PURDUE UNIVERSITY | College of Engineering

Engineering Faculty Document No.: 134-25
February 24, 2025

**TO:** The Engineering Faculty

**FROM:** The Faculty of the Elmore Family School of Electrical and Computer Engineering

**RE:** Requisite Changes to ECE 32300

The Faculty of the Elmore Family School of Electrical and Computer Engineering has approved the following changes to an undergraduate course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

Requisite Changes for ECE 32300

FROM:

ECE 32300 Electromechanical Motion Devices and Systems Laboratory

Requisites: ECE 32100 [May be taken Concurrently] and (ECE 20008 or ECE 20800)

No changes to name, title, outcomes or description are being made at this time.

TO:

ECE 32300 Electromechanical Motion Devices and Systems Laboratory

Requisites: ECE 32100 and (ECE 20008 or ECE 20800)

RATIONALE:

The faculty of the Power & Energy Systems feel students will be more successful in ECE 32300 if they already have the ECE 32100 material instead of doing them together. This will remove the difficulty of keeping the two courses synchronized and make future plans to redesign the course material for ECE 32300.

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Mithuna Thottethodi
Associate Head of Teaching and Learning
Professor of the Elmore Family School of Electrical and Computer Engineering

Link to Curriculog entry:

https://purdue.curriculog.com/proposal:32514/form

# ECE 32300

# Electromechanical Motion Devices and Systems Laboratory

## General Course Information

- Lab Hours : 3
- Credits : 1
- Counts as
  a. CMPE Complementary Elective
  b. EE Elective - Advance Level Lab
- Requisites
  a. ECE 32100
  b. ECE 20008

## Course Description

- Experiments closely coordinated with ECE 321 involving measurement of fundamental parameters of various electromechanical devices using modern instrumentation techniques.
- Computer simulation is used to predict steady-state and dynamic operating characteristics.
- Comparison of predicted and measured performance is emphasized.

## Course Objective

To reinforce experimentally the basic principles of electromechanical motion devices and to familiarize students with the operating characteristics of various electromechanical devices used in control applications including dc, induction, brushless dc, and stepper motors.

## Required Text(s)

- ECE 323 Lab Manual (available in brightspace)
- Electromechanical Motion Devices, 2nd Edition, Paul C. Krause, Oleg Wasynczuk, and Steven Pekarek, IEEE Press – Wiley, ISBN: 978-1-1182-9612-7, 2012.
  (PDF copies of relevant chapters will be available through Brightspace)

## Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated an understanding of the

- fundamental principles of electromagnetic energy conversion
- operating characteristics of solenoid-plunger arrangement and variable reluctance stepper motors
- operating characteristics of permanent-magnet dc machines
- mechanisms used to develop rotating magnetic fields
- operating characteristics of permanent-magnet synchronous machines, brushless dc machines, and induction machines

## Lab Outline

- Exp 1 : Introduction to laboratory instrumentation
- Exp 2 : Calculating machine parameters for solenoid-plunger arrangement
- Exp 3a : Calculation and measurement of electromagnetic force for solenoid-plunger arrangement
- Exp 3b : Simulation and measurement of dynamic performance for solenoid-plunger arrangement
- Exp 4a : Calculating machine parameters for variable-reluctance stepper motor
- Exp 4b : Prediction and measurement of torque-versus-position characteristics for variable-reluctance stepper motor
- Exp 5a : Calculating machine parameters for permanent-magnet dc motor
- Exp 5b : Prediction and measurement of torque-versus-speed characteristics, simulation and measurement of dynamic performance for permanent-magnet dc motor
- Exp 6a : Concept of rotating magnetic field in ac devices
- Exp 6b : Calculating machine parameters for permanent-magnet synchronous machine
- Exp 7a : Use of rotor position to control source frequency for brushless dc motor
- Exp 7b : Measurement of torque-versus-position characteristics of permanent-magnet synchronous machine and measurement of torque-versus-speed characteristics of brushless dc motor
- Exp 8a : Calculating machine parameters for induction motor
- Exp 8b : Prediction and measurement of torque-versus-speed characteristics for induction motor

## Details of Course Mentor, Course Instructor, and Teaching Assistants

- **Course Instructor**
  Professor Scott D. Sudhoff
  Michael and Katherine Birck Professor of Electrical and Computer Engineering
  Email : sudhoff@purdue.edu
  Office : WANG 2057
  Office Hours : By appointment

- **Course Instructor-cum-Teaching Assistant**
  Hari Kiran Reddy B
  Graduate Student of Electrical and Computer Engineering
  Email : reddy83@purdue.edu
  Office : EE 56
  Office Hours : Mondays (03:30 pm to 05:30 pm)

- **Teaching Assistant**
  Camina Rice
  Graduate Student of Electrical and Computer Engineering
  Email : rice188@purdue.edu
  Office : EE 56
  Office Hours : Tuesdays (03:00 pm to 05:00 pm)

- **Teaching Assistant**
  Matthew Dickerson
  Graduate Student of Electrical and Computer Engineering
  Email : dicker12@purdue.edu
  Office : EE 56
  Office Hours : Mondays (12:00 pm to 02:00 pm)

## Laboratory Meeting Times (EE 56)

| Section | CRN | Meeting Day | Meeting Time | TA |
|---|---|---|---|---|
| 10 | 25686 | Tuesday | 08:30 am to 11:20 am | Hari |
| 5 | 10848 | Tuesday | 11:30 am to 02:20 pm | Matthew |
| 3 | 17745 | Wednesday | 08:30 am to 11:20 am | Camina |
| 11 | 26293 | Wednesday | 11:30 am to 02:20 pm | Camina |
| 7 | 19075 | Thursday | 08:30 am to 11:20 am | Hari |
| 6 | 11870 | Thursday | 11:30 am to 02:20 pm | Matthew |

## Course Grading

- **Quizzes (20%)**
  Prelab quizzes and postlab quizzes together will constitute 20% of the overall grade. You will take these quizzes on your Brightspace portal in the lab. The first 10-minutes of every lab session is allocated for the prelab quizzes. Once you done with your experiment, you will have to take the postlab quiz.

- **Prelab Reports (15%)**
  Prelabs ensure adequate lab preparation and are an essential part of this course. The prelab report should be handwritten legibly in the lab notebook. Printouts of data (e.g. MATLAB plots and the code used to produce them) should be submitted with the scanned copy of the prelab report. Prelabs are due at the beginning of the lab session. **Late prelabs will receive a grade of zero.**

- **Inlab Reports (20%)**
  The inlab report consist of data and notes taken during the lab as well as any printouts, plots, and/or code used in lab. Your inlab report will be collected at the end of the lab session. It is not necessary to rewrite the provided lab manual.

- **Postlab Reports (35%)**
  Measured data will be analyzed, interpreted, and compared with analytical predictions in the postlab report. The postlab report should be handwritten legibly in the lab notebook. Printouts of data (e.g. MATLAB plots and the code used to produce them) should be submitted with the carbon copy of the postlab report. Postlabs are due at the beginning of the next weeks lab. **Late postlabs will receive a grade of zero.**

- **Lab Notebook (10%)**
  Laboratory data will be recorded in a new formal bound lab notebook with carbon copies. Purchase a spiral- or clothbound lab notebook, such as one shown below, with at least 50 pages. Do not use a notebook from a previous semester. Work in your lab notebook must be completed legibly in ink. The top of each page should include your name, your partner's name, the number and title of the experiment, the date, and your station number. You will submit a carbon copy of your work at the end of each lab. In addition, the lab notebook will be collected at the end of the semester and will be graded based upon its organization. All work (prelabs, inlabs, postlabs) should be written on consecutive pages. Missing pages or dates that are out of sequence will be penalized. Work submitted on or pages that are not carbon copies of the originals in the lab notebook will receive a grade of zero. Printouts of computer-generated plots may be appended (stapled) to the submitted prelab, inlab, and/or postlab reports.

**Note: All laboratory assignments must be completed for a passing grade, late or not.**

All quizzes and reports will be graded on a scale from 1 to 10. The final numerical grade will be the weighted sum of all graded items converted to a percentage. Letter grades will be assigned as follows

| Letter Grade | Cutoffs |
|---|---|
| A+ | 95 and above |
| A | 90 to 95 |
| A- | 85 to 90 |
| B+ | 80 to 85 |
| B | 75 to 80 |
| B- | 70 to 75 |
| C+ | 65 to 70 |
| C | 60 to 65 |
| C- | 55 to 60 |
| D+ | 50 to 55 |
| D | 45 to 50 |
| D- | 40 to 45 |
| F | Below 40 |

### Academic Integrity

Prelabs and postlabs must represent your own work. The data may (should) be identical to those of your lab partner. Moreover, you may discuss the results with your partner. However, your prelab and postlab reports must be your own work and in your own words. Copying the explanations/analysis of anyone else is plagiarism. All individuals involved will receive a zero on the assignment in which it occurred. A second incident will result in failure of the course. Both incidents will be reported to the Office of Student Rights and Responsibilities (OSRR), which may issue further penalties.

### Software Requirements

All of the labs utilize MATLAB/Simulink to control the experiment and collect data. In addition, the post analysis and subsequent plotting should be done using MATLAB. If you are unfamiliar with MATLAB, your TA can provide assistance as needed.

You can choose to go with any of the following options to download and install MATLAB software in your personal computer.

- Download and Installation of Free Version (Preferred)
  Active Purdue students and faculty can download and install this temporarily-licensed copy of MATLAB on your personally owned computers by using the following link:
  https://www.mathworks.com/academia/tah-portal/purdue-university-31484706.html

  In light of the increased demand for remote learning due to COVID-19, MathWorks has made temporary at-home access to MATLAB available to Purdue. Active students and faculty at the University can download and install MATLAB (and the entire catalog of MATLAB Toolboxes) to their personally owned computers for remote learning until October 31, 2021. After this date, the temporary at-home license for MATLAB will expire, and Purdue students and faculty will no longer be able to use MATLAB under this offering. As the situation evolves, however, MathWorks may update the expiration date so that Purdue users can continue their learning with MATLAB remotely.

  Individuals should review the page, scroll down, and click on the Sign in to get started button. Most users will need to create a MathWorks account using their Purdue e-mail address by clicking on the Create Account link just under the sign-in boxes. If the individual already has a MathWorks account using their Purdue e-mail, they can sign in. If they have created an account using another e-mail, they will need to establish a new MathWorks account with the Purdue e-mail to take advantage of this offer.

- Purchasing Student Version
  You may wish to purchase a student version for $99 USD.
  Google **MATLAB and Simulink Student Suite**

- Purdue Software Remote System (Not recommended)
  You may use "Citrix" for remote access to Purdue's MATLAB license.
  Google **Purdue Software Remote System**

### Laboratory Rules and Regulations

- You are expected to clean your lab station when you are finished. This includes returning all cables to the proper places and shutting off the equipment. Failure to do so will result in an inlab penalty.
- The computers in the lab are to be used only for Purdue University course work. Any other usage, (including but not limited to downloading music or games, viewing websites not related to the course, etc.) is strictly prohibited.
- Do not bring disks or other media (floppy, zip, CD, flash drives, etc.) into lab. All data generated in lab can be transferred to your personal ECN directory via the network or email.
- No food or drinks are permitted on the lab benches.
- You are responsible for maintaining a record of all work submitted which includes lab notebook and copies of any attachments or plots.
- During normal circumstances, you will work with one lab partner. In the case that there is an odd number of students in a given section, you may be asked to work alone or in a group of three. Groups of three will, in general, not be permitted. While personal preferences may be taken into account, the instructor reserves the right to assign you to a partner, to ask you to work alone, or to switch partners.
- All questions or request for clarification should be emailed to your TA with cc to course instructor (reddy83@purdue.edu). Please use your Purdue email account or Brighspace (not gmail or other non-Purdue account). The TA will copy the question (without revealing your identity) and email the question and corresponding answer to the entire class (all sections) via the Purdue email list server for the course. This will reduce answering the same or similar question multiple times. **Be sure to include "ECE 323" in the subject line of any email (automatically done in Brightspace).**

### Attendance Policy during COVID-19

You should stay home and contact the Protect Purdue Health Center (496-INFO) if you feel ill, have any symptoms associated with COVID-19, or suspect you have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, you still needs to inform the course mentor, course instructor, or your TA of any conflict that can be anticipated and will affect the submission of an assignment. When conflicts can be anticipated, such as for many university-sponsored activities and religious observations, you should inform the course mentor, course instructor, or your TA of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, you should contact the course mentor, course instructor, or your TA by email as soon as possible. In cases of bereavement, quarantine, or isolation, you or your representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

## Classroom Guidance Regarding Protect Purdue

The **Protect Purdue Plan**, which includes the **Protect Purdue Pledge**, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask **in classrooms and campus building**, at all times (e.g., no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining proper social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the **Office of the Student Rights and Responsibilities**.

See also **Purdue University Bill of Student Rights**.

Related Considerations:

a. A listing of recommended safe practices for the specific class or laboratory setting (other PPE or safety behavior) can be found at the link below.

   **Overarching SOP for Classrooms, Instructional Laboratories, and Experiential Courses**

b. References Supporting Protect Purdue Compliance

   - Office of the Dean of Students Protect Purdue Compliance Plan: Ask, Offer, Leave, Report
   - Office of the Dean of Students Managing Classroom Behavior and Expectations

### Academic Guidance in the Event a Student is Quarantined/Isolated

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur

### Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.

### Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

### Mental Health Statement

**If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**. Sign in and find information and tools at your fingertips, available to you at any time.

**If you need support and information about options and resources**, please contact or see the **Office of the Dean of Students**. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm. If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a **Purdue Wellness Coach at RecWell**. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

**If you're struggling and need mental health services**: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

**TaskHuman** offers 1-on-1 live video calls with coaches who help you focus on wellness topics such as anxiety, mindfulness, reducing stress, clean eating, time management, in-home workouts, relationship tensions, and nearly a thousand more topics. You can log on at any time to access experiences as diverse as working through heightened anxiety to a personalized yoga session with carefully vetted providers. Purdue ECE has an exclusive agreement with TaskHuman which gives you unlimited access to these resources (and some Purdue-specific bonuses).
Using this link gets you access to all the perks: https://taskhuman.com/referral/purdue.
Learn more here: https://engineering.purdue.edu/ECE/TaskHuman.
If you have other questions, contact Brooke Parks, Lead Instructional Specialist in ECE, at brookeparks@purdue.edu.

### Emergency Preparation

- If you experience any symptoms of COVID-19 or suspect you may have been exposed to someone with COVID-19 stay home and call the Protect Purdue Health Center at 765-496-INFO.
- Keep your cell phone on to receive a Purdue ALERT text message.
- Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.
- When attending the lab in EE56, please review the building emergency plan posted outside of the lab.

### Disclaimer

In the event of a major campus emergency or disruption of normal activities, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond my control. Relevant changes to this course will be posted on Brightspace with a notice sent by email. You are expected to read your @purdue.edu email on a frequent basis.