Agenda Item #11-90
Effective Spring 2012

Eastern Illinois University
Revised Course Proposal
PHY 3270, Introduction to Circuit Analysis

Please check one: ☐ New course ☒ Revised course

PART I: CATALOG DESCRIPTION

1. **Course prefix and number, such as ART 1000:** PHY 3270
2. **Title (may not exceed 30 characters, including spaces):** Intro to Circuit Analysis
3. **Long title, if any (may not exceed 100 characters, including spaces):** Introduction to Circuit Analysis
4. **Class hours per week, lab hours per week, and credit [e.g., (3-0-3)]:** (4-0-4)
5. **Term(s) to be offered:** ☐ Fall ☒ Spring ☐ Summer ☐ On demand
6. **Initial term of offering:** ☐ Fall ☒ Spring ☐ Summer **Year:** 2012
7. **Course description (not to exceed four lines):** Basic principles of network analysis, including Kirchoff's laws, node and mesh equations, equivalent circuits, operational amplifiers, transient analysis, sinusoidal steady-state analysis, three-phase circuits, transformers, network functions, and frequency response. EGR 931
8. **Registration restrictions:**

   a. **Identify any equivalent courses** (e.g., cross-listed course, non-honors version of an honors course). none
   b. **Prerequisite(s),** including required test scores, courses, grades in courses, and technical skills. Indicate whether any prerequisite course(s) MAY be taken concurrently with the proposed/revised course.
      Prerequisites: PHY 1361 (General Physics II), PHY 1362 (General Physics II Laboratory); prior credit or concurrent enrollment in MAT 3501 (Differential Equations I).

   c. **Who can waive the prerequisite(s)?**
      ☐ No one ☒ Chair ☐ Instructor ☐ Advisor ☐ Other (Please specify)

   d. **Co-requisites** (course(s) which MUST be taken concurrently with this one): none

   e. **Repeat status:** ☒ Course may not be repeated.
      ☐ Course may be repeated to a maximum of hours or times.

   f. **Degree, college, major(s), level, or class** to which registration in the course is restricted, if any: none
   g. **Degree, college, major(s), level, or class** to be excluded from the course, if any: none
9. **Special course attributes** [cultural diversity, general education (indicate component), honors, remedial, writing centered or writing intensive] none
10. **Grading methods** (check all that apply): ☒ Standard letter ☐ C/NC ☐ Audit ☐ ABC/NC ("Standard letter"—i.e., ABCDF--is assumed to be the default grading method unless the course description indicates otherwise.)
11. **Instructional delivery method:** ☒ lecture ☐ lab ☐ lecture/lab combined ☐ independent study/research ☐ internship ☐ performance ☐ practicum or clinical ☐ study abroad ☐ other

PART II: ASSURANCE OF STUDENT LEARNING

1. List the student learning objectives of this course:

A. Students will be able to relate currents to voltages in resistors, inductors, and capacitors.
B. Students will be able to solve linear electronic circuit problems using the lumped circuit parameter model for both DC and AC signals.
C. Students will be able to interpret schematic diagrams of electronic circuits.
D. Students will be able to apply principles of the node voltage method, the current mesh method, superposition, Thevenin equivalents, and Norton equivalents to the solution of linear circuit problems.
E. Students will be able to apply Laplace transforms to the solution of linear electronics circuits to determine both steady-state and transient solutions.
F. Students will be able to construct and interpret Bode diagrams.
G. Students will be able to utilize appropriate circuit analysis software to solve linear electronic circuit problems.

a. If this is a general education course, indicate which objectives are designed to help students achieve one or more of the following goals of general education and university-wide assessment:

- **EIU graduates will write and speak effectively.**
- **EIU graduates will think critically.**
- **EIU graduates will function as responsible citizens.**

b. If this is a graduate-level course, indicate which objectives are designed to help students achieve established goals for learning at the graduate level:

- **Depth of content knowledge**
- **Effective critical thinking and problem solving**
- **Effective oral and written communication**
- **Advanced scholarship through research or creative activity**

2. Identify the assignments/activities the instructor will use to determine how well students attained the learning objectives:

Learning Objective	Homework	Exam
A. Relate current to voltage	X	X
B. Solve circuit problems	X	X
C. Interpret schematic diagrams	X	X
D. Apply circuit theorems	X	X
E. Apply Laplace transforms	X	X
F. Construct and interpret Bode plots	X	X
G. Utilize circuit analysis software	X	X

3. Explain how the instructor will determine students' grades for the course:

Instructor will assign circuit analysis problems for homework on a topic by topic basis. Students will submit their homework solutions that will be assigned a numerical grade by the instructor that is proportional to the

fraction of correct solutions in the student's submitted work. All exams will also consist of circuit analysis problems that will be scored in the same manner as homework. The total homework score and the total exam scores will be combined as a weighted average (30% homework, 70% exams). The semester grade will be assigned based on this weighted average and the total possible number of points. If a student's score is greater than or equal to 90% of the possible points, the student will be assigned a semester grade A. If a student's score is less than 90% of the possible points but greater than or equal to 80% of the possible points, the student will be assigned a semester grade B. If a student's score is less than 80% of the possible points but greater than or equal to 70% of the possible points, the student will be assigned a semester grade C. If a student's score is less than 70% of the possible points but greater than or equal to 60% of the possible points, the student will be assigned a semester grade D. If a student's score is less than 60% of the possible points, the student will be assigned a semester grade F.

4. **For technology-delivered and other nontraditional-delivered courses/sections, address the following:**
    a. **Describe how the format/technology will be used to support and assess students' achievement of the specified learning objectives:** n/a
    b. **Describe how the integrity of student work will be assured:** n/a
    c. **Describe provisions for and requirements of instructor-student and student-student interaction, including the kinds of technologies that will be used to support the interaction (e.g., e-mail, web-based discussions, computer conferences, etc.):** n/a

5. **For courses numbered 4750-4999, specify additional or more stringent requirements for students enrolling for graduate credit. These include:**
    a. **course objectives;** n/a
    b. **projects that require application and analysis of the course content; and** n/a
    c. **separate methods of evaluation for undergraduate and graduate students.** n/a

6. **If applicable, indicate whether this course is writing-active, writing-intensive, or writing-centered, and describe how the course satisfies the criteria for the type of writing course identified. (See Appendix *.)**
    n/a

PART III: OUTLINE OF THE COURSE

Provide a week-by-week outline of the course's content. Specify units of time (e.g., for a 3-0-3 course, 45 fifty-minute class periods over 15 weeks) for each major topic in the outline. Provide clear and sufficient details about content and procedures so that possible questions of overlap with other courses can be addressed. For technology-delivered or other nontraditional-delivered courses/sections, explain how the course content "units" are sufficiently equivalent to the traditional on-campus semester hour units of time described above.

Topic	Lecture periods (50 min.)
A. Overview of circuit analysis	**1**
B. Circuit elements (independent and dependent sources, resistors)	**1**
C. Kirchoff's Laws (derivation from physical law, application to circuits)	**3**
D. Analysis of resistive circuits (series, parallel, voltage divider, current divider, delta-to-wye transformation, wye-to-delta transformation)	**4**
E. Methods of circuit analysis (node voltage method, current mesh method, source transformations, superposition, Thevenin and Norton equivalents, circuit analysis software)	**6**
F. Operational amplifiers (ideal opamp model, inverting amplifier, noninverting amplifier, summing amplifier, difference amplifier, non-ideal opamp models)	**4**
G. Reactive circuit elements (inductors, capacitors and mutual inductance)	**3**
H. First order RL and RC circuits (natural response, step response)	**4**
I. Series and parallel RLC circuits (natural response, step response)	**3**
J. Steady-state sinusoidal analysis (sinusoidal sources, phasors, circuit analysis in the frequency domain, phasor diagrams)	**6**
K. Steady-state sinusoidal power (instantaeous power, average power, reactive power, complex power, maximum power transfer)	**3**
L. Balanced three-phase circuits (three-phase sources, analysis of wye-wye connected circuits, analysis of wye-delta connected circuits, three-phase power calculations)	**4**
M. Applications of Laplace transforms to circuit analysis (definition of Laplace transform, functional transforms, operational transforms, inverse transforms, poles and zeros of Laplace transforms, initial and final value theorems, application to circuit analysis, transfer functions, use of partial fraction expansions, use of the convolution integral, impulse function)	**6**
N. Frequency selective circuits (low-pass filters, high-pass filters, band-pass filters, band-reject filters, Bode plots)	**5**
O. Active filters (first-order active filters, scaling, active band-pass and band-reject filters, higher order active filters, narrow-band filters)	**4**
(Time for three in class mid-term exams)	**3**

PART IV: PURPOSE AND NEED

1. Explain the department's rationale for developing and proposing the course.
This course is part of the Pre-Engineering program of study and has been for at least 25 years.

- **a. If this is a general education course, you also must indicate the segment of the general education program into which it will be placed, and describe how the course meets the requirements of that segment.** n/a
- **b. If the course or some sections of the course may be technology delivered, explain why.** n/a

2. Justify the level of the course and any course prerequisites, co-requisites, or registration restrictions.
This course is a 3000-level course as it has a 3000-level prerequisite, MAT 3501: Differential Equations I (which make be taken concurrently). The prerequisites PHY 1361 (General Physics II) and PHY 1362 (General Physics II Laboratory) introduce the students to the basic concepts of circuit theory and the vocabulary that is used to describe circuit elements.

3. **If the course is similar to an existing course or courses, justify its development and offering.**

    a. **If the contents substantially duplicate those of an existing course, the new proposal should be discussed with the appropriate chairpersons, deans, or curriculum committees and their responses noted in the proposal.** n/a
    b. **Cite course(s) to be deleted if the new course is approved. If no deletions are planned, note the exceptional need to be met or the curricular gap to be filled.** This course already exists.

4. **Impact on Program(s):**

    a. **For undergraduate programs, specify whether this course will be required for a major or minor or used as an approved elective.** This course is a requirement for pre-engineering students intending to major in electrical engineering and is strongly suggested for all pre-engineering students. The course is required for students in the B.S. Engineering Cooperative degree program and is an approved elective for students in the B.S. Engineering Physics degree program.
    b. **For graduate programs, specify whether this course will be a core requirement for all candidates in a degree or certificate program or an approved elective.** n/a

    If the proposed course changes a major, minor, or certificate program in or outside of the department, you must submit a separate proposal requesting that change along with the course proposal. Provide a copy of the existing program in the current catalog with the requested changes noted. n/a

PART V: IMPLEMENTATION

1. **Faculty member(s) to whom the course may be assigned:** Physics Faculty

    If this is a graduate course and the department does not currently offer a graduate program, it must document that it employs faculty qualified to teach graduate courses. n/a

2. **Additional costs to students:** none

    Include those for supplemental packets, hardware/software, or any other additional instructional, technical, or technological requirements. (Course fees must be approved by the President's Council.)

3. **Text and supplementary materials to be used (Include publication dates):** Nilsson & Reidel, Electric Circuits 6th Edition, Prentice Hall 2001; Circuit Tutor software; LTSpice Circuit Modeling Software

PART VI: COMMUNITY COLLEGE TRANSFER

If the proposed course is a 1000- or 2000-level course, state either, "A community college course may be judged equivalent to this course" OR "A community college course will not be judged equivalent to this course." A community college course will not be judged equivalent to a 3000- or 4000-level course but may be accepted as a substitute; however, upper-division credit will not be awarded. n/a

PART VII: APPROVALS

Date approved by the department or school: August 12, 2011

Date approved by the college curriculum committee: August 17, 2011

Date approved by the Honors Council *(if this is an honors course):*

Date approved by CAA: September 1, 2011

*In **writing-active courses**, frequent, brief writing activities and assignments are required. Such activities -- some of which are to be graded – might include five-minute in-class writing assignments, journal keeping, lab reports, essay examinations, short papers, longer papers, or a variety of other writing-to-learn activities of the instructor's invention. Writing assignments and activities in writing-active courses are designed primarily to assist students in mastering course content, secondarily to strengthen students' writing skills. In **writing-intensive courses**, several writing assignments and writing activities are required. These assignments and activities, which are to be spread over the course of the semester, serve the dual purpose of strengthening writing skills and deepening understanding of course content. At least one writing assignment is to be revised by the student after it has been read and commented on by the instructor. In writing-intensive courses, students' writing should constitute no less than 35% of the final course grade. In **writing-centered courses** (English 1001G, English 1002G, and their honors equivalents), students learn the principles and the process of writing in all of its stages, from inception to completion. The quality of students' writing is the principal determinant of the course grade. The minimum writing requirement is 20 pages (5,000 words).

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581-6696	**581-3413**	**581-2412**	**581-6583**