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Fall 2024 Office Hours:
Monday 3-5:00pm
Wednesday 3-5:00pm (Remote)
Friday 1-2pm

Course Meeting Location/Times:
Rm 120/121
Tuesday/Thursday 6-8:05pm

Millersville University
Department of Applied Engineering, Safety, & Technology

AENG 261 ELECTRONIC SYSTEMS
3 s.h.

CATALOG DESCRIPTION

A survey of electricity and electronics, including typical direct current and alternating current applications, safe practices, and technological impacts. Practical applications include breadboarding, design and problem solving, use of test equipment, and electronic project assembly/troubleshooting. 2 hours lecture, 3 hours lab. No prerequisites. Offered fall, spring.

COURSE OBJECTIVES *Upon successful course completion, students will be able to:*	***ASSESSMENTS*** *Students' achievement of course objectives will be assessed based on the following*:* LA	EX	***PROGRAM OUTCOMES*** *Program learning competencies for the AET(M), ARET, & MFET programs:*
1. **Measure and calculate** basic electrical quantities.	x	x	A. Disciplinary Knowledge An ability to **select and apply** the **knowledge**, **techniques**, **skills**, and modern tools of the discipline to broadly defined **applied engineering** activities.
2. **Discriminate** between safe and unsafe electrical environments.	x	x	
3. **Demonstrate** satisfactory and safe use of various electrical power supplies, an electrical bread boarding system, and electrical measurement equipment to build, test, and evaluate direct current and alternating current circuits.	x	x	
4. **Explain** fundamental electrical concepts including current, voltage, resistance, and power.	x	x	
5. **Build and evaluate** series, parallel, and series-parallel circuits.	x	x	
6. **Solve** circuit design problems using circuit simulation software and actual electrical circuit components.	x	x	

7. **Identify, describe, and safely use** electrical components including switches, resistors, capacitors, inductors, and transformers.	x	x	
8. **Describe** the impact of various electrical/electronic systems on society.	x	x	

** LA = Lab Experiment; EX = Exam*

COURSE OUTLINE

I. Introduction to Electricity and Electronics
   A. Brief history
   B. Generations of electronics
   C. Electricity and electronics compared
   D. Molecular structure of matter
      1. Breakdown of matter
      2. Conductor vs. insulator concept
   E. Basic electrical terms defined
   F. An electrical system - input, process, output
   G. Electrical safety
      1. Precautions for working on a "live" circuit
      2. Precautions with specific devices
         a. Capacitor charge
         b. Transformers
         c. Soldering tools
         d. Etc.
      3. Heating effects of devices
      4. General precautions
         a. ANSI-approved eye protection
         b. Fire
         c. Following lab procedures
         d. Etc.
   H. Impacts of electricity and electronics

II. Voltage
   A. Definition and synonymous terms
   B. Producing a voltage - input, process, output
      1. Chemical to electrical
      2. Friction to electrical
      3. Heat to electrical
      4. Light to electrical
      5. Magnetism to electrical
      6. Mechanical pressure to electrical
   C. Symbols
   D. Measurement
   E. Units of measure

III. Current
   A. Definition
   B. Electron theory of motion in a conductor
   C. Factors influencing electron motion
   D. Symbols
   E. Measurement

F. Units of measure

IV. Resistance
A. Definition
B. Factors influencing resistance
C. Symbols
D. Measurement
E. Units of measure
F. Commercial resistors
1. Types and characteristics
a. Fixed
b. Variable (potentiometers & rheostats)
2. Color coding

V. Power
A. Useful vs. wasted power
B. Power usage (the kWh)
C. Units of measure
D. Applications and calculations with Watt's Law
E. Measurement
F. AC power generation and distribution
G. Impacts

VI. Circuit Laws
A. Ohm's Law
1. Basic principles
2. Applications and calculations
B. Watt's Law
1. Basic principles
2. Applications and calculations
C. Kirchoff's Laws
1. Basic principles
2. Applications and calculations

VII. Circuit Components
A. Batteries and cells
1. Types
2. Ratings
B. Lamps
1. Types
2. Ratings
C. Switches
1. Types
2. Ratings
3. Circuit applications
D. Wires and cables
E. Protection
1. Fuses
2. Circuit breakers

VIII. Types of Circuits
A. Current flow
1. Direct current (DC) circuits
2. Alternating current (AC) circuits
a. Waveforms
b. Quantification (cycle, period, frequency
B. Series circuits
1. Laws and principles

2. Problem solving
3. Applications and impacts

C. Parallel circuits
1. Laws and principles
2. Problem solving
3. Applications and impacts

D. Series-parallel (combination) circuits
1. Laws and principles
2. Problem solving
3. Applications and impacts

IX. Magnetism
A. Origin and principles of magnetism
B. Magnetic substances
C. Magnetic terms and units
D. Uses of magnetism
E. Magnetic shielding
F. Principles of electromagnetism
G. Electromagnetic devices - applications and impacts
1. Generators
a. Theory of operation
b. Types and basic parts
c. Waveshapes produced
d. Generator losses
2. Motors
3. Solenoids
4. Relays

X. Capacitance
A. The property defined
B. Factors determining capacitance
C. Charging and discharging a capacitor
D. Capacitor parts and types
E. Value systems and conversions
F. Effects in AC and DC
1. The RC time constant
2. Capacitive reactance
3. Impedance
4. Phase shift

XI. Inductance
A. The property defined
B. Factors determining inductance
C. Coil types
D. Value systems and conversions
E. Effects in AC and DC
1. The RL time constant
2. Inductive reactance
3. Impedance
4. Phase shift

XII. Transformers
A. Fundamental characteristics
B. Turns ratio
C. Efficiency and losses in the system
D. Types
E. Providing isolation
F. Ratings

G. Series and parallel windings
H. Problem solving and analysis

XIII. Electrical Metering Systems
A. Types and characteristics of meter movements
B. Expanding the range and function of a meter movement
1. Voltmeters
2. Ammeters
3. Ohmmeters
4. Other functions
C. Meter specifications and uses
D. Electrical vs. electronic meters

XIV. Electrical Processes and Products
A. Component identification
B. Soldering
C. Circuit design and layout
D. Point-to-point wiring processes
E. Printed circuit processes
F. Project assembly
G. Project labeling techniques
H. Testing, troubleshooting and evaluation

XV. Programming / Robotic Control
A. History of the PC and Robotics
B. Microcontrollers
C. High-Level Language
1. Variables
2. Functions
3. If Statements and Loops
4. Libraries
5. Comments
6. PWM for Servo Motor Control
7. Sensors
D. Flowcharting
E. Real-time I/O

MATERIALS
Required Safety glasses.
Recommended Text: Fowler, Richard (2022). Electricity: Principles and Applications (9th ed.). McGraw-Hill.
Recommended Test leads.

GENERAL COURSE REQUIREMENTS
Students are expected to participate in or complete the following activities:

1. Obtain the specified course materials.
2. Participate in class discussions.
3. Complete and submit all required experiments/assignments on time.
4. Satisfactorily complete all tests, including the manipulative exams.
5. Participate in all assigned clean-up activities at the end of each class session.
6. Prepare for class by doing the required readings prior to lecture and arriving prepared to do the laboratory assignments for the day.
7. Follow all safety procedures in the Electronics Laboratory. This includes wearing ANSI-approved eye protection at all times.

8. Attend all lecture and laboratory sessions in their entirety. The instructor will maintain an attendance record during both lecture and laboratory segments. The attendance policy adopted by the Industry and Technology Department will be in effect; students who exceed two unauthorized absences during the semester may be removed from the course, and a grade of "F" will be assigned. A copy of the departmental policy concerning attendance is available from the Department of Industry and Technology office in Osburn Hall. Attendance will be a factor in "letters of recommendation" requested by the student from the course instructor.

EVALUATION
Course activities will be divided into the following categories:

Lab Experiments (10 @ 4%ea)	40.0%
Written Exams (2 @ 20%ea)	40.0%
Manipulative Exams (2 @ 10%ea)	20.0%
	100.0%

Scale:

93 - 100	A	80 – 82.9	B-	67 – 69.9	D+
90 – 92.9	A-	77 – 79.9	C+	63 – 66.9	D
87 – 89.9	B+	73 – 76.9	C	60 – 62.9	D-
83 – 86.9	B	70 – 72.9	C-	below 60	F

Grades will not be based upon criteria such as need, appearance, race, age, sex, or social status. Once determined, grades will not be changed except in the case of clerical errors that cause the student's true level of ability to be underestimated. Course grades may only be determined by the instructor of record.

NOTES
The instructor reserves the right to alter this syllabus as required.

Late work (less than 1 week) will be subject to a 25% reduction in the student's earned grade. All work submitted more than 1 week late will not be accepted and will result in a zero for the assignment.

STUDENTS WITH SPECIAL NEEDS
The instructor will provide reasonable accommodations to any student with special needs. The student is encouraged to inform the instructor of any condition that requires such accommodations. Also, it is the student's responsibility to contact the Office of Learning Services, Room 348, Lyle Hall (Phone 872-3178) to request an official approval for providing any special accommodations and present a copy of this official document to the instructor.

OTHER MILLERSVILLE UNIVERSITY POLICIES AND LINKS
Academic Honesty Policy link:
https://www.millersville.edu/about/administration/policies/pdf/academics/academic-policyacademic-honesty-and-dishonesty.pdf ; for additional information please see the following:
https://www.millersville.edu/cae/teaching-and-learning/academic-integrity.php

Attendance Policy link: https://www.millersville.edu/registrar/faculty/attendance-policy.php

Inclusion Statement: https://www.millersville.edu/dsj/inclusionstatement/

Land Acknowledgement: https://www.millersville.edu/dsj/land-acknowledgement/index.php

Policy on Delays and Cancellations link: https://www.millersville.edu/delays.php

Preferred Name FAQs link: https://www.millersville.edu/dsj/inclusionstatement/preferredname-faqs.php

Privacy Rights under FERPA link: https://www.millersville.edu/registrar/ferpaforstudents.php

Student Conduct and Community Standards Handbook link:
https://www.millersville.edu/studentconduct/files/studentcodeofconduct.pdf

Title IX Reporting Requirements and the Faculty member: Millersville University is committed to maintaining a safe education environment for all students. In compliance with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (under 18 years of age) when the abuse allegedly occurred to the person. Information about Title IX, resources and reporting can be found at:
https://www.millersville.edu/titleix/index.php

ATTENDANCE POLICY

MILLERSVILLE UNIVERSITY ATTENDANCE POLICY
EFFECTIVE SPRING 2003
Approved by Faculty Senate 12/4/02; Administrative approval 1/10/03

The University supports departmental and faculty class attendance policies that are reflective of and consistent with University approved guidelines. Faculty will include their class attendance policy in their syllabi given to all students in their classes at the start of the semester.

University approved guidelines:

1. **Students are expected to attend all classes.** It is the student's responsibility to complete all course requirements even if a class is missed. If a student misses class for an officially excused reason, then he/she is entitled to make up the missed work but only at the convenience of the faculty member. Responsibility for materials presented in, assignments made for, and tests/quizzes given in regularly scheduled classes lies solely with the student.

2. **The University policy is that faculty will excuse absences for the following reasons:**
   a. personal illness,
   b. death or critical illness in the family,
   c. participation in a university-sponsored activity,
   d. jury duty,
   e. military duties, or
   f. religious holidays
3. **Faculty judge the validity of student absences from class within the University's approved guidelines and may require documentation for excused absences.** Faculty will evaluate any reason, other than those listed above, for a student missing class and determine whether the absence is justified. In these circumstances, a student may make up missed work at the discretion of the instructor.
4. **In the case of foreseeable absences, students are encouraged to notify the faculty member in advance.** A student who will miss class due to participation in an official University activity must notify the instructor well in advance of the activity to assure that the absence is excused.

Appeals:
As with any academic issue, students may exercise their right to appeal adverse attendance decisions. Please refer to the current undergraduate catalog for the complete Academic Appeal procedure.

DEPARTMENT OF APPLIED ENGINEERING, SAFETY & TECHNOLOGY ATTENDANCE POLICY

Adopted May 4, 1998

Students are expected to attend all scheduled classes in accordance with the above policy. To the extent that this does not happen, the following shall apply:

1. The limit of unauthorized absences depends upon the number of scheduled days per week as follows:

   Fall and spring semesters
   - three per semester for a course scheduled three days per week
   - two per semester for a course scheduled one or two days per week

   Winter and summer sessions
   - two per session

2. Each late arrival and early departure will count as one-half of an unauthorized absence.

3. Participation in outside-of-the-classroom educational activities and intercollegiate contests shall be communicated to the instructor prior to the absence. Failure to do so will convert these authorized absences to "unauthorized absences."

4. Students whose "unauthorized" absences exceed the policy stated in item #1 are liable to dismissal from the course with a grade of 'F' or 'Z.'

BIBLIOGRAPHY

The instructor can direct you to specific references in your area of interest.

Bayne, C. A. (2000). *Applied electricity and electronics*. Tinley Park, IL: Goodheart-Willcox.

Boctor, S. A., Ryff, P. R., Hiscocks, P., Ghorab, M. T., & Holmes, M. R. (1997). *Electrical concepts and applications*. Albany, NY: Delmar Learning.

Boylestad, R., & Nashelsky, L. (2002). *Introduction to electricity, electronics, and electromagnetics* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Floyd, T. L. (2004). *Electronics fundamentals: Circuits, devices, and applications* (6th ed.). Upper Saddle River, NJ: Prentice Hall.

Frenzel, L. P. (1995). *DC/AC circuits, principles and practice*. Albany, NY: Delmar Learning.

Gates, E. (2001). *Introduction to electronics* (4th ed.). Albany, NY: Delmar Learning.

Gerrish, H. H., Dugger, W. E., Jr., & DeLucca, K. P. (2004). *Electricity*. Tinley Park, IL: Goodheart-Willcox.

Gibilisco, S. (2005). *Electronics demystified: A self-teaching guide*. New York: McGraw-Hill.

Grob, B., & Schultz, M. E. (2003). *Basic electronics*. (9th ed.). New York: Glencoe McGraw-Hill.

Matt, S. R. (1998). *Electricity and basic electronics*. Tinley Park, IL: Goodheart-Willcox.

Meade, R. L. (2003). *Foundations of electronics* (4th ed.). Albany, NY: Delmar Learning.

Patrick, D. R., & Fardo, S. W. (2002). *Electricity and electronics: A survey* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Petruzella, F. D. (2001). *Essentials of electronics* (2nd ed.). New York: Glencoe McGraw-Hill.

Petruzella, F. D. (2006). *Electricity for the trades*. New York: McGraw-Hill.

Robbins, A. H., & Miller, W. C. (2004). *Circuit analysis with devices: Theory & practice*. Albany, NY: Delmar Learning.

Roberts, R. R., Gerrish, H. H., & Dugger, W. E., Jr. (2004). *Electricity & electronics*. Tinley Park, IL: Goodheart-Willcox.

Scherz, P. (2000). *Practical electronics for inventors*. New York: McGraw-Hill.

Terrell, D. (2000). *Fundamentals of electronics: DC/AC circuits*. Albany, NY: Delmar Learning.