
ELECTRIC POWER AND CONTROLS

BE 462 (SPRING 2017)

Instructor: <u>Dev</u> Shrestha	Office: JML 81B Phone: 208 885 7545 E-mail: devs@uidaho.edu
Meeting:	Lecture: (MW) JML 42, 8:30-9:20 AM Lab: (T) JML 76, 12:30 – 3:20 PM
Requirement	Prereq: Engr 240, Coreq: Math 310
Office hours:	TR; 10:00-11:00 AM (Walk-ins welcome)
Classes and Credits:	2 one-hour lectures: 1 three-hour lab: 3 credits

COURSE OBJECTIVES

The objective of this course is to give students an understanding of electric power and control systems applied to biological (and agricultural) engineering. The course covers electrical system design and safety following the National Electrical Code. The electrical system includes wiring, lighting, electric motors (DC, induction, stepper, and servo), motor controls systems, and programmable logic controllers. This course will give students a solid foundation and exposure to control system in their option areas.

EXPECTED COURSE OUTCOME

1. Be able to design and install electrical system following the National Electrical Code.
2. Understand electric motors, the theory of operation, limitations, selection, and controls.
3. Be able to design and program Programmable Logic Controllers (PLCs).
4. Understand feedback controls and be able to select and optimize a controller.
5. Be able to design and implement an automated control system in student's chosen option area.

TEXT AND SUPPLIES

No designated textbook. Handouts will be provided as course content.
2014 National Electric Code (NEC) - National Fire Protection Association
Fundamentals of Electricity for Agriculture, by Gustafson and Morgan, 3rd Ed.
Electronic copy is available to download through UI subscription at:
<http://elibrary.asabe.org/textbook.asp?confid=fea2004>

TENTATIVE CLASS SCHEDULE

Active and regular participation is necessary. Students are expected to read handouts ahead of class and to bring your questions to discuss in the class.

Date	Discussion Topic
Jan-11	Fundamentals of Electric Power
Jan-16	UI holiday; MLK day
Jan-18	Fundamentals of Electric Power
Jan-23	Phasor representation of a sinusoid
Jan-25	Phasor representation of a sinusoid
Jan-30	Three phase power
Feb-1	Three phase power
Feb-6	Residential and industrial power supply system
Feb-8	Planning an electrical System using NEC
Feb-13	Planning an electrical System using NEC, Midterm Review
Feb-15	Midterm Exam, Closed book, One-page note is allowed
Feb-20	UI holiday; President's day
Feb-22	Fundamentals of DC motor
Feb-27	Fundamentals of Induction motor
Mar-1	Understanding slip, torque, efficiency, and motor types
Mar-6	Motor performance analysis
Mar-8	Motor performance analysis
Mar-13	Spring Break
Mar-15	Spring Break
Mar-20	Electric motor controls and VFD
Mar-22	Motor characteristics and selection
Mar-27	Motor characteristics and selection
Mar-29	Designing a motor branch circuit, Midterm review
Apr-3	Midterm Exam, Closed book, One-page note is allowed
Apr-5	PLC programming and controls
Apr-10	PLC programming and controls
Apr-12	PLC programming and controls
Apr-17	System modeling for controls
Apr-19	System modeling for controls
Apr-24	Controller design and tuning
Apr-26	Controller design and tuning
May-1	Controller design and tuning
May-3	Controls case studies, Final Exam Review

LAB SCHEDULE

The laboratory reports are due the following week the lab is completed at the latest. Only one lab report per group is adequate. The lab reports should follow the Transactions of the ASABE journal article writing style. Other details will be discussed in the class.

Date	Lab work
Jan-17	Review
Jan-24	Introduction to electrical tools, uses and safety
Jan-31	Understanding, measuring and correcting for Power Factor
Feb-7	NEC and electric Planning
Feb-14	NEC and electric Planning
Feb-21	NEC and electric Planning
Feb-28	Electric motors
Mar-7	Electric motors performance test
Mar-14	Spring Break
Mar-21	VFD for motor controls
Mar-28	Motor control circuits
Apr-4	SCADA system industry tour
Apr-11	PLC programming with ladder logic
Apr-18	System modeling and controller design with Simulink®
Apr-25	PID control with a VFD
May-2	PID control with a VFD

GRADING:

Class Attendance, participation	10%
Laboratory Reports	20%
Homework	20%
Hour Exams (2 × 15%)	30%
Final Exam	20%

Student attendance is expected in all classes. Do not copy from anyone or let anyone copy your work, both will lose credit if found duplicate work. Turn off your phone, and refrain from using screen during class time. Late homework submission is not allowed unless granted prior permission. Expected outside of class work: 4 hours/week.

Final Exam: 7:30 am – 9:30 am, Wednesday, May 10, 2017

Disability Support Services Reasonable Accommodations Statement:

Reasonable accommodations are available for students who have documented temporary or permanent disabilities. Please notify your instructor(s) during the first week of class regarding accommodation(s) needed for the course. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 306.