

# EE 321 – Electromechanical Motion Devices

## Fall 2019

**Course Website:** All electronic-based course material will be posted on Blackboard

**Instructor:** Oleg Wasynczuk  
Email: [wasynczu@ecn.purdue.edu](mailto:wasynczu@ecn.purdue.edu)  
Phone: (765) 494-3475  
Office Hrs:  
M/W/F 9:00-10:00 am, Wang 2061

**TA:** Kiana Pitman  
Email: [pitman0@purdue.edu](mailto:pitman0@purdue.edu)  
Office Hrs:  
M/F 10:30 am-12:30 pm, EE209  
W 12:30-2:30 pm, EE209  
On 8/30 only, EE208

Keith Scott  
Email: [scott343@purdue.edu](mailto:scott343@purdue.edu)  
Office Hrs:  
T 12:00-4:00 pm, EE209  
Th 12:00-3:00 pm, Wang 2052

*Please include "ECE321" on subject line of any email (or else it may be overlooked)*

**Prerequisites:** EE 202 and PHYS 261

**Prerequisites by topic:** (1) Basic circuit analysis,  
(2) Elementary Electromagnetics and Mechanics

**Corequisites:** EE 255

**Corequisites by topic:** (1) Basic Electronics.

**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 and electromotive applications are presented.

**Course Outcomes:** A student who successfully fulfills the course outcomes will have demonstrated:

- i. An ability to analyze/design electromagnetic circuits/devices.
- ii. An understanding of the concepts and principles of electromechanical energy conversion.
- iii. An understanding of the concept of time-varying transformations in the analysis of time-varying systems.
- iv. An ability to analyze dc machines.
- v. An understanding of converters for dc drives.
- vi. An ability to analyze brushless dc machines.
- vii. An ability to analyze induction machines.

**Course Outline:**

Topics	Lectures
1. Magnetic and Coupled Circuits	5
2. Electromechanical Energy Conversion	5
<b>EXAM 1</b>	1
3. Stepper Motors	3
4. DC machines	4
5. Converters for DC Drives	4
<b>EXAM 2</b>	1
6. Rotating MMF Concepts	4
7. Permanent Magnet Synchronous Machines	5
8. Brushless DC Machines	5
<b>EXAM 3</b>	1
9. Induction Machines	7

**Text:** Electromechanical Motion Devices, 2<sup>nd</sup> Edition, Paul C. Krause, Oleg Wasynczuk, and Steven Pekarek, IEEE Press – Wiley, ISBN: 978-1-1182-9612-7, 2012.  
**Electronic copy available through Blackboard.**  
**Draft chapters of third edition may be posted on Blackboard.**

**Handouts:** Occasionally, Posted on Blackboard

**Class Demeanor:** Questions may be asked at any time (encouraged). However, **there can only be one conversation taking place at any given time.** Private conversations during class are disruptive to neighboring students, and to me, and are therefore disallowed. Failure to heed warnings (two) will result in referral to Dean of Students.

**Exams:** There will be three one-hour evening exams during the semester. The final exam period will be divided into two parts. The first part will cover the last three weeks (roughly) of material. The second part will be comprehensive.

- Only one 8½ × 11, front and back, crib sheet will be allowed at your desk during the exam.
- Electronic devices such as calculators, music players, earphones, cell phones will **NOT** be allowed.
- The exam period will be **exactly** one hour in length. Students caught writing after the end of the exam period or failing to adhere to exam rules and procedures (to be posted on Blackboard) will receive a grade of zero for the exam.
- Both the crib sheet and the exam will be collected.
- Any regrade requests must be submitted in writing no more than five school days following the availability of graded exam.
- Make-up exams will be given only in the case of family emergencies or incapacitating illness. In any case, you must contact me **prior** to exam.
- Make-up exams will be “white board” oral exams conducted by two ECE faculty/staff members.
- Under no circumstances will an exam be given early.
- I will abide by all regulations of ADA, in letter and in spirit – for ALL students. For all in-class accommodations, please see me outside of class hours (after class or during office hours) to share your Accommodation Memorandum and discuss your accommodations as soon as possible. You will need to schedule all exams requiring extra time with Disability Resource Center (DRC).

**Hour Exam Dates:**

	<b>Date</b>		<b>Time</b>	<b>Room</b>
Exam 1	9/17	Tues	8:00-9:00p	PHYS 112
Exam 2	10/16	Wed	8:00-9:00p	PHYS 112
Exam 3	11/12	Tues	8:00-9:00p	PHYS 112
Exam 4	TBD			
Final	TBD			

Compensating days off to be announced.

***Cheating:*** Any student caught cheating on any exam will receive an F for the course and will be reported to the Dean of Students (DOS). Examples of cheating include but are not limited to sharing answers with anyone else by any means during an exam; using any item other than allowed crib sheet during exam; attempting to obtain advance copy of exam through theft or cyber theft; changing the answer after exam is returned and asking for a regrade; having someone else take an exam on your behalf (both students will be reported to DOS); unauthorized access, misuse, or sabotage of 321-related computer accounts.

***Homework:*** There will be approximately 10-12 homework assignments throughout the semester. Only a subset of the problems will be graded. Homework will be submitted via Blackboard or by submitting a hard copy to a drop box located outside of Wang 2061. Under no circumstances will homework be accepted during class. Homework assignments will be posted on Blackboard and will be announced in class. Homework solutions will also be posted on Blackboard after the due date/time of the respective homework assignment. No homework will be accepted after the solutions are posted.

***Cheating on Homework:*** Comparing answers on homework or discussing homework with others will not be considered as cheating. However, copying someone else's homework outright will be considered cheating and will result in a grade of zero for that assignment (for all individuals involved).

***Grading:*** Each of the three one-hour evening exams administered during the semester is considered one unit (total of three units). The final will consist of two parts, each considered as one unit. The first hour will cover the last three weeks (roughly) of material (i.e. a fourth one-hour exam). The second hour will be a comprehensive final exam. The homework is considered as one unit. Grades will be determined by averaging the five highest units (lowest unit dropped). This will account for 98% of the final grade. Satisfaction of a course outcome is determined by receiving a passing score on at least one exam problem related to that outcome.

***Attendance:*** Almost all of the material we cover is related or "connected" to other material covered earlier. Moreover, exam questions will be based upon material covered in class. As such, attendance is very important and will be recorded on a daily basis. Attendance will count for 2% of your overall grade.

The approximate course cutoffs are as follows: A: 85-100, B: 70-85, C: 55-70, D: 40-55

The exact cutoffs will be determined after careful consideration of overall class performance and any extenuating circumstances but will be not deviate by more than 2 points from listed cutoffs.

**In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through Blackboard.**