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OFFICE OF THE SENATE COUNCIL

1. General Information

1a. Submitted by the College of: ENGINEERING

Date Submitted: 9/28/2015

1b. Department/Division: Mining Engineering

1c. Contact Person

Name: Joseph Sottile

Email: joseph.sottile@uky.edu

Phone: 257-4616

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: No

2b. Prefix and Number: MNG 311

2c. Full Title: Electrical Circuits and Mining Machinery

2d. Transcript Title:

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 3

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: A study of dc and ac electrical circuits, single-phase and three-phase circuits, transformers, and ac and dc rotating machinery used in the mining industry.

2k. Prerequisites, if any: MA 114, PHY 232

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Spring,

Will the course be offered every year?: Yes

If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 40

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: Yes

Will it be of interest to a significant number of students outside the degree pgm?: No

If Yes, explain:

8. Check the category most applicable to this course: Traditional – Offered in Corresponding Departments at Universities Elsewhere,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: No

If YES, name the proposed new program:

b. Will this course be a new requirement for ANY program?: Yes

If YES, list affected programs: BS Mining Engineering

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: No

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6.How do course requirements ensure that students make appropriate use of learning resources?

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10.Does the syllabus contain all the required components? NO

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:

SIGNATURE|HONAKER|Rick Honaker|MNG 311 NEW Dept Review|20141016

SIGNATURE|BJSTOK0|Barbara J Brandenburg|MNG 311 NEW College Review|20150428

SIGNATURE|JMETT2|Joanie Ett-Mims|MNG 311 NEW Undergrad Council Review|20151006

New Course Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Generate R

Open in full window to print or save

Attachments:

Browse... Upload File

	ID	Attachment
Delete	3948	Rationale and Justification for MNG 311.docx
Delete	5191	MNG 311 UGC Review Checklist.docx
Delete	5437	MNG 311 Syllabus_Sept 28-2015.docx

First 1 Last

(*denotes required fields)

1. General Information

a. * Submitted by the College of: ENGINEERING Submission Date: 9/28/2015

b. * Department/Division: Mining Engineering

c.

* Contact Person Name: Joseph Sottile Email: joseph.sottile@uky.edu Phone: 257-4616

* Responsible Faculty ID (if different from Contact) Email: Phone:

d. * Requested Effective Date: ◉ Semester following approval OR ○ Specific Term/Year [1]

e.

Should this course be a UK Core Course? ○ Yes ◉ No

If YES, check the areas that apply:

☐ Inquiry - Arts & Creativity	☐ Composition & Communications - II
☐ Inquiry - Humanities	☐ Quantitative Foundations
☐ Inquiry - Nat/Math/Phys Sci	☐ Statistical Inferential Reasoning
☐ Inquiry - Social Sciences	☐ U.S. Citizenship, Community, Diversity
☐ Composition & Communications - I	☐ Global Dynamics

2. Designation and Description of Proposed Course.

a. * Will this course also be offered through Distance Learning? ○ Yes [4] ◉ No

b. * Prefix and Number: MNG 311

c. * Full Title: Electrical Circuits and Mining Machinery

d. Transcript Title (if full title is more than 40 characters):

e. To be Cross-Listed [2] with (Prefix and Number):

f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3 Lecture	Laboratory [1]	Recitation	Discussion
Indep. Study	Clinical	Colloquium	Practicum
Research	Residency	Seminar	Studio
Other	If Other, Please explain:		

g. * Identify a grading system:

◉ Letter (A, B, C, etc.)
○ Pass/Fail
○ Medicine Numeric Grade (Non-medical students will receive a letter grade)
○ Graduate School Grade Scale

h. * Number of credits: 3

i. * Is this course repeatable for additional credit? ○ Yes ◉ No

If YES: Maximum number of credit hours:

If YES: Will this course allow multiple registrations during the same semester? ○ Yes ○ No

j. * Course Description for Bulletin:
A study of dc and ac electrical circuits, single-phase and three-phase circuits, transformers, and ac and dc rotating machinery used in the mining industry.

k. Prerequisites, if any:
MA 114, PHY 232

l. Supplementary teaching component, if any: ○ Community-Based Experience ○ Service Learning ○ Both

3. * **Will this course be taught off campus?** ○ Yes ◉ No
If YES, enter the off campus address:

4. **Frequency of Course Offering.**

a. * Course will be offered (check all that apply): ☐ Fall ☑ Spring ☐ Summer ☐ Winter

b. * Will the course be offered every year? ◉ Yes ○ No
If No, explain:

5. * **Are facilities and personnel necessary for the proposed new course available?** ◉ Yes ○ No
If No, explain:

6. * **What enrollment (per section per semester) may reasonably be expected?** 40

7. **Anticipated Student Demand.**

a. * Will this course serve students primarily within the degree program? ◉ Yes ○ No

b. * Will it be of interest to a significant number of students outside the degree pgm? ○ Yes ◉ No
If YES, explain:

8. * **Check the category most applicable to this course:**

☑ Traditional – Offered in Corresponding Departments at Universities Elsewhere
☐ Relatively New – Now Being Widely Established
☐ Not Yet Found in Many (or Any) Other Universities

9. **Course Relationship to Program(s).**

a. * Is this course part of a proposed new program? ○ Yes ◉ No
If YES, name the proposed new program:

b. * Will this course be a new requirement [5] for ANY program? ◉ Yes ○ No
If YES [5], list affected programs::
BS Mining Engineering

10. **Information to be Placed on Syllabus.**

a. * Is the course 400G or 500? ○ Yes ◉ No
If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in **10.b**. You must include: (i) identi additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR

b. ☑ * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if appl **10.a** above) are attached.

[4] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.
[5] The chair of the cross-listing department must sign off on the Signature Routing Log.

Rationale and Justification for MNG 311

The Department of Mining Engineering is proposing a program change that includes the creation of a new course, MNG 311 – *Electrical Circuits and Mining Machinery*, and dropping EE 305 – *Electrical Circuits and Electronics*. The rationale for this change is to give students exposure to electric power systems, including three-phase systems and one-line diagrams, and electrical machinery. MNG 311 will also prepare students for MNG 511 – *Mine Power System Design*.

For comparison, the description of both courses is given below, as well as the goals of MNG 311.

Description of EE 305 – A service course covering electrical engineering principles for engineering or science students with majors outside of electrical engineering. Topics include: circuits analysis, power, electronics, digital logic and instrumentation. Prereq: PHY 232, MA 114.

Description of MNG 311 – A study of dc and ac electrical circuits, single-phase and three-phase circuits, transformers, and ac and dc rotating machinery used in the mining industry.
Prerequisites: PHY 232, MA 114.

Course Goals of MNG 311 – Students completing this course will be able to perform steady-state analysis of dc circuits, ac circuits, and three-phase circuits; understand transformer operation and utilize the transformer equivalent circuit for performance analysis; understand dc machine operation and operating characteristics and analyze performance utilizing equivalent circuit models; understand the operation of three-phase induction motors and analyze performance of three-phase induction motors.

Inspection of these descriptions shows that both courses include circuit analysis but EE 305 emphasizes electronics, while MNG 311 emphasizes power systems and machinery. The major differences are listed below.

1. EE 305 emphasizes electronics, digital logic, and electronics.
2. MNG 311 does not include electronics, digital logic, and electronics; instead, it includes three-phase systems and machinery.
3. MNG 311 has been developed specifically to prepare students for applications that they will most likely be exposed to in the mining industry.
4. MNG 311 prepares students for MNG 511.

Based on this comparison, it can be seen that the content of MNG 311 is significantly different from the content of EE 305. (In addition, MNG 311 and EE 305 should not be cross-listed.)

Course: MNG 311 **University Senate Syllabi Guidelines Review Checklist**

General Course Information

- ☒ **Full and accurate title of the course**
- ☐ Departmental and college prefix
- ☒ **Course prefix, number and section number**
- ☒ **Scheduled meeting day(s), time and place**

Instructor Contact Information (if specific details are unknown, "TBA" is acceptable for one or more fields)

- ☒ **Instructor name**
- ☐ Contact information for teaching/graduate assistant, etc.
- ☐ Preferred method for reaching instructor
- ☒ Office phone number
- ☒ **Office address**
- ☐ **UK email address**
- ☒ **Times of regularly scheduled office hours and if prior appointment is required**

Course Description

- ☒ **Reasonably detailed overview of the course (course description should match on syllabus and eCATS form)**
- ☒ **Prerequisites, if any (should match on syllabus and eCATS form)**
- ☒ **Student learning outcomes**
- ☐ Course goals/objectives
- ☐ Required materials (textbook, lab materials, etc.)
- ☐ Outline of the content, which must conform to the Bulletin description
- ☐ **Summary description of the components that contribute to the determination of course grade**
- ☐ **Tentative course schedule that clarifies topics, specifies assignment due dates, examination date(s)**
- ☐ **Final examination information: date, time, duration and location**
- ☒ **For 100-, 200-, 300-, 400-, 400G- and 500-level courses, numerical grading scale and relationship to letter grades for undergraduate students**
- ☐ **For 400G-, 500-, 600- and 700-level courses, numerical grading scale and relationship to letter grades for graduate students. (Graduate students cannot receive a "D" grade.)**
- ☒ **Relative value given to each activity in the calculation of course grades (Midterm=30%; Term Project=20%, etc.)**
- ☐ **Note that undergraduate students will be provided with a Midterm Evaluation (by the midterm date) of course performance based on criteria in syllabus**
- ☒ **Policy on academic accommodations due to disability. Standard language is below:**

  If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

UGE Review ( )

Provide UK email address for instructor

Attendance policy refers to the class as MNG 599

Add midterm grading statement

Course topics are included, but should be outlined in a week-by-week format, including exam dates and homework due dates

Include make-up policy for students with excused absences

Course Policies

- [x] **Attendance**
- [x] **Excused absences**
- [ ] **Make-up opportunities**
- [x] Verification of absences
- [ ] Submission of assignments
- [x] **Academic integrity, cheating & plagiarism**
- [ ] Classroom behavior, decorum and civility
- [ ] Professional preparations
- [ ] Group work & student collaboration

Committee Review ( )

Comments

MNG 311 - ELECTRICAL CIRCUITS AND MINING MACHINERY

Spring Semester 2016

Course Description: A study of dc and ac electrical circuits, single-phase and three-phase circuits, transformers, and ac and dc rotating machinery used in the mining industry. Prerequisites: PHY 232, MA 114.

Textbook: Rizzoni, G., *Fundamentals of Electrical Engineering,* 1st edition

Instructor: Dr. Joseph Sottile
234A MMRB
257-4616, joseph.sottile@uky.edu

Schedule: Monday/Wednesday/Friday 9:00AM - 9:50AM in TBA

Course Goals: Students completing this course will,
be able to perform steady-state analysis of dc circuits, ac circuits, and three-phase circuits; understand transformer operation and utilize the transformer equivalent circuit for performance analysis; understand dc machine operation and operating characteristics and analyze performance utilizing equivalent circuit models; understand the operation of three-phase induction motors and analyze performance of three-phase induction motors.

Tentative course topics:

1. Fundamentals of electric circuits. Charge, current, voltage, Kirchhoff's laws, energy sources, Ohm's law, open and short circuits, series and parallel connections, voltage and current division, sign conventions. (Chapter 2)
2. Resistive network analysis. Node analysis, mesh current analysis, superposition, equivalence, Thevenin's theorem, Norton's theorem, source transformation, maximum power transfer. (Chapter 3)
3. Ac network analysis. Energy storage elements, time-dependent sources, sinusoids, average and RMS values, solution of circuits with energy storage elements, phasors and impedance, ac circuit analysis methods, ac equivalent circuits. (Chapter 4)
4. Ac power. Power in ac circuits, instantaneous and average power, complex power, power factor, power factor correction. (Chapter 7)
5. Resonance and quality factor.
6. Balanced three-phase circuits. Three-phase voltage generation, delta/wye connections, three-phase power, one-line diagrams. (Chapter 7)
7. Principles of electromechanics. Electricity and magnetism, Faraday's law, self and mutual inductance, Ampere's Law, magnetic circuits, ideal and practical transformers. (Chapter 13)
8. Introduction to electric machines. Classification and principles of operation; dc machines: physical structure, analysis of dc generators, analysis of dc motors, speed-torque characteristics of dc motors; ac machines: rotating magnetic fields, induction motors. (Chapter 14)

Course and Program Outcomes

The following items will be used to assess the achievement of specific program outcomes:

Course Outcomes	Student Outcome*
1. Conduct dc circuit analysis: apply fundamental circuit analysis techniques to dc circuits; dc power.	(a)
2. Conduct ac circuit analysis: apply circuit analysis techniques to steady state ac circuits using phasors; ac power; power factor; resonance; balanced three-phase circuit analysis.	(a)
3. Conduct fundamental electric machinery analysis: simple magnetic circuits; introducyion to dc motors and generators; introduction to three-phase induction motors.	(a)

* See department website for list of Program Learning Outcomes.
http://www.engr.uky.edu/mng/students/undergraduate/outcomes/

Office Hours: I am generally available throughout the day, except for class time and the hour prior to class.

My Class Schedule:

Time	Mon.	Tues.	Wed.	Thur.	Fri.
8:00					
9:00					
10:00					
11:00					
12:00					
1:00					
2:00					
3:00					
4:00					
5:00					

Summary of grading and tentative dates

Exam 1 - 20%	(2/10)
Exam 2 - 20%	(3/9)
Exam 3 - 20%	(4/13)
Final exam - 25%	(As listed in Schedule of Classes)
Homework - 15%	(approximately 75 homework problems)

Grades

A = 90 - 100%
B = 80 - 89.9%
C = 70 - 79.9%
D = 60 - 69.9%
E = below 60%

Mid-term Grade
Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar (http://www.uky.edu/registrar/content/academic-calendar)

Graduate Students

Graduate students are not eligible to take this course for graduate credit.

Canvas

We will be using the Canvas Learning Management System (Canvas LMS) to provide access to assignments and grades and to provide a location for posting any information that is important for the class. If you are having trouble with Canvas, send an email to helpdesk@uky.edu, or phone 218-4357 for a quicker response.

Homework Notebooks

When practical, homework will be conducted on Canvas. However, students are still required to complete and keep hard copies of their homework assignments in a homework notebook. Homework must be neat and done on engineering paper. Students must bring their homework notebooks to every class; and the notebooks will be checked periodically. In cases where the homework has been submitted on Canvas, but there is no hard copy of the completed assignment in the notebook, a grade of zero will be given for that (or those) assignment(s). Homework will not be assigned during Deadweek, but a previously assigned homework may be due during Deadweek.

Cell Phones and Other Electronics

Cell phone use (and other electronics, except calculators) is not permitted in class. Please keep your phone on vibrate and out of sight during class.

5.2.4.6 Dead Week [US: 4/13/09]

A. The last week of instruction of a regular semester is termed "Dead Week." In the rest of these Rules, this term also refers to the last three days of instruction of a summer session and a summer term.
B. In cases of "Take Home" final examinations, students shall not be required to return the completed examination before the regularly scheduled examination period for that course.
C. No written examinations, including final examinations, may be scheduled during the Dead Week.
D. No quizzes may be given during Dead Week.
E. No project/lab practical/paper/presentation deadlines or oral/listening examinations may be scheduled to fall during the Dead Week unless it was scheduled in the syllabus AND the course has no final examination (or assignment that acts as a final examination) scheduled during finals week. A course with a lab component may schedule the lab practical of the course during Dead Week if the lab portion does not also require a Final Examination during finals week.

F. Make-up exams and quizzes are allowed during Dead Week; these are exempt from the restrictions stated in C, D and E.
G. Class participation and attendance grades are permitted during Dead Week.
H. The current wording of this rule does not prohibit continuing into Dead Week regularly assigned graded homework that was announced in the class syllabus. [RC: 9/09]

Excused Absences: Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, David T. Beach (dtbeac1@uky.edu, 859-257-2754), Suite 407 of the Multidisciplinary Science Building, 725 Rose Street, 0082.

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

Verification of Absences: Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

Completing Missed Work: (Rule 5.2.4.2, section E)

Students missing any graded work due to an excused absence bear the responsibility of informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required), and of making up the missed work. The Instructor of Record shall give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred. [US: 11/10/85 and SREC: 11/20/87]

Academic Integrity: Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. *The minimum penalty for a first offense is a zero on the assignment on which the offense occurred.* If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Cheating on any exam during the semester will result in a grade of zero. Cheating on the final exam will result in failing the course.

Individuals who purposely allow others to cheat from their work will realize the same penalty as those who cheated.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following web site: http:/www.uky.edu/ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of *Student Rights and Responsibilities* available online at the following URL, (http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

Accommodations Due To Disability

If a student with a documented disability requires academic modifications or accommodation for this course, the student must provide me with a Letter of Accommodation from the UK Disability Resource Center (DRC). If a student is not registered with the DRC, the student may contact David T. Beach via email at dtbeac1@uky.edu or by telephone 859-257-2754. The student may also visit the DRC website for information on how to register for services as a student with a disability: www.uky.edu/drc.

Tentative Timeline

Time	Topics	Assignments/Exams
Week 1 **Week 2**	Fundamentals of electric circuits. Charge, current, voltage, Kirchhoff's laws, energy sources, Ohm's law, open and short circuits, series and parallel connections, voltage and current division, sign conventions. (Chapter 2)	HW Assignments: Approximately 24 problems
Week 2 **Week 3** **Week 4**	Resistive network analysis. Node analysis, mesh current analysis, superposition, equivalence, Thevenin's theorem, Norton's theorem, source transformation, maximum power transfer. (Chapter 3)	
Week 4		Exam 1
Week 4 **Week 5** **Week 6** **Week 7**	Ac network analysis. Energy storage elements, time-dependent sources, sinusoids, average and RMS values, solution of circuits with energy storage elements, phasors and impedance, ac circuit analysis methods, ac equivalent circuits. (Chapter 4)	HW Assignments: Approximately 15 problems
Week 8		Exam 2
Week 8 **Week 9**	Ac power. Power in ac circuits, instantaneous and average power, complex power, power factor, power factor correction. (Chapter 7)	HW Assignments: Approximately 12 problems
Week 9	Resonance and quality factor.	
Week 10 **Week 11**	Balanced three-phase circuits. Three-phase voltage generation, delta/wye connections, three-phase power, one-line diagrams. (Chapter 7)	HW Assignments: Approximately 10 problems
Week 12		Exam 3
Week 12 **Week 13**	Principles of electromechanics. Electricity and magnetism, Faraday's law, self and mutual inductance, Ampere's Law, magnetic circuits, ideal and practical transformers. (Chapter 13)	HW Assignments: Approximately 6 problems
Week 13 **Week 14** **Week 15**	Introduction to electric machines. Classification and principles of operation; dc machines: physical structure, analysis of dc generators, analysis of dc motors, speed-torque characteristics of dc motors; ac machines: rotating magnetic fields, induction motors. (Chapter 14)	HW Assignments: Approximately 8 problems
Week 16		Final Exam