Purdue University
Request for Addition, Expiration, or Revision of an Undergraduate Course
(100-400 Level)

Department: Motorsports Engineering
Effective Session: Fall 2009

Instructions: Please check the items below which describe the purpose of this request.

- New course with supporting documents
- Add existing course offered at another campus
- Expiration of a course
- Change in course number
- Change in course title
- Change in course credit/type
- Change in course attributes (department head signature only)
- Change in instructional hours
- Change in course description
- Change in course requisites
- Change in semesters offered (department head signature only)
- Transfer from one department to another

Proposed:

Subject Abbreviation: MSME
Course Number: 380
Long Title: Control Systems Analysis and Design
Short Title: Control Systems Analysis and Design

Existing:

Subject Abbreviation
Course Number
Long Title
Short Title

Terms Offered:

- Summer
- Fall
- Spring
- CAMPUS ES INVOLVED
  - Calumet
  - Cont Ed
  - Ft. Wayne
  - Indiapolis
  - N. Central
  - Tech Statewide
  - W. Lafayette

Credit Type

1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs. (Check One)
   Maximum Cr. Hrs.
3. Equivalent Credit: Yes
4. Thesis Credit: Yes

Course Attributes: Check All That Apply

1. Pass/Not Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable
4. Maximum Repeatable Credit:
5. Designator Required
6. Special Fees

Instructional Type

- Lecture
- Recitation
- Presentation
- Laboratory
- Lab Prep
- Studio
- Distance
- Civic
- Experiential
- Research
- Inc. Study
- Prac/Obsrv

Weeks Offered

- 75
- 15

% of Credit Allocated

Delivery Method

- Asyn.
- Or Syn.

- Internet
- Live
- Text-Based
- Video

Cross-Listed Courses

Course Description (Include Requisites):

This course studies classical feedback concepts, Bode and Nyquist plots, state space formulation, and stability for control system designs.

Calumet Department Head: Date
Calumet School Dean: Date

Ft. Wayne Department Head: Date
Ft. Wayne School Dean: Date

Indianapolis Department Head: Date
Indianapolis School Dean: Date

North Central Department Head: Date
North Central Chancellor: Date

West Lafayette Department Head: Date
West Lafayette College/School Dean: Date
West Lafayette Registrar: Date

Office of the Registrar
New Course Request

Indiana University

Check Appropriate Boxes: Undergraduate credit ☑  Graduate credit ☐  Professional credit ☐

1. School/Division  School of Engineering & Technology  2. Academic Subject Code  MTSE

3. Course Number 360  (must be cleared with University Enrollment Services)

4. Instructor Peter Hyjek

5. Course Title Control Systems Analysis & Design

Recommended Abbreviation (Optional) (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year) Fall 2009

7. Credit Hours: Fixed at 3 or Variable from ______ to ______

8. Is this course to be graded S/F (only)? Yes ☑  No ☒

9. Is variable title approval being requested? Yes ☐  No ☑

10. Course description (not to exceed 50 words) for Bulletin publication:

P: MTSE 210 and MTSE 340 or ME 340 or permission of instructor. This course studies classical feedback concepts, Bode and Nyquist plots, state space formulation, and stability for control system designs.

11. Lecture Contact Hours: Fixed at 3 or Variable from ______ to ______

12. Non-Lecture Contact Hours: Fixed at ______ or Variable from ______ to ______

13. Estimated enrollment: 25 of which ______ percent are expected to be graduate students.

14. Frequency of scheduling: ______  Will this course be required for majors? Yes ☑  No ☐

15. Justification for new course: Part of the already approved BS in Motorsports Engineering

16. Are the necessary reading materials currently available in the appropriate library? Yes ☑  No ☐

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by  

Richard E. Riley  Date 8/19/09  
Department Chair or Division Director

Approved by  

N. Akay  Date 3-17-09  
Chancellor-Vice-President

Dean of Graduate School (when required) Date

University Enrollment Services Date

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPD 724  
University Enrollment Services, Chancellor-Vice-President: School Division: Yeager, Department Division: Park, University Enrollment Services, Advance White
MSTE360 Control System Analysis and Design (co-listed with ME 482)

Syllabus

(3 Credit hours, Fall 2006)

Instructor: Dr. Sohel Anwar, Assistant Professor, Mechanical Engineering Dept., IUPUI. Office: SL 260N, Tel. 274-7640, Fax 274-9744, E-mail: soanwar@iupui.edu.

Teaching Assistant: Delon Reyhart, Graduate Assistant, Mechanical Engineering Dept., IUPUI. Office: SL 025, Tel. 274-9741, E-mail: dreyhart@iupui.edu. Office Hours: TBA.

Lecture Hrs: TR 6:00 PM – 7:15 PM in SL 108.
Office Hrs: TR 3:30 PM – 5:00 PM in SL 260N or by appointment.


Prereq.: ECE 301 or ME 330 or equivalent.

Catalog Description:
Classical concepts of feedback system analysis and associated compensation techniques. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Homework: Homework problems will be assigned every week in order for you to understand course materials covered in the lectures. All homeworks are due in a week from the date of assignment.
- Late homework will not be accepted.
- All work submitted should be the student's own.
- All necessary steps towards obtaining the solution, as well as any Matlab code, must be included in the write-up for full credit.

There will be approximately ten homework assignments during the course of the semester. Each student's lowest two scores will be dropped. The problems will generally be drawn from the \Design Problems" and \Matlab Problems" sections following each chapter. Students should keep returned homework as results of some problems may be used in later homework assignments.

Projects: A project will be assigned. A formal report on the project will be due at the end of the semester.

Exams: Three in-class midterm and a final exam will be given. The final will be non-cumulative with emphasis on the materials which are not covered in the midterms. No make-up exams will be given.

Academic Misconduct: Any cheating in the exams will result in a grade of "F" automatically.

Grading: Homework 20%, Project 20%, Three Midterm Exams 45% (15% each), Final Exam (non-cumulative) 15%.

Grading Scale

<table>
<thead>
<tr>
<th>Letter grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>95-100</td>
</tr>
<tr>
<td>A</td>
<td>90-94.99</td>
</tr>
<tr>
<td>A-</td>
<td>87-89.99</td>
</tr>
<tr>
<td>B+</td>
<td>84-86.99</td>
</tr>
<tr>
<td>B</td>
<td>81-83.99</td>
</tr>
<tr>
<td>B-</td>
<td>78-80.99</td>
</tr>
<tr>
<td>C+</td>
<td>74-77.99</td>
</tr>
<tr>
<td>C</td>
<td>70-73.99</td>
</tr>
<tr>
<td>C-</td>
<td>65-69.99</td>
</tr>
<tr>
<td>F</td>
<td>0-64.99</td>
</tr>
</tbody>
</table>

Americans with Disabilities Act:
If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241. The office is located in CA 001E.

Course Content:
To teach students to construct both block diagrams and mathematical models for physical systems consisting of some common electrical and mechanical components, to determine the impulse, step and frequency response of these systems, to perform a stability analysis, and to design standard type compensators to meet common specifications.

Course Objectives:
Upon successful completion of the course, students should be able to:

i. Explain the concept of feedback control [a2, a4]
ii. Derive and use mathematical models of simple electrical and mechanical systems. [a, e]
iii. Explain the concepts of stability and accuracy for control [a2]
iv. Perform analyses for transient and steady-state responses, and for stability and sensitivity of linear time-invariant systems. [a, c, k]
v. Plot root-locus and Bode plots manually and by using Matlab [a2, k4]
vi. Design controllers to meet specifications and requirements in both time domain and frequency domain. [a, c, e, k]
vii. Use computer-aided tools such as Matlab/Simulink for control system analysis and design. [a, c, e, k]

Using the Textbook Website
Students should take the initiative to do additional problems from the “Exercises” and “Problems” sections to make sure that they not only understand the material of each chapter, but can use the material successfully. They should also visit the web site for the textbook and be sure that they can
successfully answer all of the “Multiple Choice”, “True or False”, and “Matching Terms & Concepts” questions posted for each chapter. To access these questions on the web site for the text, go to [http://wps.prenhall.com/esm_dorf_modctrlsys_10](http://wps.prenhall.com/esm_dorf_modctrlsys_10) and at the top of the page, select the appropriate chapter. Select “Multiple Choice”, “True or False”, or “Matching Terms & Concepts” from the options on the left, and after filling in the answers, click “Submit Answers for Grading”. Please do not email me your results unless specifically requested to do so as part of a homework assignment. The missing appendices for the textbook are accessed by selecting “TOC” and then “Book Resources”. In addition to the Appendices, Matlab and Simulink code for examples from the text is available here.

The “Errata” listing for the new text is posted on OnCourse. Be sure to check these so that you do not waste time trying to figure out something in the text that doesn't make sense because it is, in fact, false. If you find additional errors in the text that are not listed, please let me know so that I can post them on OnCourse web page to let the rest of the class know.

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Topics</th>
<th>Reading Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction and Overview</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>2-4</td>
<td>Mathematical Models</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>5-7</td>
<td>State Variable Models</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>8</td>
<td>First Midterm</td>
<td>Chapters 1-3</td>
</tr>
<tr>
<td>9-10</td>
<td>Feedback Control System Characteristics</td>
<td>Chapter 4</td>
</tr>
<tr>
<td>11-12</td>
<td>Performance Analysis</td>
<td>Chapter 5</td>
</tr>
<tr>
<td>13-14</td>
<td>Stability Analysis</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>15</td>
<td>Second Midterm</td>
<td>Chapters 4-6</td>
</tr>
<tr>
<td>16-18</td>
<td>Root Locus Method</td>
<td>Chapter 7</td>
</tr>
<tr>
<td>19-20</td>
<td>Basic Frequency Response Methods</td>
<td>Chapter 8</td>
</tr>
<tr>
<td>21-22</td>
<td>Stability in the Frequency Domain</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>23</td>
<td>Third Midterm</td>
<td>Chapters 7-9</td>
</tr>
<tr>
<td>24-27</td>
<td>Controller Design Methods</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>28-29</td>
<td>State Space Analysis and Design</td>
<td>Chapter 11</td>
</tr>
<tr>
<td>30</td>
<td>Robustness</td>
<td>Chapter 12</td>
</tr>
<tr>
<td>Finals</td>
<td>Final exam</td>
<td>Chapters 10-12</td>
</tr>
</tbody>
</table>