Mechanical Engineering Course Evaluation
ME 421 Automatic Controls
Dr. Georg F. Mauer

Reviewer: Michelle Miller
Date/time/room: 12/2/09 8:30 – 10:00am TBE-172

Description per Course Catalog: Introduction to feedback system concepts; mathematical modeling of mechanical, hydraulic, electromechanical and servo systems; feedback system characteristics and performance; stability; design and compensation of control systems. 3 credits.

Syllabus: Dr. Mauer provided the website for an on-line syllabus using a multi-media EPSON computer projection system and navigated to the site during class for the benefit of the reviewer. Syllabus reflected the description in the course catalog and is enclosed for detailed information.

Lecture Topic: Comprehensive review of semester topics for final exam. Some specific topics covered included transfer functions, linearization, feedback systems, stability, characteristic equations, root locus, and Fourier analyses.

Observation: Students politely gathered in the hall outside of the room until Dr. Mauer arrived at approximately 8:20am to open the locked classroom door. Class began on time. Students continued to respectfully enter the classroom up to one hour past the start time of the lecture due to their concurrent participation in a Senior Design Competition. A total of 40 students were eventually present. Reviewer noted 3/40 were female. Dr. Mauer displayed prepared slides containing material for a comprehensive review using sample questions for potential exam material. During the lecture students freely discussed equations and concepts amongst each other and interactively with the instructor. The instructor clearly explained exactly what was expected to be known for the exam. Dr. Mauer indicated the notes and specific software and hardware (graphing calculators) that would be allowed to be used by students during the exam. Class ended at 9:50am.

Identified Best Practice: This reviewer was very surprised (and impressed) to see the use of I-Clickers, wireless interactive audience response devices that record individual students’ responses to multiple choice questions. The recorded responses were displayed so that students could see how their answers compared to others. Dr. Mauer cleverly used this medium to stimulate discussions and focus explanations on concepts identified as strengths or weaknesses based upon the student responses. The reviewer was positively stunned by this marvelous use of technology.

Actions for Performance Enhancement: None.
ME 421 - AUTOMATIC CONTROLS

Introduction to feedback system concepts; mathematical modeling of mechanical, hydraulic, electromechanical and servo systems; feedback system characteristics and performance; stability; design and compensation of control systems.

Credits 3
Prerequisites EE 290, and ME 330.
# FALL 2009 - UNIVERSITY OF NEVADA, LAS VEGAS
DEPARTMENT OF MECHANICAL ENGINEERING

MEG 421 Automatic Controls MW 8:30 – 9:45 a.m. Room TBE-B 172
Text: "Feedback Control of Dynamic Systems, Fifth Edition" by Franklin et al.
Instructor: Georg F. Mauer
Office: TBE-B130 Phone 895-3830 E-mail: maier@me.unlv.edu
Office Hours: MW 10:00 to 11:00 am, 3:00 to 4:30 pm

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic and Chapter</th>
<th>Problems submit before class. Weekly due dates listed at left, e.g. First Hw is due Monday 8/31.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/24</td>
<td>Fundamentals 1 to 2.2 Note: Use VisSim, Xmath or Matlab Software for Matlab problems. Always submit all programming work with your assignment.</td>
</tr>
<tr>
<td>2</td>
<td>8/31</td>
<td>Dynamic Models 2.3 - 2.6 1.1 a-d, 1.3, 1.7 a-c, 2.1 c</td>
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<tr>
<td>3</td>
<td>9/09</td>
<td>Dynamic Models cont. 2 to end 2.4, 2.8, 2.18</td>
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<tr>
<td>4</td>
<td>9/14</td>
<td>Dynamic Response 3 to 3.2 2.20, 2.21</td>
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<tr>
<td>5</td>
<td>9/21</td>
<td>Dynamic Resp., cont., Test #1 3.2a-c, 3.9c, 3.11, 3.13, 3.20 a,b</td>
</tr>
<tr>
<td>6</td>
<td>9/28</td>
<td>Dynamic Resp., cont. 3.28, 3.31, 3.35</td>
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<tr>
<td>7</td>
<td>10/05</td>
<td>Basic feedback 4 4.4, 4.7, 4.8, 4.10</td>
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<tr>
<td>8</td>
<td>10/12</td>
<td>Routh, Root Locus 4.4, 5 to 5.2 4.19, 4.29a-d use Matlab 4.19, 4.29a-d use Matlab</td>
</tr>
<tr>
<td>9</td>
<td>10/19</td>
<td>Root Locus, Cont. 5.3 to end 5.3, 5.5d-f, 5.7 a-c</td>
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<tr>
<td>10</td>
<td>10/26</td>
<td>Test #2, Freq. Analysis 6.1 - 6.2 5.20, 5.22, 5.25</td>
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<tr>
<td>11</td>
<td>11/02</td>
<td>Nyquist Criterion 6.3 - 6.5 5.29, 6.3c-i polar plot only, 6.4 c,d polar plot only</td>
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<tr>
<td></td>
<td>November 2.........Final day to drop or withdraw</td>
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<tr>
<td>12</td>
<td>11/09</td>
<td>Nyquist cont. 6.6 6.6 a-d, 6.7 a-c,</td>
</tr>
<tr>
<td>13</td>
<td>11/16</td>
<td>Design and Compensation 6.7 6.17 b,c, Evaluate stability in Bode plot. plus Homework 12 Supplement in Box below. A blank Bode plot template is posted here. Clearly scale and label each axis! Note on 6.17. We didn't have time in class for the stability discussion, so see Book re. the Nyquist criterion.</td>
</tr>
<tr>
<td>14</td>
<td>11/23</td>
<td>Design and Compensation, Test # 3 on 11/25 (Wednesday) 6.26a-d, 6.33, 6.39</td>
</tr>
<tr>
<td>15</td>
<td>11/30</td>
<td>Time Domain Analysis 7 TBA</td>
</tr>
</tbody>
</table>

## Fall 2009 Homework 12 Supplement, due Mon 11/16

1. Manually construct the Bode plots (Linear Approximations) of

\[ G_1(s) = \frac{1}{s(0.25s + 1)(s/6 + 10)} \]  
and of \[ G_2(s) = \frac{(s + 2)}{s + 20} \] in the same graph. Use different colors for G1 and G2. Clearly mark every break frequency in the graph.

2. Copy both completed Bode plots onto a new blank plot, and manually combine (add) both plots. Since Bode plots employ logarithmic graphing, the addition of two plots represents the product G1*G2.

| Homework(7.5%), Class Participation (i-Clickers 7.5%), and Design Project (15%) | 30% |
| Tests and Quizzes | 45% |
| Final Exam | 25% |

**FINAL EXAM: Wednesday December 9 8:00 AM to 10:00 a.m.**

**Policies: All tests are closed book and closed notes. Make-up tests will NOT be given. Exceptions are made only if the student provides valid reason for absence PRIOR to the test date. Only students who have completed the**

http://www.me.unlv.edu/Undergraduate/coursenotes/control/syllabus.htm 12/3/2009
prerequisite courses are eligible for participation in this course. Students are expected to attend classes regularly.

I-Clickers: Every student will be required to bring an individually coded I-clicker to every class meeting. I-Clickers are wireless interactive audience response devices that record individual students' responses to multiple choice questions. Every student registered in Section ME 421 001 will be required to bring an I-Clicker coded to his/her name to each class meeting. You can purchase an I-clicker at the UNLV bookstore, or borrow one from the MEG department. Loaned clickers must be returned to the department before the final exam at the end of the semester. Students who would receive a passing grade, but who have not returned their loan I-clickers, will receive a semester grade of Incomplete. Short multiple-choice I-clicker questions will be asked at irregular intervals during class. The student responses over the semester will be part of the individual semester grade and will be entered in the class participation category. No I-clicker make-up questions will be given.

Homework and Lab: Homework is due weekly BEFORE class on the date shown in the schedule. Late homework is NOT accepted. The course will in part consist of an open-ended design project, in which you will design and analyze a control system for a specific application. A separate handout will be issued for the project. You must complete every design assignment with a passing grade and submit a satisfactory final project report in order to complete the course. Students must complete every lab assignment with a passing grade. Lab reports are due at the beginning of the lab meeting, one week after each lab. A penalty of 20% of the maximum grade will be assessed for each day of late submission of any report. Any report submitted more than five days late will be given a failing grade, and result in an "F" grade for either the course or the lab. Students with disabilities may request accommodations through the disability resource center. Students requiring accommodations with regard to religious holidays must request these from the instructor in writing no later than Friday, 8/28/09.

Computer Use: We will use computers extensively throughout the lab and for homework. Please obtain an account on the college network. You will find that the software tools (Matlab, Mathcad, Vis Sim) are very useful for eliminating menial work, and for improving your understanding. The software tools are installed on the PC's in TBE-B-361 and the controls lab (TBE-B121). Learning the tools will require some time and effort from everyone. Be patient, and take enough time to practice. You may use other appropriate software instead of Matlab for homework assignments. Both software packages are functionally the same at the command level. Home users: A student version of Matlab is available at the bookstore. All handouts have been posted on the MEG web page at:

http://www.me.unlv.edu/Undergraduate/coursenotes/control/control.htm

Academic Misconduct — "Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution."

An example of academic misconduct is plagiarism: "Using the words or ideas of another from the Internet or any source, without proper citation of the sources." See the "Student Academic Misconduct Policy" (approved December 9, 2005) located at:

http://studentlife.unlv.edu/judicial/misconductPolicy.html

Copyright — The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. To familiarize yourself with copyright and fair use policies, you are encouraged to visit the following website:

http://www.unlv.edu/committees/copyright/

Disability Resource Center (DRC) — It is important to know that over two-thirds of the students in the DRC reported that this syllabus statement, often
read aloud by the faculty during class, directed them to the DRC office.
The Disability Resource Center (DRC) coordinates all academic accommodations for students with documented disabilities. The DRC is the official office to review and house disability documentation for students, and to provide them with an official Academic Accommodation Plan to present to the faculty if an accommodation is warranted. Faculty should not provide students accommodations without being in receipt of this plan.

UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, offering reasonable accommodations to qualified students with documented disabilities. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC), Room 137, and the contact numbers are: Voice (702) 895-0866, TDD (702) 895-0652, fax (702) 895-0651. For additional information, please visit: http://studentlife.unlv.edu/disability/.

Religious Holidays Policy -- Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the last day at late registration of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. This policy shall not apply in the event that administering the test or examination at an alternate time would impose an undue hardship on the instructor or the university which could not be avoided.
http://catalog.unlv.acalog.com/content.php?catoid=1&navoid=44&bc=1

Tutoring – The Academic Success Center (ASC) provides tutoring and academic assistance for all UNLV students taking UNLV courses. Students are encouraged to stop by the ASC to learn more about subjects offered, tutoring times and other academic resources. The ASC is located across from the Student Services Complex, #22 on the current UNLV map. Students may learn more about tutoring services by calling (702) 895-3177 or visiting the tutoring website at:
http://academicsuccess.unlv.edu/tutoring/

UNLV Writing Center – One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance.

Appointments may be made in person or by calling 895-3908. The student’s Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: http://writingcenter.unlv.edu/

Expected Learning Outcomes – With the completion of the course students will have acquired:

a. A fundamental knowledge of state-of-the-art and evolving areas associated with automated processes in mechanical engineering
b. The ability to solve open-ended design problems
c. An introductory knowledge of manufacturing and design methods
d. The ability to use computers in solving engineering problems
e. The ability to mathematically model and analyze engineering systems
f. Training in the oral and written presentation of technical information

Grading / Exams / Grade Posting – Final Grades will be posted on the Registrar’s site at the end of the semester.

Missed Class(es) / Student – As a general rule, a student missing a class or laboratory assignment because of observance of a religious holiday shall have the opportunity to make up missed work. Students must notify the instructor of anticipated absences by the last day of late registration, August 28, 2009, to be assured of this opportunity. Students who represent UNLV at any official extracurricular activity shall also have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to the missed class(es).

Rebelmail – By policy, faculty and staff should only e-mail students’
Rebelmail accounts. Rebelmail is UNLV’s official e-mail system for students. It is one of the primary ways students receive official university communication. All UNLV students receive a Rebelmail account after admission to the university. Non-admitted students should contact the Student Help Desk at (702) 895-0761, in the Student Union Room 231, or by e-mail: studenthelp@unlv.edu. See http://rebelmail.unlv.edu/ for information.

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12/3/2009