TO: The Faculty of the College of Engineering

FROM: School of Electrical and Computer Engineering of the College of Engineering

RE: New Graduate Course, ECE 51012 Electromechanics

The faculty of the School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 51012 Electromechanics
Sem. 2, Lecture 3, Cr. 3.

Prerequisite: ECE 202 and PHYS 272

Prerequisite by Topic: Basic circuit analysis; elementary electromagnetics; elementary mechanics

Description: The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented.

Reason: This course is meant primarily as a first course for incoming graduate students, or for use an honors course for upper level undergraduate students. The course is aimed as setting the stage for future study in the analysis, modeling, simulation, and design of electromechanical devices. The course typically has 1-2 undergraduate students and 15-20 graduate students. The course is rigorous in nature with extensive mathematical derivations of everything covered in the course. The textbook used in the course is also very rigorous, much more so than competing books in the area, and is supplemented by extensive notes provided by instructor. The student assessment includes requiring the students to derive new results by applying what they have learned to novel electromechancial devices in both homework and exam problems. All topics considered are highly relevant to the present state of the art in electromechanical devices.

Michael R. Melloch

Michael R. Melloch, Associate Head
School of Electrical and Computer Engineering

Approved for the faculty of the Schools of Engineering by the Engineering Curriculum Committee
ECC Minutes #6 Date 11-15-16
Chairman ECC

Office of the Registrar
FORM 40G REV. 4/13

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE
(50000-60000 LEVEL)

DEPARTMENT: Electrical and Computer Engineering EFFECTIVE SESSION: Spring 2016

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] 1. New course with supporting documents (complete proposal form)
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	ECE	Subject Abbreviation	
Course Number	51012	Course Number	
Long Title	Electromechanics		
Short Title	Electromechanics		

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED (Check All That Apply): [ ] Fall [x] Spring [ ] Summer

CAMPUS(ES) INVOLVED: [ ] Calumet [ ] N. Central [ ] Cont Ed [ ] Tech Statewide [ ] Ft. Wayne [x] W. Lafayette [ ] Indianapolis

CREDIT TYPE

1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs ____ (Check One) To [ ] Or [ ] Maximum Cr. Hrs ____
3. Equivalent Credit: Yes [ ] No [x]
4. Thesis Credit: Yes [ ] No [x]

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ]
   Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Fees [ ] Coop [ ] Lab [ ] Rate Request
   Include comment to explain fee
6. Registration Approval Type: Department [ ] Instructor [ ]
7. Variable Title [ ]
8. Honors [ ]
9. Full Time Privilege [ ]
10. Off Campus Experience [ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	3	50	16	100
Recitation				
Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented.

*COURSE LEARNING OUTCOMES:

a. The student will acquire a knowledge of magnetics and magnetic materials as it related to electromechanical devices (a,c)
b. The student will understand the energy conversion process including field energy, co-energy, force and torque production (a,c)
c. The student will be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices (a,c)

Calumet Department Head	Date	Calumet School Dean	Date	Calumet Director of Graduate Studies	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date	Fort Wayne Director of Graduate Studies	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date	IUPUI Associate Dean for Graduate Education	Date
North Central Department Head	Date	North Central School Dean	Date	North Central Director of Graduate Studies	Date
West Lafayette Department Head	10/28/15	West Lafayette College/School Dean	12/2/15	Date Approved by Graduate Council	Date
Graduate Area Committee Convener	Date	Graduate Dean	Date	Graduate Council Secretary	Date
				West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

Supporting Document to the Form 40G
for a New Graduate Course

To: Purdue University Graduate Council

From: Faculty Member: Scott Sudhoff

Department: Electrical and Computer Engineering

Campus: West Lafayette

Date:

Subject: Proposal for New Graduate Course

Contact for information if questions arise:
Name: Matt Golden
Phone: 494-3374
Email: goldenm@purdue.edu
Address: EE Building, Room 135

Course Subject Abbreviation and Number: ECE 51012

Course Title: Electromechanics

Course Description:

The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented.

Semesters Offered:

For the benefit of graduate student plan of study development, how frequently will this prototype be offered? Which semesters?
Each Spring

A. Justification for the Course:

Provide a complete and detailed explanation of the need for the course (e. g., in the preparation of students, in providing new knowledge/training in one or more topics, in meeting degree requirements, etc.), how the course contributes to

existing majors and/or concentrations, and how the course relates to other graduate courses offered by the department, other departments, or interdisciplinary programs.

Justify the level of the proposed graduate course (500- or 600-level) including statements on, but not limited to: (1) the target audience, including the anticipated number of undergraduate and graduate students who will enroll in the course; and (2) the rigor of the course.

This course is meant primarily as a first course for incoming graduate students, or for use an honors course for upper level undergraduate students. The course is aimed as setting the stage for future study in the analysis, modeling, simulation, and design of electromechanical devices. The course typically has 1-2 undergraduate students and 15-20 graduate students. The course is rigorous in nature with extensive mathematical derivations of everything covered in the course. The textbook used in the course is also very rigorous, much more so than competing books in the area, and is supplemented by extensive notes provided by instructor. The student assessment includes requiring the students to derive new results by applying what they have learned to novel electromechancial devices in both homework and exam problems. All topics considered are highly relevant to the present state of the art in electromechanical devices.

Use the following criteria:
Graduate Council policy requires that courses at the 50000 level in the Purdue system should be taught at the graduate level and meet four criteria: a) the use of primary literature in conjunction with advanced secondary sources (i.e., advanced textbooks); b) assessments that demonstrate synthesis of concepts and ideas by students; c) demonstrations that topics are current, and; d) components that emphasize research approaches/methods or discovery efforts in the course content area (reading the research, critiquing articles, proposing research, performing research). Such courses should be taught so that undergraduate students are expected to rise to the level of graduate work and be assessed in the same manner as the graduate students.

- Anticipated enrollment
  - Undergraduate 1-2
  - Graduate 15-20

B. Learning Outcomes and Method of Evaluation or Assessment:

ECE Graduate Learning Outcomes:

a. Knowledge and Scholarship (thesis/non-thesis)

b. Communication (thesis/non-thesis)
c. Critical Thinking (thesis/non-thesis)
d. Ethical and Responsible Research (thesis) or Professional and Ethical Responsibility (non-thesis)

- List Learning Objectives for this course and map each Learning Objective to one or more of the ECE Learning Outcomes (a-d, listed above):

  a. The student will acquire a knowledge of magnetics and magnetic materials as it related to electromechanical devices (a,c)
  b. The student will understand the energy conversion process including field energy, co-energy, force and torque production (a,c)
  c. The student will be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices (a,c)
  d. The student will understand the operation of rotating electric machines including stepper motors, permanent magnet ac machine, and induction machines (a,c)
  e. The student will understand what is acceptable and unacceptable practice with regard to taking exams, working on homework, and working on the project, and the implications of unacceptable practices. (d)

- Methods of Instruction

  - Lecture

- Will/can this course be offered via Distance Learning?

  Yes

- Grading Criteria

  Grading criteria (select from checklist); include a statement describing the criteria that will be used to assess students and how the final grade will be determined. Add and delete rows as needed.

  - exams
  - a design project
  - homework

  ▶ Describe the criteria that will be used to assess students and how the final grade will be determined:
  The course will be graded primarily on a combination of examinations. A smaller part of the grade will be based on a project and homeworks. The examination component will include a multiple (typically three) exams during the semester and final examination.

C. Prerequisite(s):

List prerequisites and/or experiences/background required. If no prerequisites are indicated, provide an explanation for their absence. Add bullets as needed.

- ECE 202 and PHYS 272
- Prerequisite by Topic: basic circuit analysis; elementary electromagnetics; elementary mechanics

D. Course Instructor(s):

Provide the name, rank, and department/program affiliation of the instructor(s). Is the instructor currently a member of the Graduate Faculty? (If the answer is no, indicate when it is expected that a request will be submitted.) Add rows as needed.

Name	Rank	Dept.	Graduate Faculty or expected date
Scott Sudhoff	Professor	ECE	Yes

E. Course Outline:

Provide an outline of topics to be covered and indicate the relative amount of time or emphasis devoted to each topic. If laboratory of field experiences are used to supplement a lecture course, explain the value of the experience(s) to enhance the quality of the course and student learning. For special topics courses, include a sample outline of a course that would be offered under the proposed course. **(This information must be listed and may be copied from syllabus).**

Lectures	Principal Topics
6	Magnetic and coupled circuits
6	Electromechanical energy conversion
1	Exam 1
3	Stepper motors
4	DC machines
3	Converters for dc drives
1	Exam 2
5	Rotating MMF concepts
2	Reference Frame Theory

6	Permanent Magnet AC Machines
1	Transformers
1	Exam 3
6	Induction machines

F. Reading List (including course text):

A primary reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

A secondary reading list or bibliography should include material students may use as background information.

- Primary Reading List
  - S.D. Sudhoff, "Lecture Handouts," Boiler Copy Maker, Memorial Union
  - Electromechanical Motion Devices, 2nd Edition, Krause, Wasynczuk, Pekarek, IEEE/Wiley,Secondary Reading List

G. Library Resources

Describe any library resources that are currently available or the resources needed to support this proposed course.

H. Course Syllabus

(While not a necessary component of this supporting document, an example of a course syllabus is available, for information, by clicking on the link below, which goes to the *Graduate School's Policies and Procedures Manual for Administering Graduate Student Program.*
See Appendix K.
http://www.purdue.edu/gradschool/faculty/documents/Graduate_School_Policies_and_Procedures_Manual.pdf