



# ENGR318

## Electromechanical Energy Conversion

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**Walla Walla University—Seventh-day Adventist Higher Education**  
*Edward F. Cross School of Engineering—Winter 2022—Course Syllabus—4 credits*

**Lecture (Online):** M/W/TH 7 – 7:50 p.m.

**LAB Section A:** Lab Lecture Noon -12:50 p.m. and Lab Activities/Experiments 1:00-2:50 p.m.

**LAB Section B:** Lab Lecture Noon-12:50 p.m. and Lab Activities/Experiments 3:00-5:50 p.m.

**Lab Location:** KRH 118

### Instructor information

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**Instructor:** Heidi Schuette, M.S., P.E.

**Email:** [Heidi.Schuette@wallawalla.edu](mailto:Heidi.Schuette@wallawalla.edu)

**Phone:** (509) 366-1706

**Office:** CSP 260

**Office hours:** Fri 9-11 a.m. or by appointment

**Instructor:** Rob Frohne, Ph.D.

**Email:** [Rob.Frohne@wallawalla.edu](mailto:Rob.Frohne@wallawalla.edu)

**Phone:** (509) 527-2075

**Office:** CSP 261

**Office hours:** M-Fr 10-11 a.m.; M/W/Th/F 11 a.m. – 1 p.m.; W 2-4 p.m.; or contact via TEAMS

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### Course description

ENGR318 is the study of electromechanical energy conversion principles and their application to electrical machines. Topics include three-phase circuits, magnetic circuits, force and torque, transformers, AC and DC motors and generators, performance characteristics and applications.

### Required materials

- **Fitzgerald, Kingsley, and Umans. Electric Machinery.** Seventh edition. McGraw Hill.

## Student learning objectives

1. Understand the basic concepts of magnetic circuits.
2. Demonstrate the ability to explain the principles of operation of a transformer, an electromagnet, induction and synchronous motors and generators.
3. Demonstrate the ability to calculate voltage, current, force, torque, and speed, as applicable, from the parameters of the above devices.
4. Derive device parameters from experimental results.

## Core themes

**Table 1:** Summary of university core themes in this course

University core theme	Summary of how the core theme is actualized in this course
<i>Excellence in Thought</i>	This course teaches you a systematic approach in the understanding of electric devices.
<i>Generosity in Service</i>	The Engineer's Creed calls us to "dedicate [our] professional knowledge and skills to the advancement and betterment of human welfare."
<i>Beauty in Expression</i>	This course invites students to communicate your ideas with clarity and precision.
<i>Faith in God</i>	The study of EMEC provides insight in how God designed the natural laws of this world.

## Religious accommodations

State regulations require the university to reasonably accommodate student absences for reasons of faith or conscience, observance of religious holidays, or participation in an organized activity conducted by a religious denomination, church, or organization. The full [religious accommodation policy and request form](#) can be found on the WWU website.

## Title IX: Sex Discrimination and Sexual Misconduct Policy

WWU prohibits all forms of sex discrimination and sexual misconduct including, but not limited to, sex-based intimidation and harassment, sexual harassment, domestic violence, dating violence, stalking and sexual violence. If you have been subjected to, or are aware of, an instance of sex discrimination or sexual misconduct, you are highly encouraged to report it to the Title IX coordinator via email at [titleix@wallawalla.edu](mailto:titleix@wallawalla.edu), through the [Title IX website](#), or by calling (509) 527-2141. The university has resources to help.

## Academic Integrity

The [WWU academic integrity policy](#) states that “an integral part of the mission of Walla Walla University is to prepare its students to be responsible individuals with Christian values.” We assume that any work you submit in a class is your own work. This principle of academic honesty is important in any scholarly work. Using another person’s material without proper acknowledgment is a violation of academic integrity and cannot be tolerated in an academic institution. Unacknowledged use of another person’s answers may result in a failing grade for the assignment or for the course.

## Instructor responsibility

### Evaluation timeline

All materials submitted by a student will be evaluated in a timely manner (typically 2 weeks, but more quickly during summer sessions). Exams will be scored and accessible for viewing before the next exam. The score for each class requirement is available on the D2L Brightspace course site. Students should review graded materials and the gradebook in a prompt and regular manner. Identified disagreements and errors must be brought to the instructor’s attention within two weeks of the return of all course work.

### Returned materials.

All materials that have been graded must be viewable (even if temporarily) by the student for review. Indicate how a student can find the graded materials and if they need to be returned to the instructor. If the student can only view the materials temporarily, indicate so and state that they may not capture images of the material on any device.

## Course requirement weighting and grading scale

Course grades will be earned according to overall percentages. Pluses and minuses will be awarded according to where you fall within the grade range. The instructors reserve the right to issue a better grade than indicated by the % earned by the student.

<b>A</b>	90–100	<b>C</b>	70-79	<b>F</b>	59 and below
<b>B</b>	80–89	<b>D</b>	60-69		

**Homework (HW) —10%**

**Labs —20%**

**Exams —40%**

**Final Exam —30%**

**Homework**

Daily homework is due before the next class period. Late homework will be docked points.

**Viewing your grade**

Grades can be accessed at any time in the D2L Brightspace gradebook. Scores will be posted within two weeks of an assignment due date. Students are responsible for checking their scores on a regular basis.

**Progress reports**

Although a student should be able to determine their tentative course grade at any time, the institution has a special alert to notify students of poor academic performance. Students should also be told to check for progress reports via their WWU registration account.

## **Classroom policies and procedures**

**Attendance policy**

Attendance is an integral part of the learning experience. Attendance (or lack thereof) is typically reflected in one's performance and, as a result, in one's final grade. Please plan to attend all lectures. If you are required to be away from class please notify the instructor prior to the planned absence. Excused absences are documented absences such as doctor's notes and funeral notices. Students are responsible for all announcements and assignments given during class.

**Use of old course materials**

Use of course materials from prior sessions of this course may be helpful as reference material for learning the subject. However, old course material should never be copied or submitted by the students for their current course assignments.

**Grading disagreements and concerns**

Questions on specific scores must be submitted to the instructor in written format within two weeks of grading.

**Student conduct and professionalism**

The School of Engineering seeks to help you develop the habit of neat, accurate work through its Homework Format Standard. A copy of this document is posted on the course website. Please review the document carefully and remember to follow it. Homework that does not meet this standard will receive a reduced grade or be returned ungraded.

**Civility and professional conduct statement**

Civility is the art of treating others, as well as ourselves with respect, dignity, and care. Civility is apparent when we are sensitive to the impact that our communications, practices, and

behaviors have on others, and when we acknowledge each person's self-worth and unique contributions to the community as a whole. Interactions in and outside of class are expected to be professional and respectful. Interacting with other members of the university community offers each of us opportunities for personal reflection and self-correction to assure ongoing professional growth.

### **Emergency procedures**

WWU is dedicated to providing a safe campus environment. [Emergency preparedness resources](#) are available online to help you prepare to respond to an event of dangerous weather, fire, active shooters, injuries, etc. You will also find a link to [sign up for our emergency campus notification system](#). An emergency procedure flip chart and evacuation routes are posted in classrooms near the door.

## **Technical requirements**

### **D2L Brightspace**

The Desire2Learn (D2L) Brightspace course management software system provides course information and can be accessed at [class.wallawalla.edu](http://class.wallawalla.edu). The general hardware specifications necessary for an optimal experience using D2L Brightspace can be found on the [WWU distance education website](#).

- **Get started:** [Login to Brightspace](#) with your WWU username and password.
- **Get Help:** For technical assistance, please contact the Information Technology Help Desk at (509) 527-2317. For assistance with Brightspace issues, email both [Dave.Reeves@wallawalla.edu](mailto:Dave.Reeves@wallawalla.edu) and [Sylvia.Nosworthy@wallawalla.edu](mailto:Sylvia.Nosworthy@wallawalla.edu).

### **Supplemental software**

As a WWU student, you have access to [download Microsoft 365 products for free](#) with your WWU username and password. This includes Microsoft Word and PowerPoint which you will use frequently in online courses.

You will also often be required to view PDF files. You can [download Adobe Acrobat Reader for free](#).

## **Support services**

### **Disability support services**

If you have a physical or learning disability and need accommodations, please contact Disability Support Services in the Student Development Center, Village Hall, or call (509) 527-2366. Accommodations for documented disabilities are arranged through the Disability Support Services (DSS) office. This syllabus and course materials are available in alternate format as appropriate to the disability. Accommodations are not retroactive. If you do not declare the

disability to the DSS office, you may not receive appropriate accommodations. Disability support policies are available at [wallawalla.edu/disability-support](http://wallawalla.edu/disability-support).

### **Library resources**

Library resources and services are available at [wallawalla.edu/library](http://wallawalla.edu/library). You can reach a reference librarian for research assistance by email at [reference@wallawalla.edu](mailto:reference@wallawalla.edu) or by calling (509) 527-2134.

### **Information technology services – computer support**

For help with accessing Brightspace, your student account, email, or other technical support, contact the Information Technology help desk by calling (509) 527-2317 or emailing [support@wallawalla.edu](mailto:support@wallawalla.edu). **Hours:** Monday–Thursday: 8 a.m.–6 p.m. / Friday: 8 a.m.–4 p.m.

## Course Schedule

*The schedule is subject to change at the professional judgement of the instructor(s).*

**Table 2: Planned Course Schedule**

Lecture Day/Date	Lecture Topic	Reading	Assigned	Due
M, Jan 3	Magnetics	1.1-1.2	HW 1	
T, Jan 4	LAB 1 – General Instruction & Safety Certification		LAB 1	
W, Jan 5	Magnetic Materials	1.3-1.4	HW 2	HW 1
Th, Jan 6	Permanent Magnets	1.5-1.7	HW 3	HW 2
M, Jan 10	Ideal Transformers	2.1-2.3	HW 4	HW 3
T, Jan 11	LAB 2 – Electricity and Magnetism	CH 1	LAB 2	
W, Jan 12	Equivalent Circuits	2.4-2.6	HW 5	HW 4
Th, Jan 13	Three Phase Transformers	2.7-2.8	HW 6	HW 5
M, Jan 17	Three Phase Circuits Power Factor	Appendix A	HW 7	HW 6
T, Jan 18	LAB 3 – Modeling a Small Power Transformer	CH 2	LAB 3	LAB 2
W, Jan 19	Three Phase Circuits & Review for Exam 1	CH 1 & 2	HW 8	HW 7
Th, Jan 20	Exam 1 – Chapters 1 & 2			
M, Jan 24	Force, Torque, Energy	3.1-3.2	HW 9	HW 8
T, Jan 25	LAB 4 – Three-Phase Transformers	CH 2	LAB 4	LAB 3
W, Jan 26	Excitation and Permanent Magnets	3.3-3.4	HW 10	HW 9
Th, Jan 27	AC Machines Introduction	4.1-4.2	HW 11	HW 10
M, Jan 31	Distributed Windings	4.3	HW 12	HW 11
T, Feb 1	LAB 5 – Brushless DC (BLDC) Motors	CH 4.4-4.5	LAB 5	LAB 4
W, Feb 2	Torque	4.6-4.7	HW 13	HW 12
Th, Feb 3	Synchronous Machines	5.1-5.2	HW 14	HW 13
M, Feb 7	Open and Short Circuit Models	5.3	HW 15	HW 14
T, Feb 8	LAB 6 – Three-Phase Machines	CH 5	LAB 6	LAB 5
W, Feb 9	Steady-State Power Angle	5.4	HW 16	HW 15
Th, Feb 10	Steady-State Operating Characteristics	5.5	HW 17	HW 16
M, Feb 14	Induction Machine Circuit Models, VFDs	6.1-6.3	HW 18	HW 17
T, Feb 15	LAB 7 – GE Synchronous Machine	CH 6	LAB 7	LAB 6
W, Feb 16	Review for Exam 2	CH 3 – 5	HW 19	HW 18
Th, Feb 17	<b>Exam 2 – Chapters 3, 4, and 5</b>			

Lecture Day/Date	Lecture Topic	Reading	Assigned	Due
M, Feb 21	<b>Mid-Winter Break – No Classes</b>			
T, Feb 22	LAB 8 – Induction Machine Model	CH 6	LAB 8	LAB 7
W, Feb 23	Equivalent Circuit Analysis	6.4	HW 20	HW 19
Th, Feb 24	Equivalent Circuits, Torque, Power	6.5	HW 21	HW 20
M, Feb 28	Equivalent Circuits, Model Parameters	6.6-6.7	HW 22	HW 21
T, Mar 1	LAB 9 – Synchronous Machines Again	CH 6	LAB 9	LAB 8
W, Mar 2	More on DC Machines	7.7	HW 23	HW 22
Th, Mar 3	VR Machines and Stepping Machines	8.1	HW 24	HW 23
M, Mar 7	Torque Waveforms	8.3	HW 25	HW 24
T, Mar 8	LAB 10 – Single Phase Motors	CH 7.1-3	LAB 10	LAB 9 LAB 10
W, Mar 9	Stepping Motors, Single Phase Motors	8.5, 9.1-9.3	HW 26	HW 25
Th, Mar 10	Review for Final Exam			HW 26
T, Mar 15	<b>FINAL EXAM, 2-3:50 pm, CSP 165</b>			
Mar 17-27	<b>SPRING BREAK!!!</b>			

***Final Exam Schedule:***

*Tuesday, March 15, 2:00 p.m. to 3:50 p.m. (Location: CSP 165)*