Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Samuel Ginn College of Engineering
   Department: Electrical and Computer Engineering

2. Course Prefix and Number: ELEC 3030
   3. Effective Term: Spring 2010

4. Course Title: RF Systems Lab
   Abbreviated Title (30 characters or less): RF Systems Lab

5. Requested Action:
   - Renumber a Course
   - Add a Course
   - Revise a Course

6. Course Credit:
   Contact/Group Hours
   Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study)
   Weekly or Per Term?
   Credit Hours
   Anticipated Enrollment

   Maximum Hours (Repeatability): 1

   Total Credit Hours: 1

7. Grading Type:
   - Regular (ABCDF)
   - Satisfactory/Unsatisfactory (S/U)
   - Audit

8. Prerequisites/Corequisites:
   Use "P:" to indicate a prerequisite, "C:" to indicate a corequisite, and "P/C:" to indicate a prerequisite with concurrency.
   P - ELEC 2210

9. Restrictions: List specific restriction in space above.
   - College
   - Major
   - Standing
   - Degree

10. Course Description:
    (20 Words or Less; exactly as it should appear in the Bulletin)
    Assembly, testing and analysis of an AM radio. Integration of basic concepts of electronics, electromagnetics, and signals and systems.

11. May Count Either...
    or...
    (Indicate if this particular course cannot be counted for credit in addition to another)
    Program Type
    Program Title
    Requirement or Elective?
    (e.g.: minor, major, etc.)
    (e.g.: MS in Chemistry, Performance Option, Minor in Art)
    (required or optional?)
    Major
    ELEC (Bachelor of Electrical Eng.)
    Required
    Major
    WIRE (Bachelor of Wireless Eng.)
    Required

12. Affected Program(s):
    (Respond "N/A" if not included in any program; attach memorandum if more space is required)

13. Overlapping or Duplication of Other Units' Offerings:
    (If course is included in any other degree program, is used as an elective frequently by other unit(s), or is in an area similar to that covered by another college/school, attach correspondence with relevant unit)
    - Applicable
    - Not Applicable
**14. Justification:**

Previous prerequisites, ELEC 2020 and ELEC 2210, were merged into one course, ELEC 2210, in 2009. Course title is being changed from "EE Lab III" to "RF Systems Lab" due to elimination of EE Labs I and II (ELEC 2010-2020). New title also more accurately reflects content.

(Include a concise, yet adequate rationale for the addition/revision of the course, citing accreditation, assessments (faculty, graduate, and/or external) where applicable)

**15. Resources:**

None

(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond "Not Applicable")

**16. Student Learning Outcomes:**

1. To understand overall operation of an AM radio.
2. To be able to analyze circuits with PSpice.
3. To be able to design and implement a circuit that will enhance radio operation.
4. To develop capability in written and oral technical communications.

(State in measurable terms (reflective of course level) what students should be able to do when they have completed this course)

**17. Course Content Outline:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview &amp; requirements; intro to lab equipment and safety</td>
</tr>
<tr>
<td>2</td>
<td>Week 2 Common emitter amplifier</td>
</tr>
<tr>
<td>3</td>
<td>Week 3 Simple audio amplifier</td>
</tr>
<tr>
<td>4</td>
<td>Week 4 AM detector</td>
</tr>
<tr>
<td>5</td>
<td>Week 5 RF amplifier</td>
</tr>
<tr>
<td>6</td>
<td>Week 6 More RF amplifier &amp; overall radio</td>
</tr>
<tr>
<td>7</td>
<td>Week 7 Antenna</td>
</tr>
<tr>
<td>8</td>
<td>Week 8 Demonstrate simple working radio</td>
</tr>
<tr>
<td>9</td>
<td>Week 9 Mixer and bandpass filter</td>
</tr>
<tr>
<td>10</td>
<td>Week 10 Oscillator</td>
</tr>
<tr>
<td>11</td>
<td>Week 11 Demonstrate working heterodyne radio, work on projects</td>
</tr>
<tr>
<td>12</td>
<td>Week 12 Work on projects</td>
</tr>
<tr>
<td>13</td>
<td>Week 13 Work on projects</td>
</tr>
<tr>
<td>14</td>
<td>Week 14 Team design project presentations</td>
</tr>
</tbody>
</table>

(Provide a comprehensive, week-by-week breakdown of course content, including assignment due dates)

**18. Assignments / Projects:**

Weekly laboratory projects are listed above.

The final design projects are done in 2-3 member teams, tasked with adding or modifying circuits or components to enhance operation of their radio.

Students present their designs via a PowerPoint oral presentation followed by a live demonstration.

(List all quizzes, projects, reports, activities and other components of the course grade -- including a brief description of each assignment that clarifies its contribution to the course's learning objectives)

**19. Rubric and Grading Scale:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory practice</td>
<td>40%</td>
</tr>
<tr>
<td>Written communications</td>
<td>20%</td>
</tr>
<tr>
<td>Design project including oral presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Final examination</td>
<td>20%</td>
</tr>
</tbody>
</table>

(List all components of the course grade -- including attendance and/or participation if relevant -- with point totals for each; indicate point totals and ranges or percentages for grading scale; for S/U grading, detail performance expectations for a passing grade)

**20. Justification for Graduate Credit:**

N/A

(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))
(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Tiger Cub, Faculty Handbook, or any existing university policy.)

**POLICY STATEMENTS**

**Attendance:** Although attendance is not required, students are expected to attend all classes, and will be held responsible for any content covered in the event of an absence.

**Excused Absences:** Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoenas for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request, and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please see the Tiger Cub for more information on excused absences.

**Make-Up Policy:** Arrangement to make up a missed major examination (e.g., hour exams, mid-term exams) due to properly authorized excused absences must be initiated by the student within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the advent of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

**Academic Honesty Policy:** All portions of the Auburn University student academic honesty code (Title XII) found in the Tiger Cub will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

**Disability Accommodations:** Students who need special accommodations in class, as provided for by the Americans With Disabilities Act, should arrange for a confidential meeting with the instructor during office hours in the first week of classes (or as soon as possible if accommodations are needed immediately). The student must bring a copy of their Accommodation Letter and an Instructor Verification Form to the meeting. If the student does not have these forms, they should make an appointment with the Program for Students with Disabilities, 128B Haley Center, 844-2096 (V/T).

ELEC 3030 – ELECTRICAL ENGINEERING LAB III

2009 Catalog Data: ELEC 3030. ELECTRICAL ENGINEERING LAB III (1) LAB. 3. Pr., ELEC 2020, ELEC 2210. Assembly, testing and analysis of an AM/FM radio. Integration of basic concepts of electronics, electromagnetics, and signals and systems. Topics include devices (diodes, transistors, antennas, transformers), circuit schematics, and PSpice simulation.


Course handouts to supplement Radio Kit Manual


Coordinator: Stuart M. Wentworth, Associate Professor of Electrical Engineering

Goals: Examination of how various components and subsystems in an electronic system are designed and integrated. A commercially available AM/FM radio kit is used as a platform for study. Integration of basic concepts in electronic circuits, signals and systems and electromagnetics to construct, analyze and understand the operation of an AM/FM radio. Students will use schematics and will employ a variety of devices including diodes, transistors, and antennas. Design and implementation of a circuit to enhance radio operation. Practice in written and oral technical communications.

Prerequisites by topic:

1. Operation of basic electronic equipment (oscilloscopes, power supplies, multimeters), the circuit simulator PSpice, linear systems, basic analog and digital circuit analysis.

Topics:

1. All lab sections meet together for a 1 hour per week lecture session along with each section’s 2 hour laboratory session. The table on the next page shows the week-by-week coverage of topics in lecture and expected accomplishments in lab.

Typical methods for evaluating student performance:

<table>
<thead>
<tr>
<th>Method</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory practice</td>
<td>40%</td>
</tr>
<tr>
<td>Written communications</td>
<td>20%</td>
</tr>
<tr>
<td>Design project including oral presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Final examination</td>
<td>20%</td>
</tr>
</tbody>
</table>

Computer Usage:

Students conduct PSpice computer simulations of 4 sections of their AM/FM radio: (1) the audio amplifier stage, (2) the detector and AGC stage, (3) the AM mixer/oscillator stage and (4) the FM ratio detector. In addition, students are expected to use PSpice in the development of their design projects.

Laboratory projects (including major items of equipment and instrumentation used):

Students are required to have their own electronics toolkit and use the following equipment in performing their measurements: Tektronix 2215A 60 MHz dual trace oscilloscope, Hewlett-Packard 3311A function generator, HP 6216A dc power supplies, Fluke 8010A digital multimeter.
Class attendance: Class attendance and its effect on course grade is the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

Policy on unannounced quizzes: Unannounced quizzes and their effect on course grade are the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

ABET category content as estimated by faculty member who prepared this course description:

- Engineering science: 2/3 credit or 67%
- Engineering design: 1/3 credit or 33%

Students who need special accommodations should make an appointment to discuss their needs as soon as possible.

Prepared by: Victor P. Nelson

Date: 10/11/2005
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• course overview&lt;br&gt;• writing technical memos&lt;br&gt;• overall radio operation&lt;br&gt;• basic AM/FM</td>
<td>• acquire kits/verify contents before lab&lt;br&gt;• intro to lab facilities, discuss ESD&lt;br&gt;• solder training (with video)&lt;br&gt;• instrument review project</td>
</tr>
<tr>
<td>2</td>
<td>• operation of diodes and transistors&lt;br&gt;• PSpice simulation of audio amp stage&lt;br&gt;• transistor output stages</td>
<td>• assemble audio amplifier (section 1)</td>
</tr>
<tr>
<td>3</td>
<td>• audio amplifier operation: a controls point of view&lt;br&gt;• teaming and the design projects</td>
<td>• PSpice simulation due&lt;br&gt;• test audio amplifier (section 1)</td>
</tr>
<tr>
<td>4</td>
<td>• diode detectors and AGC&lt;br&gt;• PSpice simulation of detector stage</td>
<td>• assemble and test detector and AGC stage (section 2)</td>
</tr>
<tr>
<td>5</td>
<td>• operation of transistor amplifiers</td>
<td>• PSpice simulation due&lt;br&gt;• assemble and test the 2nd and 1st IF amplifier stages (sections 3 and 4)</td>
</tr>
<tr>
<td>6</td>
<td>• operation of mixers and oscillators&lt;br&gt;• PSpice simulation of Q1 circuit</td>
<td>• assemble and test the mixer and oscillator stage (section 5)&lt;br&gt;• perform final alignment</td>
</tr>
<tr>
<td>7</td>
<td>• amplitude modulation</td>
<td>• PSpice simulation due&lt;br&gt;• modulation lab (shorten to 1 hour?)&lt;br&gt;• catchup or work on design project</td>
</tr>
<tr>
<td>8</td>
<td>• the FM ratio detector&lt;br&gt;• PSpice sim of FM ratio detector stage</td>
<td>• assemble and test the FM ratio detector (section 6)</td>
</tr>
<tr>
<td>9</td>
<td>• frequency modulation</td>
<td>• PSpice simulation due&lt;br&gt;• assemble and test the 2nd and 1st FM IF amps (sections 7 and 8)</td>
</tr>
<tr>
<td>10</td>
<td>• FM RF amplifier, mixer and oscillator operation</td>
<td>• assemble and test the FM RF amplifier, mixer and oscillator (section 9)</td>
</tr>
<tr>
<td>11</td>
<td>• oral presentations</td>
<td>• antenna assembly and final alignment&lt;br&gt;• catchup or work on design project</td>
</tr>
<tr>
<td>12</td>
<td>• antennas</td>
<td>• antennas lab (1 hour max)&lt;br&gt;• work on design project</td>
</tr>
<tr>
<td>13</td>
<td>• review radio operation&lt;br&gt;• modern communications equipment</td>
<td>• student design presentations</td>
</tr>
<tr>
<td>14</td>
<td>Final Exam</td>
<td>-</td>
</tr>
</tbody>
</table>

Design Project: Two-member teams of students will redesign specific sections of the radio or will design add-on sections. These design projects will vary each semester. Teams may design and implement (1) a new AM detector/AGC stage that makes use of a full wave rectifier rather than the present half wave rectifier. (2) a new output amplifier stage to drive a bigger speaker. (3) a signal power level meter.
ELEC 3030 – RF SYSTEMS LAB  
(Required for ELEC, WIRE)

2010 Catalog Data: ELEC 3030. RF SYSTEMS LAB (1) Lab. 3. Pr., ELEC 2210. Assembly, testing and analysis of an AM radio. Integration of basic concepts of electronics, electromagnetics, and signals and systems.

Text: ELEC 3030 RF Systems Lab Manual (online)

Coordinator: Stuart M. Wentworth, Associate Professor, Electrical and Computer Engineering

Course Objectives:
1. To understand overall operation of an AM radio
2. To be able to analyze circuits with PSpice
3. To be able to design and implement a circuit that will enhance radio operation.
4. To develop capability in written and oral technical communications.

Prerequisites by topic:
1. Operation of basic electronic equipment (oscilloscopes, power supplies, multimeters)
2. Basic use of the circuit simulator PSpice
3. Familiarity with linear systems, basic analog and digital circuit analysis

Topics:
1. All lab sections meet together for a 1 hour weekly lecture along with each section’s 2-hour laboratory session. The following table shows week-by-week coverage of topics in lecture and expected accomplishments in lab.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview overall operation; the common emitter amplifier</td>
<td>Overview &amp; requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intro to lab equipment and safety</td>
</tr>
<tr>
<td>2</td>
<td>(Labor Day or MLK Holiday)</td>
<td>Common emitter amplifier</td>
</tr>
<tr>
<td>3</td>
<td>Audio amplifiers</td>
<td>Simple audio amplifier</td>
</tr>
<tr>
<td>4</td>
<td>AM detector</td>
<td>AM detector</td>
</tr>
<tr>
<td>5</td>
<td>RF Amplifier: the Common Source amplifier</td>
<td>RF amplifier</td>
</tr>
<tr>
<td>6</td>
<td>Overview projects/expectations</td>
<td>More RF amplifier &amp; overall radio</td>
</tr>
<tr>
<td>7</td>
<td>Antennas</td>
<td>Antenna</td>
</tr>
<tr>
<td>8</td>
<td>Heterodyne radios</td>
<td>Demonstrate simple working radio</td>
</tr>
<tr>
<td>9</td>
<td>Mixers and Band pass filters</td>
<td>Mixer and bandpass filter</td>
</tr>
<tr>
<td>10</td>
<td>Oscillators</td>
<td>Oscillator</td>
</tr>
<tr>
<td>11</td>
<td>FM radio</td>
<td>Demonstrate working heterodyne radio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work on projects</td>
</tr>
<tr>
<td>12</td>
<td>Guest: HAM radio</td>
<td>Work on projects</td>
</tr>
<tr>
<td>13</td>
<td>Review</td>
<td>Work on projects</td>
</tr>
<tr>
<td>14</td>
<td>Final exam</td>
<td>Team design project presentations</td>
</tr>
</tbody>
</table>

Typical methods for evaluating student performance:
Laboratory practice 40%
Written communications 20%
Design project including oral presentation 20%
Final examination 20%

Computer Usage:
1. Students conduct PSpice computer simulations on every stage of their radio except for the antenna.
2. MATLAB is used for antenna design.
3. Students use computers to prepare plots, tables, memos, and presentation slides.
Laboratory projects (including major items of equipment and instrumentation used):
Students are required to have their own electronics toolkit, including breadboards. The following equipment is provided for performing measurements: Tektronix TDS 2022 200 MHz two channel oscilloscope, BK Precision 20 MHz function generator, Hewlett-Packard 3311A function generator, HP 6216A dc power supplies, BelMerit DX405 digital multimeter

Design Projects: 2-3 member teams are tasked with adding or modifying circuits or components to enhance operation of their radio. Students present their designs via a PowerPoint oral presentation followed by a live demonstration.

Class attendance: Class attendance and its effect on course grade is the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

Policy on unannounced quizzes: Unannounced quizzes and their effect on course grade are the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

Contribution of course to meeting the professional component:
Engineering topics: 3 credits
- 80% engineering science, 20% engineering design

Relationship of course to program outcomes:
- Outcome 1: Ability to apply knowledge of math, science and engineering to solve problems.
- Outcome 3: Ability to design an electrical component or system to meet desired needs.
- Outcome 5: Ability to design and conduct experiments to acquire needed data, and to analyze and interpret data to solve engineering problems.
- Outcome 6: Proficiency in use of computers and other modern tools to solve engineering problems.
- Outcome 7: Ability to function as a member of a team in the solution of engineering problems.
- Outcome 8: Proficiency in communicating ideas and information orally and in writing.
- Outcome 9: Appreciation of the need for, and an ability to learn new concepts as required for the continuing practice of electrical engineering.

Special Accommodations:
Students who need accommodations are asked to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by E-mail. Bring a copy of your Accommodation Memo and an Instructor Verification Form to the meeting. If you do not have an Accommodation Memo but need accommodations, make an appointment with The Program for Students with Disabilities, 1244 Haley Center, 844-2096 (V/TT).

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Prepared by: Stuart M. Wentworth Date: 4/10/2009