Code #EN18 (2014) Rev

**New/Special Course Proposal-Bulletin Change Transmittal Form**

X **Undergraduate Curriculum Council** - Print 1 copy for signatures and save 1 electronic copy.

**Graduate Council** - Print 1 copy for signatures and send 1 electronic copy to [mmcginnis@astate.edu](mailto:mmcginnis@astate.edu)

|  |
| --- |
| X **New Course or** ☐**Special Course (Check one box)**  *Please complete the following and attach a copy of the catalogue page(s) showing what changes are necessary.* |

|  |  |
| --- | --- |
| **Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date…  **COPE Chair (if applicable)** |
| **Department Chair:** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date…  **General Education Committee Chair (If applicable)** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date… **College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date…  **Undergraduate Curriculum Council Chair** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date… **College Dean** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date…  **Graduate Curriculum Committee Chair** |
|  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Enter date…  **Vice Chancellor for Academic Affairs** |

1.Proposed Course Prefix and Number (For variable credit courses, indicate variable range.)

EE 4354

2.Course Title – if title is more than 30 characters (including spaces), provide short title to be used on transcripts. Title cannot have any symbols (e.g. slash, colon, semi-colon, apostrophe, dash, and parenthesis). Please indicate if this course will have variable titles (e.g. independent study, thesis, special topics).

Intelligent Control Systems

3.Will this course be lecture only, lab only, lecture and lab, activity, dissertation, experiential learning, independent study, internship, performance, practicum, recitation, seminar, special problems, special topics, studio problems, student exchange, occupational learning credit, or course for fee purpose only (e.g. an exam)? Please choose one.

Lecture and Lab

4. What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental)?

Standard Letter

5. Is this course dual listed (undergraduate/graduate)?   
Yes

6. Is this course cross listed? (If it is, all course entries must be identical including course descriptions. It is important to check the course description of an existing course when adding a new cross listed course.)

No

7. Brief course description (40 words or fewer) as it should appear in the bulletin.

Introduction of fuzzy logic, fuzzy logic in control engineering, neural networks, Bayesian or belief networks, neuro-fuzzy systems, neuro-fuzzy controllers, controller design, and application problems.

8. Indicate all prerequisites and if this course is restricted to a specific major, which major. (If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

a. Are there any prerequisites?

Yes, prerequisite EE 4313 Control Systems or ME 3613 Controls Systems for Mechanical Engineers

b. Why?

This course requires introductory knowledge of Control systems. Students will use their control system background and the soft computing techniques in developing new solutions to the control applications.

9. Course frequency (e.g. Fall, Spring, Summer). Not applicable to Graduate courses.

Spring, even

10. Contact Person (Name, Email Address, Phone Number)

Shubhalaxmi Kher, [skher@astate.edu](mailto:skher@astate.edu), 870-972-2088

11. Proposed Starting Term/Year

Spring 2016

12. Is this course in support of a new program? No

If yes, what program?

Enter text...

13.Does this course replace a course being deleted? No

If yes, what course?

Enter text...

Has this course number been used in the past? No

*Submit Course Deletion Proposal-Bulletin Change Transmittal Form.*

14. Does this course affect another program? Yes, BSME and MSE

If yes, provide contact information from the Dean, Department Head, and/or Program Director whose area this affects.

Dr. S. Haran, Director, ME program, [sharan@astate.edu](mailto:sharan@astate.edu), 870-972-2088

Dr. B. Kemp, Director MSE program, [bkemp@astate.edu](mailto:bkemp@astate.edu), 870-972-2088

Dr. P. Mixon, Interim Dean, Engineering, [pmixon@astate.edu](mailto:pmixon@astate.edu), 870-972-2088

15. Justification should include:

a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

Along with the fast development of computer technologies, e.g., ubiquitous computing, cloud computing and cyber-physical systems, all kinds of networks (e.g., control network, communication network, sensor network, body area network, social network, opportunistic network, cloud-based network, etc.) appeared and were applied in large-scale factories, including a lot of traditional and new industries, e.g., textile industry, coal industry, mining industry, steel industry, machinery industry, petrochemical industry, and biomedical industry, etc. Assisted by various industrial networks, automation in industry can reduce cost greatly because it takes advantage of control systems and information technologies to optimize productivity in the production of goods and delivery of services. However, the industrial environment is usually dynamic and harsh, including extreme temperature, humidity, electromagnetic interference and vibration, which proposed specific requirements to intelligent industrial systems under certain circumstances. All these highlight the criticality of the design, analysis and implementation of intelligent industrial systems.

This course is aimed to introduce various intelligent techniques to introduce Fuzzy and Neural network based mechanisms. Investigations on involving these techniques for control applications will be performed. Tools like MatLab Simulink/ Labview will be used for simulations.

b. How does the course fit with the mission established by the department for the curriculum? If course is mandated by an accrediting or certifying agency, include the directive.

With the BSEE degree program accredited by ABET at Arkansas State University, the need to update and include modern courses in the degree program was felt by the faculty and the students. This new course on Intelligent control systems will provide a strong design analysis platform using soft computing techniques to help modernize the upper level BSEE curriculum. The faculty along with the Electrical Engineering advisory council agreed that a modern course covering Intelligent Control Systems will best meet needs of the program graduates and the industries.

c. Student population served.

EE and ME majors, both undergraduate and graduate.

d. Rationale for the level of the course (lower, upper, or graduate).

This course is designed to be a Senior /Masters level Fall/Spring Semester elective course. The course requires working knowledge of control systems. The material and the pre-requisites are appropriate for Senior level EE as well as ME students and MSE graduate students.

16. Outline (The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

Week Topic

1. Introduction of basic intelligent control concepts

2-4 Concepts of Fuzzy logic, Fuzzy set theory, Fuzzy relations, graphs, and Fuzzy arithmetic, Fuzzy rules , implications, and approximate reasoning

5-6 Fuzzy logic in control engineering

7-8 Fuzzy logic and Artificial Intelligence, Fuzzy model identification

9-11 Neural networks, Perceptron, Multi-layer networks, Kohonen maps

12 Bayesian or belief networks

13-14 Neuro-Fuzzy systems, Neuro-Fuzzy controllers, Applications

17. Course requirements (e.g. research papers, projects, interviews, tests, etc.)

Tests, computer programming assignments, projects,

18. Special features (e.g. labs, exhibits, site visitations, etc.)

None

19. Department staffing and classroom/lab resources (Will this require additional faculty, supplies, etc.?)

No

20. What is the primary intended learning goal for students enrolled in this course?

Primary goal is to learn fuzzy, neural, and hybrid computing techniques and develop applications.

21. Reading and writing requirements:

a. Name of book, author, edition, company and year

1. Yen and Langari, Fuzzy Logic, Intelligence, control, and Information, prentice Hall, ISBN 0-13-525817-0, 1998.

2. Pedo Ponce-Cruz, Fernando D. Ramirez-Figueroa, Intelligent Control Systems with LabVIEW, Springer ISBN 978-1-84882-684-7, 2010.

b. Number of pages of reading required per week: 25 to 50

c. Number of pages of writing required over the course of the semester: around 100

22.High-Impact Activities (Check all that apply)

☐Collaborative assignments

X Research with a faculty member

☐Diversity/Global learning experience

☐Service learning or community learning

☐Study abroad

☐Internship

X Capstone or senior culminating experience

☐Other Explain: Enter text...

23.Considering the indicated primary goal (in Box #20), provide up to three outcomes that you expect of students after completion of this course.

**Outcome #1:** (For example, what will students who meet this goal know or be able to do as a result of this course?)

Students will learn to use fuzzy data sets and model systems using various feedforward, backpropagation, and adaptive algorithms.

Learning Activity :(For example, what instructional processes do you plan to use to help students reach this outcome?)

Students will develop algorithms, write software simulation programs and test the performance using various software tools such as MATLAB and Simulink, LabVIEW, etc.

Assessment Tool: (For example, what will students demonstrate, represent, or produce to provide evidence of their learning?)

Successful students will demonstrate results and/or outcomes from their algorithms and simulations through graded assignments.

*(Repeat if needed for additional outcomes 2 and 3)*

Outcome **#2:**

Learning Activity:

Assessment Tool:

**Outcome #3**:

Learning Activity:

Assessment Tool:

24.Please indicate the extent to which this course addresses university-level student learning outcomes:

* 1. Global Awareness

X Minimally  
☐Indirectly  
☐ Directly

* 1. Thinking Critically

☐Minimally  
☐Indirectly  
X Directly

* 1. Using Technology

☐Minimally  
☐Indirectly  
X Directly

**From the most current electronic version of the bulletin, copy all bulletin pages that this proposal affects and paste it to the end of this proposal.**

**To copy from the bulletin:**

1. Minimize this form.
2. Go to <http://registrar.astate.edu/bulletin.htm> and choose either undergraduate or graduate.
3. This will take you to a list of the bulletins by year, please open the most current bulletin.
4. Find the page(s) you wish to copy, click on the “select” button and highlight the pages you want to copy.
5. Right-click on the highlighted area.
6. Click on “copy”.
7. Minimize the bulletin and maximize this page.
8. Right-click immediately below this area and choose “paste”.
9. For additions to the bulletin, please change font color and make the font size larger than the surrounding text. Make it noticeable.
10. For deletions, strike through the text, change the font color, and enlarge the font size. Make it noticeable.

Add course description to page 444 in the catalog after EE 4353 Power systems and before EE 4373 Electronics II.

Page 444, 2014-15 Undergraduate Bulletin

**Here**

**EE 3383.Principles and Practices in Electrical Engineering** Principles of and good practices in electrical engineering, professional organizations, literature, intellectual property, licensure, ethics and regulations, vendors, products, specifications, procurement, communications and human relations, resource management, product certification and manufacturability, and modern and tools and issues. Prerequisite, C or better in EE 3313. Spring.

**EE 3401.Electronics I Laboratory** Basic laboratory experiments in electronic circuits and solid state electronic devices. Corequisite, EE 3403. Prerequisite, C or better in ENGR 2421. Fall.

**EE 3403.Electronics I** Theory, analysis, and introductory design of diode, bipolar junction transistor, operational amplifier, and field effect transistor devices and circuits. Prerequisite, C or better in ENGR 2423. Fall.

**EE 4303.Engineering Field and Waves II** Study of electromagnetic waves in free space, dielectrics, and conductors, transmission lines, polarization, reflection, refraction, diffraction, waveguides, resonators, antennas, and radiation. Prerequisites, C or better in MATH 4403 and EE 3343. Dual listed as EE 5303. Demand.

**EE 4313.Control Systems** Analysis and design of linear feedback systems. Transfer func-tions, transient and steady state characterization, stability determination. Closed loop analysis and design using root locus and frequency domain methods. Prerequisites, C or better in EE 3403. Corequisite, EE 3353. Dual listed as EE 5313. Demand.

**EE 4333.Communications Theory** Frequency spectra of time signals. Review of Fourier series and transforms. Signal mixing, modulation, and demodulation. AM and FM broadcasting techniques and bands. Pulsed and digital communication modes. Prerequisite, C or better in EE 3353 and EE 3403. Dual listed as EE 5333. Demand.

**EE 4321.Electrical Machinery Laboratory** Experiments dealing with motor, generators, transformers, and associated measurements and controls. Prerequisite, C or better in ENGR 2421. Corequisite, EE 4323. Demand.

**EE 4323.Electrical Machinery** Introduction to the analysis and design of electromechanical energy conversion systems, magnetic circuit theory, general transformer and machinery theory, and DC and AC motors and generators. Prerequisite, C or better in EE 3313 or ENGR 3473, and ENGR 3423. Dual listed as EE 5323. Demand.

**EE 4344.Microprocessor and PLC Applications** A microcomputer and programmable logic controller course for junior and senior level engineers. A survey of small computers and their engineering functions including control, sensing, and computation. The concept of using control programming languages is introduced. Prerequisites, C or better in EE 3333 and EE 3401, or consent of instructor. Dual listed as EE 5344. Demand.

**EE 4353. Power Systems** Generation, transmission, and distribution of large scale electrical power, associated energy losses and practical design problems and complications. Transmission line analysis. Three phase power networks. Load monitoring and control. Prerequisite, C or better in EE 3313 and ENGR 3423. Corequisite, MATH 4403. Dual listed as EE 5353. Demand.

**EE 4354. Intelligent Control Systems** Introduction of fuzzy logic, fuzzy logic in control engineering, neural networks, Bayesian or belief networks, neuro-fuzzy systems, neuro-fuzzy controllers, controller design, and application problems. Prerequisite for EE majors: C or better in EE 4313; Prerequisite for ME majors: C or better in ME 3613. Dual listed as EE 5354. Spring, even.

**EE 4373.Electronics II** A continuation of EE 3403 with emphasis on the analysis, simulation, and design of feedback, operational amplifier systems, frequency response, integrated circuits, and power and wave shaping circuits. Prerequisite, C or better in EE 3313, ENGR 3443, and EE

3403. Dual listed as EE 5373. Spring, odd.

**EE 4383.Digital Electronics II** Continuation of the study of digital circuit design with emphasis on the design of larger systems and use of LSI components. Register transfer logic, computer interfacing and design, and microcomputer based system design. Prerequisite, C or better in EE

3333. Demand. Dual listed as EE 5383.

**EE 4773. Intermediate Electrical Engineering Laboratory** Advanced design-oriented experi-ments in electronics, measurement, interfacing, and other electrical engineering topics. Corequisite, EE 4373. Prerequisites, C or better in EE 3333, and EE 3401. Spring

**EE 479V.Special Problems in Electrical** **Engineering** Individually directed problems in electrical engineering for juniors and seniors. A course outline and project summary listing the goals and expected outcomes must be approved by the student advisor and the program director. Prerequisites are dependent on the nature of the special problem. Demand.