATALOG COURSE DESCRIPTION

MEEN 5600. Feedback Control of Dynamic Systems. 3 hours. Overview of feedback controls, modeling of
dynamics systems, dynamic responses. Analysis and design of control systems, PID control, frequency
response design and introduction to digital control. Various control systems design principles and case studies

Prerequisite(s):

Additional course material required: Scientific calculator. Students will be using MATLAB, a modeling
and simulation software.

Course material and announcements will be posted on Blackboard at www.learn.unt.edu. In addition,
any important notice regarding the course will be sent to you by e-mail. So, please make sure that we have
your correct UNT e-mail address and check your e-mail every now and then.

C. COURSE OBJECTIVES

The objectives of this course are to develop the knowledge and skills necessary for the design of automatic
control systems for dynamic systems.
1. Dynamic analysis of engineering systems for control system design. Use of knowledge from calculus, physics, differential equations, linear algebra, dynamic systems, and electrical science. Ability to systematically formulate models for physical engineering systems and understand their solutions.

2. Design of feedback control devices for engineering systems. Ability to design closed-loop control systems based on feedback of measured signals. Design of control schemes and controller gains to obtain the desired performance from the closed-loop control system.

3. A recognition that new advanced control strategies are continually being developed.

4. Conducting a project-level analysis for a selected control problem.

D. RELATIONSHIP OF COURSE TO ACHIEVING MECHANICAL AND ENERGY ENGINEERING STUDENT OUTCOMES (MEEN 4800.006)

(a) Ability to apply knowledge of mathematics, science, and engineering
(b) Ability to function on multi-disciplinary teams
(c) Ability to identify, formulate, and solve engineering problems
(d) Understanding of professional and ethical responsibility
(e) Ability to communicate effectively
(f) Broad education necessary to understand the impact of engineering solutions in a global and societal context
(g) Recognition of the need for, and an ability to engage in, lifelong learning
(h) Knowledge of contemporary issues
(i) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

E. PREREQUISITE KNOWLEDGE:

F. COURSE REQUIREMENTS:

General Plan

The class will focus on both understanding of concepts and problem solving. It will emphasize your figuring out things using your own mind, not simply memorizing what is in a textbook. On a typical day you will be given lecture on main concepts and typical problem solving methods. You will then be engaged in questioning and discussion in class for the problem solving practice. You are encouraged to assess and monitor your own progress using criteria and standards discussed in class. If at any time in the semester you feel unsure about your ”grade”, you should request an assessment from the professor.

The knowledge acquired through your learning experience in this course will be reinforced by a combination of written assignment, either from the textbook or from the professor, and class projects. Those assignments should follow the recommended format and reflect a logical reasoning of your thinking. At different stages of the course, an assessment will be given in a form of a written quiz. At the mid semester and near the end of the semester, a test will be given in place of a quiz. You are encouraged to improve your performance, increase your strengths and diminishing your weaknesses.

Requirements

All students must complete all of the following:

1. Homework assignments. Due on Thursday of the following week unless announced in class.
2. Close-book quizzes, all in a multiple-choice format.
3. 2 Progressive Tests, all in open book format.
4. Consistent classroom attendance and active participation (extra credit).
Grade Evaluation

The class will be graded based on a percentage and point system. Following weight factors are applied to calculation of the final grade:

ASSIGNMENTS 20%
QUIZZES 20%
TEST ONE 15%
TEST TWO 15%
CLASS PROJECT 25%
ACTIVE CLASS PARTICIPATION (for extra credit. A class roll will be circulated.) 5%

TOTAL 100%

Class Policies

Excusable absence from the quizzes or tests is accepted only if the student informs the professor before the event such as illness and non-reschedulable prior appointment, or after the event, such as medical or other emergencies, within a reasonable time frame. In all the cases, academic honesty is expected. Under this condition, a make-up test can be honored.

Quizzes will be evaluated on a median average basis, and tests will be averaged arithmetically.

Graduate students may have separate assignments and tests, and are evaluated at the graduate-level expectation.

Grade Significance:

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<thead>
<tr>
<th>GRADE</th>
<th>SCORE RANGE</th>
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<th>SCORE RANGE</th>
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<tbody>
<tr>
<td>A</td>
<td>100 - 85 %</td>
<td>C</td>
<td>69.9 - 55 %</td>
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<tr>
<td>B</td>
<td>84.9 - 70 %</td>
<td>D</td>
<td>54.9 - 40 %</td>
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<tr>
<td></td>
<td></td>
<td>F</td>
<td>&lt; 40 %</td>
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Dishonesty

Any form of dishonesty during the semester will result in a final grade of F for the course and a recommendation for expulsions to the Provost. No exceptions. Please avoid cheating or any other form of misconduct. If you are having personal problems, come and talk to the instructor.
## Feedback Controls Fall Schedule Overview

<table>
<thead>
<tr>
<th>Week</th>
<th>Of Date</th>
<th>Topic</th>
<th>HW/Project Assignments</th>
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<tbody>
<tr>
<td>1</td>
<td>8/29</td>
<td>Introduction/Course Overview</td>
<td></td>
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<tr>
<td>2</td>
<td>9/05</td>
<td>Mathematical Models</td>
<td></td>
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<tr>
<td>3</td>
<td>9/12</td>
<td>Block Diagram State Variable Models</td>
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<tr>
<td>4</td>
<td>9/19</td>
<td>Feedback Characteristics</td>
<td>Quiz 1 (9/22)</td>
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<td>5</td>
<td>9/26</td>
<td>Performance of Feedback Control Systems</td>
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<tr>
<td>6</td>
<td>10/03</td>
<td>Stability</td>
<td>Quiz 2 (10/06)</td>
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<td>7</td>
<td>10/10</td>
<td>Root Locus Method</td>
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<tr>
<td>8</td>
<td>10/17</td>
<td>Frequency Response Methods</td>
<td>Test 1 (10/20)</td>
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<td>9</td>
<td>10/24</td>
<td>Stability and Frequency Domain</td>
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<tr>
<td>10</td>
<td>10/31</td>
<td>PID Controllers</td>
<td>Quiz 3 (11/03)</td>
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<tr>
<td>11</td>
<td>11/07</td>
<td>Design of Feedback Control</td>
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<tr>
<td>12</td>
<td>11/14</td>
<td>Control System Design Case Studies</td>
<td>Test 2 (11/17)</td>
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<tr>
<td>13</td>
<td>11/21</td>
<td>Control System Design Case Studies</td>
<td>Thanksgiving (no class 11/24)</td>
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<tr>
<td>14</td>
<td>11/28</td>
<td>Introduction to Digital Control</td>
<td>Quiz 4 (12/01)</td>
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<tr>
<td>15</td>
<td>12/05</td>
<td><strong>Final Project Presentations</strong> (Final Reports)</td>
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<tr>
<td>16</td>
<td>12/12</td>
<td></td>
<td>(12/13) and (12/15)</td>
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### Disclaimer

The course schedule, content, and assignments are subject to modification when circumstances dictate and as the course progresses. If changes are made, you will be given due notice.