146 Proposal # (Academic Affairs use only) 010R Proposal # (College use only)

REQUEST FOR A NEW COURSE

University of Central Oklahoma

Course Subject (Prefix), Number, and Title:

Course Subject	Recommended Number	Course Title (maximum of 30 characters) *Remember when abbreviating names, this is how they will appear on student's transcripts.
ENGR	5403	Adv. Control Sys. Design & Lab

Course Title: (full title of course if longer than 30 characters)

Advanced Control Systems Design and Lab

For information regarding CIP codes contact your department chair or visit: http://www.uco.edu/academic-affairs/ir/program_inventory.asp

CIP Code: 14.1001

For graduate courses, please attach a syllabus for this course. (See syllabus requirement policy 2.2.)

Course description as it will appear in the appropriate catalog.

Course description only Do not include prerequisites or enrollment restrictions, these should be added under questions 6-12. (Please use standard American English including full sentences.)

This course will provide a comprehensive treatment of the analysis and design of advanced control systems. Modern control theories in state-space domain and Laplace transform domain will be introduced. Topics include modern control design techniques such as root locus design, lead-lag and PID controllers, and controller design via frequency response and state space. This course has a lab component and lab experiments are related to the theoretical material covered in the class.

Engineering and Physics
Department submitting the proposal

Alaeddin Abuabed	aabuabed@uco.edu	3459
Person to contact with questions	email address	Ext. number

Approved by:

9/25/2020
Department Chairperson Date

Digitally signed by Britney Hopkins
Date: 2020.09.28 18:27:21 -05'00'
College Curriculum Committee Chair Date
(Please notify department chair when proposal is forwarded to dean.)

9/29/2020
College Dean Date
(Please notify the department chair when proposal is forwarded to AA.)

Academic Affairs Curriculum or Graduate Council Date

Office of Academic Affairs Date

Effective term for this new course
(Assigned by the Office of Academic Affairs.)

VHI

1. Does this course have an undergraduate / graduate counterpart?
   x Yes ___ No

2. Is this proposal part of a larger submission package including a program change?
   x Yes ___ No

3. Does this new course affect a teacher preparation program? (All courses required for any teacher preparation program must have approval from the Council on Teacher Education (CTE) before approval from AACC or Graduate Council.)
   ___ Yes x No If yes, send copy of proposal to the Education Curriculum Committee Chair, Dr. Darla Fent.
   CTE Approval (Stamp or initial)_____

4. Has this course been previously taught as a common course (4910 seminar, 4960 institute, etc.)?
   ___ Yes x No If yes, when was the most recent offering? _____

5. Does this course affect majors or minors outside the department?
   Yes x No If yes, provide name(s) of department chair(s) contacted, dates, and results of discussion.
   _____

6. Prerequisite courses:
   Example 1: MATH 1213 and (MATH 2165 or MATH 2185) and CHEM 1213 Example 3: 8 hours of biology including BIO 1404
   Example 2: (ACCT 2113 and 2213) and (MGMT 3013 or ISOM 3613)
   ENGR 4303 or ENGR 5303

7. Co-requisite(s): Which of the above prerequisite courses, if any, may be taken in the same semester as the proposed new course?
   None

8. Concurrent enrollment: Courses that must be taken the same semester. Example: lab courses.
   None

9. Will this course have enrollment restrictions?
   ____ Yes x No If No, go to question 13.

10. Specify which major(s) may or may not take this course. Specifying a major, excludes all other majors from enrolling.
    Check one: May _____ May not _____
    Major Code: _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____

11. Which of the following student classification(s) may enroll in this course?

		Check all that apply:
Graduate	(2) 19 + hours	_____
Graduate	(1) 0-18 hours	_____
Post Baccalaureate *		_____
Senior		_____
Junior		_____
Sophomore		_____
Freshman		_____

    * Graduate level courses are not open to Post Baccalaureate students.

12. Check or list other restrictions for this course.

    Admission to Graduate Programs _____
    Admission to Nursing Program _____
    Admission to Teacher Education _____

    Other _____

13. **Course objectives:** Objectives should be observable, measurable and include scholarly or creative activities to meet the course level characteristics. Course objectives should also be in line with the course description. (Please refer to instructional objectives documents at: http://www.uco.edu/academic-affairs/faculty-staff/aacc.asp#FAQ/Helpful%20Hints.)

Upon completion of this course, students will be able to:

1. Define the mathematics of state space representation;
2. Design linear controllers using PID controllers;
3. Demonstrate the understanding of the root locus techniques;
4. Design controllers using root locus methods;
5. Design controllers using frequency response methods;
6. Design controllers using state space representations
7. Examine discrete time control theory;
8. Design digital controllers using lead-lag controllers;
9. Demonstrate the understanding of nonlinear control theory.
10. Design nonlinear control systems.

Course Detail Information:

14. Contact Hours (per week)

2 Lecture hours (in class)

3 Lab hours (also studios)

____ Other (outside activities)

15. Repeatable course.

1 Number of times this course can be taken for credit.

16. Schedule type: (select one only)

____ Activity P.E. (A)
____ Lab only (B)
X Lecture/Lab (C)
____ Lecture only (L)
____ Recitation/Lab (R)
____ Student Teaching (STU)
____ Studio Art/Design (XSU)

17. List existing course(s) for which this course will be a prerequisite. Adding a "new course" as a prerequisite to an existing course will likely cause enrollment problems. (Please submit a prerequisite change form for each course for which this course will serve as a prerequisite.)

None

18. What resources, technology or equipment must be acquired to teach this course? List items, which must be purchased and estimate cost. (Be specific, e.g., technology software, equipment, computer lab; etc.)

None

19. The UCO Library has the required library resources available for this new course?

x Yes __ No If yes, provide names of Librarian/Faculty Liaisons contacted, dates, and results of discussion.

Librarian Deborah Thompson was contacted on July 20, 2020. Resources are currently available for this course. Databases, journals, books, and electronic access sites are available to students through the UCO virtual library and interlibrary loan system.

If no, what additional library resources must be acquired for this new course? List items which must be purchased and estimated cost. (Be specific, e.g., books, magazines, journals, etc.)

20. Names of current faculty qualified to teach this course.
Alaeddin Abuabed, Nesreen Alsbou, Evan Lemley

21. Additional faculty (adjunct or full-time) required and specific competencies required to teach this course:
No additional full-time faculty will be required: Competencies are a background in EE and experience working with the embedded systems found in IoT devices.

22. How will this course be staffed and equipped? Identify the additional costs associated with this new course. If no costs, explain why not.
The lab equipment will utilize electronic equipment currently available in the department's two EE labs, as well as equipment and software developed and donated by several industry partners: Nortek Air Solutions, Honeywell, Tridium, and others. Supplies needed to support the lab will be purchased with the fees generated by students taking the course (the current CMS fees are sufficient for this purpose). The department currently employs an Electronics Laboratory Associate to support its EE labs, and this lab will be part of those duties. The 3 hour instructional load for the primary course instructor may require an adjunct to pick up a lower level course.

23. Identify the source(s) of funds for any additional costs for the new course. i.e. internal reallocations, special fees from students, etc. If you plan to propose special fees be assessed for this course, be aware there is a separate approval process for special fees.
Tuition revenue from this course should more than offset the instructional cost of the adjunct covering the primary instructor's current load. Nortek Air Solutions has also indicated that they may be able to support this position once the course is in place. They are currently one of the college's and university's top recurring donors.

24. Projected enrollment for two academic years following approval of new course:

Semester	2021-2022	2022-2023
Fall		
Spring	4	4
Summer		

Note: these are only the projected number of grad students. Additional students will populate this section from the dual-level undergrad course.

25. Using State Regents' definition of liberal arts and sciences (quoted below), characterize the course as follows:
x Non-liberal arts and sciences
_____ Liberal arts and sciences

"The liberal arts and sciences are defined as those traditional fields of study in the humanities; social and behavioral sciences; communications; natural and life sciences, mathematics; and the history, literature, and theory of fine arts (music, art, drama, dance). Courses in these fields whose primary purpose is directed toward specific occupational or professional objectives, or courses in the arts which rely substantially on studio or performance work are not considered to be liberal arts and sciences for the purpose of this policy. Courses required for the General Educational Program are not necessarily synonymous or mutually exclusive with the liberal arts and sciences." State Regents Policy and Procedures. Chapter 2, Section 5, "Degree Requirements" part 1, (2). P. II-2-86

26. Please provide a concise, yet comprehensive, statement that explains the reasons for requesting the new course. Include documentation or assessment information supporting the specific request (if possible). Indicate the expected source of student enrollment (majors, minors, programs etc.)

UCO was approached by one of its key industry sponsors, Nortek Air Solutions, who expressed an interest in hiring UCO engineering students who were better prepared in the design and development of control systems. They arranged commitments from several of their industry partners (Honeywell, Tridium, and others) to donate hardware and software in support of this request. They suggested that for graduates to be trained to the level required in area industry, a 3-course sequence was required.

The Department of Engineering & Physics already has a graduate level Control Systems course, as well as a graduate level Mechatronics course. The 3-course sequence would then be Mechatronics, Control Systems, and Advanced Control Systems Design, the course proposed here. This sequence will support graduate students in Engineering Physics - Mechanical Engineering (Nortek is an HVAC firm that hires many UCO graduates) and Engineering Physics - Electrical Engineering (which relies heavily on Control Systems) majors.

27 Which of the six transformative learning tenets does this course incorporate? (check all that apply or only those that apply) This question was a directive from the Provost and is used for informational purposes.

Discipline Knowledge	x
Leadership	
Research, Scholarly and Creative Activities	x
Service Learning and Civic Engagement	
Global and Cultural Competencies	
Health and Wellness	

28. Clearly explain how the characteristics of this course meet or exceed those outlined in Course Level Characteristics. (Copy and paste table from "Course Level Characteristics" document for the appropriate course level of proposed course. Document may be found on: http://sites.uco.edu/academic-affairs/files/course-level-characteristics-table.doc .

5000 LEVEL COURSES

Course Level Characteristics	Please describe how this course meets this requirement.
1. It is assumed that students in these courses have sufficient graduate coursework requiring a serious commitment of time and energy and are pursuing a doctoral degree within the university.	Students enrolled in this class are the graduate students. In this course, students are required to study advanced topics in control theory. Students enrolled in this class should have successfully finished an undergraduate or a graduate course in control theory. Students enrolled in this class are expected to work on real-world engineering control problems and use computerized tools to design and simulate PID controllers. This course also requires students to study special controllers from journal papers and literature review.
2. It is assumed that students in these courses have mastered the ability to engage in critical thinking, decision making, and independent	Graduate students enrolled in this course will be required to provide a peer critique for a

judgement while retaining ethical accountability.	published work in a peer-reviewed journal, identify the article's weaknesses and strengths, and suggest possible improvements. Students will be asked to provide their peer-review report and it will be counted toward the grade of the class.
3. It is assumed that students in these courses have mastered disciplinary knowledge as evidenced by an ability to engage with and contribute to theoretical and empirical knowledge in the field.	Graduate students enrolled in this course will be required to work on a project and submit a peer review style paper that documents their project work and findings. They can choose an advanced control problem to provide a solution to a system in any engineering discipline.
4. It is assumed that students in these courses have mastered the ability to design, conduct, evaluate, complete, and disseminate scholarly contributions in the field as well as to provide supervision of scholarly pursuits if assigned.	Graduate students enrolled in this course will be required to submit a peer reviewed style paper which will be discussed and critiqued by other students in the class as well as the instructor. They will be asked to improve their paper based on the feedback they received from their peers and submit again. This work will be graded by the instructor and counted toward the final grade of the class.
5. It is assumed that students in these courses demonstrate an individual responsibility, personal accountability, and professional obligation to provide leadership in and a contribution to the field.	Students will be asked to individually take exams, homework and solve problems in control systems. Furthermore, they will be required to solve advanced control computer-based problems. They will also be asked to work on projects as a team. In addition, students are required to provide input about other classmates' work and projects. This will advance their leadership skills in this field.

ENGR 5403 – Advanced Control Systems Design and Lab

Course Description

This course will provide a comprehensive treatment of the analysis and design of advanced control systems. Modern control theories in state-space domain and Laplace transform domain will be introduced. Topics include modern control design techniques such as root locus design, lead-lag and PID controllers, and controller design via frequency response and state space. This course has a lab component and lab experiments are related to the theoretical material covered in the class.

Prerequisites
ENGR 4303/5303 Control Systems

Instructor

Office:
Phone:
Email:
Office hours:

Class Schedule and Location:

Required Text Book
N. Nise, Control systems Engineering, 7th., Wiley, 2015. ISBN 978-1118170519

Topics to be covered

1. State Space Representation
2. PID Controllers
3. Root Locus Techniques
4. Design Via Root Locus
5. Frequency Response Techniques
6. Design Via Frequency Response
7. Design Via State Space
8. Digital Control Systems
9. Nonlinear Control

Course Objectives/Expected Student Outcomes

Upon completion of this course, students will be able to:

1. Define the mathematics of state space representation;
2. Design linear controllers using PID controllers;
3. Demonstrate the understanding of root locus techniques;
4. Design controllers using root locus methods;
5. Design controllers using frequency response methods;
6. Design controllers using state space representations
7. Examine discrete time control theory;
8. Design digital controllers using lead-lag controllers;
9. Demonstrate the understanding of nonlinear control theory.
10. Design nonlinear control systems.

Transformative Learning Objectives

Academic Mission

Helping students learn so that they may become productive, creative, ethical, engaged citizens and leaders.

Alignment of Course with Transformative Learning:

	Course Goal	Assessment Method
Discipline Knowledge	X	Exams, Quizzes, HW & Project
Leadership		
Problem Solving/Research	X	Exams, Quizzes, HW & Project
Service Learning and Civic Engagement		
Global and Cultural Competencies		
Health and Wellness		

General Policies:

- **Calculator:** You must own a scientific calculator – see the list of allowed calculators for exams in the Department of Engineering and Physics. **Please bring your calculator to class for each meeting**.
- **Engineering Paper:** Engineering Paper available from the UCO bookstore. Please use engineering paper for all homework assignments.
- **Internet & Email:** Access to the Internet and ability to send and receive Email. If you do not have a computer at home you can use machines on the UCO campus: Look at http://technology.uco.edu/support/microcomplab.htm for a full list of available general use computers on campus. Note: Emails directed to the entire class such as class announcements will go to your official UCO email address (the address that ends in *uco.edu*).
- **Portable Electronic Devices (including cell phones):** Please turn off any portable electronic devices (esp. cell phones) during class. You may not access any portable electronic device during exams except calculators that are on the approved list for Engineering and Physics courses.

University Policies:

- All students are expected to come to class alert and ready to participate. Sleeping, reading newspapers, and doing homework for other classes are not allowed during class. Students are expected to assist in maintaining a classroom environment that is conducive to learning. Inappropriate behavior in the classroom shall result, minimally, in a request to leave the class.
- It is the aim of the faculty of University of Central Oklahoma to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension.
- Students with disabilities who need special accommodations must make their requests by contacting the ***Assistant Director of Disability Support Services, Ms. Kimberly Fields at (405) 974-2549. The DSS Office is located in the Nigh University Center, Room 309.***

Class Policies:

In Class contribution

- Coming to class prepared,
- Asking good questions,
- Answering questions well,
- Participation in class discussions
- Peer project evaluation

Homework:

- Homework is due at the beginning of the class period on the due-date.
- 20% penalty per day will be awarded for each late home work for first two days and **no credit will be awarded for the homework turned in on the third day.**
- Students must complete all parts of the homework on their own; however, it is acceptable to discuss homework with friends. You cannot hand in the same work with different names.
- Please follow the format/rubric of homework as instructed so that homework solutions will be neat and readable. Disorganized or unreadable work will not be graded. Show all the steps of your work, not just final answer.

Exams:

- ***There will be no make-up exam****
- If you need to miss an exam due to schedule conflicts or a documented valid reason then you should notify me in the first week of class.
- There will be three exams and weight of each exam is shown in the grading policy
- Portable Electronic Devices (including cell phones) should be turned off during exams except calculators that are on the approved list for Engineering and Physics courses

*Student(s) with emergency and documented circumstances well beyond a student's control (hospitalization, death in family, etc.) will be considered for make-up exam.

Grading

Weight Factor	
In-class contributions	5%
Homework	10%
Paper & critique	10%
2 midterm Exams	30%
Final Exams	25%
Lab	20%

Grading Scale	
A	(90-100)%
B	(80-89)%
C	(70-79)%
D	(60-69)%
F	<60%

University Emergency Management, Campus Safety and Alert:
http://www.uco.edu/administration/safety-transportation/index.asp