Code # EN15 (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 pheath@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.*  |

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**COPE Chair (if applicable)** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**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 3393

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).

Probability and Random Signals

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

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)?

No

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.

Application of probabilistic models and analysis techniques to engineering signals and systems with inherent randomness. Topics include probability theory, probability density functions, random variables, random vectors, estimation, detection, discrete and continuous processes, and power spectra.

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?

Prerequisite: EE 3353 Signals and Systems

b. Why?

EE 3373 builds on the deterministic signals and system analysis techniques developed in EE 3353 by including randomness found in electrical signals.

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

Spring

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

Shubhalaxmi Kher, skher@astate.edu, 870.972.2088

Brandon A. Kemp, bkemp@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? No

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

Enter text...

15. Justification should include:

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

Electrical engineering fundamentally deals with two quantities: energy and information. Modern systems, including communication systems, computers, sensors, etc., rely on engineers being able to design systems which generate, transmit, store, and retrieve information via electrical signals which include inherent randomness. The goals of this course are to develop the probabilistic framework necessary for modeling randomness in signals and systems, to introduce mathematical methods for efficiently using information, and to develop computer algorithms for application in electrical systems.

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.

While the Arkansas State University B. S. E. E. program is presently accredited by ABET, discussions during and since the most recent program review have illuminated the need for a modernization of the curriculum including more advanced coverage of probability. The faculty along with the Electrical Engineering Advisory Council has agreed that a modern course covering applied probability and random variables as applied to signals and systems would best meet the needs of program graduates.

c. Student population served.

Electrical engineering undergraduate students.

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

Upper: The course is designed to be a second semester, junior level course. The course should be completed after EE 3353 Signals and Systems (Fall) and prior to the senior design capstone sequence in the senior year of study.

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 to Probability and Numerical Simulations

2 Axioms of Probability

3 Modeling Experiments: Repeated Trials

4 Random Variables

5 Functions of Random Variables

6 Two Random Variables

7 Random Vectors

8 Review and Exam

9 Bayesian Estimation

10 Parameter Estimation and the Cramer-Rao Lower Bound

11 Hypothesis Testing and Receiver Operating Characteristics

12 Stochastic Processes and Power Spectrum

13 Discrete and Continuous Time Processes

14 Examples and Review

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

Exams, weekly problem sets, and computer programing 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?

Demonstrate understanding of probability theory and random variables application to model signals and systems in electrical engineering.

21. Reading and writing requirements:

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

A. Required Text: Papoulis and S. U. Pillai, *Probability, Random Variables, and Stochastic Processes* 4th Edition, McGraw-Hill, 2002. ISBN: 0-07-366011-6

B. Supplementary Reference Text: Dimitri P. Bertsekas and John N. Tsitsiklis, *Introduction to Probability*, 2nd Edition, Athena Scientific, 2008. ISBN-13: 978-1886529236 (or equivalent)

b. Number of pages of reading required per week: Approximately 1 chapter (50 pages) per week.

c. Number of pages of writing required over the course of the semester: None

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

[ ] Collaborative assignments

[ ] Research with a faculty member

[ ] Diversity/Global learning experience

[ ] Service learning or community learning

[ ] Study abroad

[ ] Internship

[ ] 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 be able to apply mathematical techniques in design of systems with inherent randomness

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

Students will implement signal processing algorithms based on probability theory through project assignment. Students will produce computer code (Matlab, for example) models of random signals and demonstrate estimation, detection, and/or filtering algorithms for the efficient use of the information.

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

 Student model effectiveness will be evaluated with an appropriate rubric.

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

**Outcome #2:**

Enter text...

Learning Activity:

Enter text...

Assessment Tool:

Enter text...

**Outcome #3**:

Enter text...

Learning Activity:

Enter text...

Assessment Tool:

Enter text...

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.

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**Area of Concentration: Electrical Engineering**

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| --- | --- |
| **Electrical Engineering:** Electives denoted with an asterisk (\*) may be selected from any courses within the desig­nated elective group; subject to a program advisor’s approval. They must make a rational contribution to the student’s personal and professional education goals.  | **Sem. Hrs.**  |
| CHEM 1023, General Chemistry II  | 3  |
| CS 2114, Structured Programming  | 4  |
| EE 3401, Electronics I Laboratory  | 1  |
| EE 3403, Electronics I  | 3  |
| EE 3313, Electric Circuits II  | 3  |
| EE 3333, Digital Electronics I  | 3  |
| EE 3343, Engineering Fields and Waves I  | 3  |
| EE 3353, Continuous and Analog Systems  | 3  |
| EE 3393 Probability and Random SignalsEE 3383, Principles and Practices in Electrical Engineering  | 33 |
| EE 4323, Electrical Machinery **OR** EE 4353, Power Systems  | 3  |
| EE 4373, Electronics II **OR** EE 3363, Semiconductor Matl and Devices I  | 3  |
| EE 4773, Intermediate Electrical Engineering Laboratory **OR** EE 3303, Semiconductor and Optoelectronic Materials and Devices I Laboratory  | 3  |
| EE 4383, Digital Electronics II **OR** EE 4313, Control Systems  | 3  |
| ENGR 4413, Engineering Problem Solving  | 3  |
| \*Engineering Electives  | 2  |
| \*Approved Electives  | 3  |
| **Total Required Hours:**  | **46**  |

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Major in Electrical Engineering

Bachelor of Science in Electrical Engineering

A complete 8-semester degree plan is available at http://registrar.astate.edu/.

University Requirements:

See University General Requirements for Baccalaureate degrees (p. 41)

First Year Making Connections Course:

Sem. Hrs.

ENGR 1402, Concepts of Engineering (See College of Engineering Core Courses)

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General Education Requirements:

Sem. Hrs.

See General Education Curriculum for College of Engineering

38

Additional Support Courses:

Sem. Hrs.

Refer to Additional Support Courses for College of Engineering

7

College of Engineering Core Courses:

Sem. Hrs.

Refer to College of Engineering Core Courses

34

Major Requirements:

Electives denoted with an asterisk (\*) may be selected from any courses within the desig

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nated elective group; subject to a program advisor’s approval. They must make a rational

contribution to the student’s personal and professional education goals.

In addition to the University requirements for all Baccalaureate Degrees, a Bachelor of

Science in Electrical Engineering requires that one of the two following conditions be met:

1. “C” or better in each course in the 49-hour major courses;

OR

2. 2.5 (or greater) grade point average in the 49-hour major courses listed below

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Sem. Hrs.

CHEM 1023, General Chemistry II 3

CS 2114, Structured Programming 4

EE 3401, Electronics I Laboratory 1

EE 3403, Electronics I 3

EE 3313, Electric Circuits II 3

EE 3333, Digital Electronics I 3

EE 3343, Engineering Fields and Waves I 3

EE 3353, Continuous and Analog Systems 3

EE 3393 Probability and Random Signals 3

EE 3383, Principles and Practices in Electrical Engineering 3

EE 4323, Electrical Machinery

OR

EE 4353, Power Systems 3

EE 4333, Communications Theory 3

EE 4373, Electronics II OR

EE 3363, Semiconductor Materials and Devices I 3

EE 4773, Intermediate EE Lab OR

EE 3303, Semiconductor and Optoelectronics Matl and Devices I Lab 3

EE 4383, Digital Electronics II OR

EE 4313, Control Systems 3

ENGR 4413, Engineering Problem Solving 3

\*Engineering Electives 2

\*Approved Electives 3

Sub-total

49

Total Required Hours:

128

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**Electrical Engineering (EE)**

**EE 3303. Semiconductor and Optoelectronic Materials and Devices I Laboratory** E x ­perimentation and demonstrations in semiconductor growth and deposition, material analysis and characterization, doping, and processing. Fabrication of simple devices. Metallization, etching, and other manufacturing processes. Lecture one to two hours, laboratory four to five hours per week. Prerequisite, C or better in CHEM 1011, PHYS 2034, and EE 3401. Corequisite, EE 3363. Spring, even.

**EE 3313. Electric Circuits II** Transient analysis, average power, RMS values, mutual inductance, resonance, network theorems and principles, polyphase networks, complex power. Prerequisite, C or better in MATH 2214 and ENGR 2423. Spring.

**EE 3331. Digital Electronics I Laboratory** Experimentation and design with digital electronic and computer components and circuits including logic gates, flip flops, counters, and registers. Practical applications in timing and control. Logic families such as TTL, ECL, and CMOS. Prereq­uisite, C or better in ENGR 2421. Corequisite, EE 3333. Demand.

**EE 3333. Digital Electronics I** Introduction to the analysis and design of digital and computer circuits, Boolean algebra, binary arithmetic, combinational logic, sequential logic, registers, counters, adders, comparators, and computer organization. Prerequisite, C or better in either CS 2114 or ENGR 2423. Fall.

**EE 3343. Engineering Fields and Waves I** Study of time invariant electric and magnetic fields in free space and in materials, electrical current flow as a function of electric field, magnetic flux, interaction of magnetic fields with electrical current and voltage, electrical and magnetic potentials, time changing electric and magnetic fields, and introduction to Maxwell’s Equations. Prerequisites, C or better in MATH 3254 and EE 3313. Fall.

**EE 3353. Continuous and Analog Systems** Methods of analysis of continuous and analog systems and associated synthesis, simulation, and design, system response in the time and frequency domains, Laplace transforms, Fourier series and transforms, transfer functions, and convolution. Prerequisite, C or better in EE 3313. Corequisite, MATH 4403. Fall.

**EE 3363. Semiconductor Materials and Devices I** Semiconductor materials and theory of solid state electronic devices. Semiconductor growth and processing techniques. Semiconductor parameters such as bandgap, mobility, carrier densities, diffusion length, carrier lifetime, and en­ergy level distribution. Pn junctions and Schottky barriers. Constraints and limitations on practical devices. Prerequisite, C or better in CHEM 1013, PHYS 2034, and C or better in EE 3403 and ENGR 3443. Spring, even.

**EE 3393. Probability and Random Signals**  Application of probabilistic models and analysis techniques to engineering signals and systems with inherent randomness. Topics include probability theory, probability density functions, random variables, random vectors, estimation, detection, discrete and continuous processes, and power spectra. Prerequisite, C or better in EE 3353. Spring.