Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Sam Ginn College of Engineering
   Department: Electrical & Computer Engineering

2. Course Prefix and Number: ELEC 5360/6360/6366
   3. Effective Term: Fall 2014

4. Course Title:
   Bio-Medical Applications of Electromagnetics
   Abbreviated Title (30 characters or less):
   Bio-Medical Electromagnetics

5. Requested Action:
   - [ ] Renumber a Course
   - [ ] Add a Course
   - [ ] Revise a Course
   - Current Course Number:
   - Proposed Course Number:
   - Type of Revision:

6. Course Credit:
   Contact/Group Hours:
   - Minimum Hours: 3
   - Maximum Hours (Repeatability): 3
   - Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study):
     Lecture
   - Weekly or Per Term?: weekly
   - Credit Hours: 3
   - Anticipated Enrollment: 24
   - Total Credit Hours: 3

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 3310

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)
    Development of medical instrumentation using electromagnetic principles; focus on magnetic resonance imaging systems.

11. May Count Either:
    - [ ] ELEC 5360
    - [ ] ELEC 6360
    (Indicate if this particular course cannot be counted for credit in addition to another)

12. Affected Program(s):
    (Respond "N/A" if not included in any program; attach memorandum if more space is required)
    | Program Type | Program Title | Requirement or Elective? |
    |--------------|---------------|-------------------------|
    | major        | Bachelor in Electrical Engineering | elective |
    | major        | MS/PhD in Electrical Engineering | elective |

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:
As of Fall 2013, the course was taught twice as ELEC 5970/6970. Students in the course are exposed to new and emerging applications of electromagnetics in medical diagnosis and therapies. The addition of this elective course fulfills the departmental need for more electives to fulfill accreditation and ABET requirements.

15. Resources:
The distance version will be administered through the Auburn Engineering Online Program. Lectures and course materials will be provided online. Electronic communications (email, Skype) will be used for interactions with the instructor. Exams will be administered through the Online Program proctoring service.

16. Student Learning Outcomes:
1. To introduce electrostatic, magnetostatic, quasi-static and RF bio-electromagnetic applications.
2. To understand the physics behind electromagnetic interactions with biological tissues
3. To be familiar with numerical skills for Bio-electromagnetic device design
4. To be familiar with hardware fundamentals of Bio-electromagnetic devices

17. Course Content Outline:
Week 1: Review of electromagnetics
Week 2/4: Membrane structure and electrophysiology
Week 4/5: Electroencephalography (EEG), Magnetoencephalography (MEG) and capacitive imaging
Week 5/7: Deep Brain Stimulation (DBS) and electrode design
Week 7/8: Loop, solenoid, Helmholtz and saddle coils
Week 8/9: Trans-cranial Brain Stimulation (TMS) and coil design
Week 10/11: MRI basics
Week 12/13: RF coil design and implementation for MRI
Week 14: RF hyperthermia, body area network and etc.

Homework is assigned for all topics, usually due once per week.

18. Assignments / Projects:
Some homework will require MATLAB solution. In addition, graduate students will be required to provide analytical results of canonical problems to verify numerical simulation programs for each project. This makes ELEC 6360/6366 a greater intellectual challenge than ELEC 5360.

19. Rubric and Grading Scale:
<table>
<thead>
<tr>
<th>Category</th>
<th>ELEC 5360</th>
<th>ELEC 6360/6366</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Matlab Project</td>
<td>45%</td>
<td>45%</td>
</tr>
<tr>
<td>Presentation/Project</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

A typical grading scale (A = 90-100, etc) is used in this course.

20. Justification for Graduate Credit:
This course is about the application of electromagnetics in bio-
medical applications. It introduces computer simulations of electromagnetic fields in biological tissues and RF fundamentals for device design. It is beyond the scope of what is typically presented in undergraduate electromagnetics courses.

(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.).

(Include 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 Student Policy eHandbook, 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, subpoena 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 consult the Student Policy eHandbook 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 Student Policy eHandbook 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 accommodations are asked to electronically submit their approved accommodations through AU Access and 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. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TTY).
Approvals

R. Mark Nelms

Digitally signed by R. Mark Nelms
DN: cn=M. Mark Nelms, ou=Auburn University,
ou=Department of Electrical & Computer Engineering, mail=nelmsm@auburn.edu, c=US
Date: 2014/04/08 08:02:12 -05'00'

Department Chair / Head

[Signature]

Date

6/9/14

College / School Curriculum Committee

[Signature]

Date

6/9/14

College / School Dean

[Signature]

Date

Dean of the Graduate School (for Graduate Courses)

[Signature]

Date

Assoc. Provost for Undergraduate Studies (for Undergraduate Courses)

[Signature]

Date

Contact Person: Stuart M. Wentworth
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