

**Department of Technology**  
**Fall 2004**

**EET 352**  
**ELECTRICAL POWER TECHNOLOGY**

**Instructor:**

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**Office:**

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**Class schedule:**

**Section 001, CRN 11463; TR: 6 pm – 7.55 pm, Room 407/400**

**Office Hours:**

**MW: 8.30 am – 10 am, MTWR: 4.30 pm – 6 pm.** If my office door is open at other times I will most likely be available for discussion. Come right in.

**Credit hours:**

3

**Prerequisite:**

Grade of at least a “C” in MAT 090 or equivalent

**COURSE DESCRIPTION:**

Modern electrical power systems: The production, distribution, measurement and control of electrical power systems; single phase and three-phase systems, transformers, electrical machinery and lighting systems.

**TEXTBOOK (recommended):**

- 1. Electrical Power Systems Technology**, Stephen Fardo & Dale Patrick, 2<sup>nd</sup> Edition; Newnes publishers; ISBN: 0-7506-9722-9,
- 2. Electricity and electronics: A Survey**, Dale Patrick & Stephen Fardo, 5<sup>th</sup> Edition, Prentice Hall publishers; ISBN: 0-13-019564-2

## **COURSE OBJECTIVES:**

Upon completing EET 352 the student should be able to:

- A. Understand the principle of electromagnetic induction and its use in operation of DC, single-phase AC and three-phase AC machinery.
- B. Analyze the functional aspects of the following three-phase transformer/distribution systems: Delta-delta, delta-wye, open delta, wye-wye, and wye-delta.
- C. Describe the basic operation of the following power production systems: Fossil fuel systems, nuclear systems, hydroelectric systems.
- D. Construct, test and troubleshoot common industrial and commercial control circuits utilized with electrical machinery.
- E. Explain the meanings of the following variables in electrical power applications: Watts, volt-amperes, phase angle, real power, apparent power and power factor.
- F. Perform electrical wiring design calculations which involve the following: Conductors, grounding, branch circuits, feeders, illumination, and electric heating.
- G. Understand the National Electric Code as a planning standard for residential, commercial, or industrial wiring.

## **COURSE OUTLINE:**

- A. Electrical power production systems
  1. Power system fundamentals
  2. Generation of electrical power using fossil fuel systems, steam turbines, hydroelectric systems, nuclear reactors, solar energy, wind energy, etc.
  3. Principle of electromagnetic induction
  4. Alternating Current (AC) Power Systems
    - a. Single-Phase AC Power Systems converting mechanical to electrical energy
    - b. Three-Phase AC Power Systems
    - c. Frequency of Generators
  5. Direct Current (DC) Power Systems
    - a. DC conversion systems converting mechanical to electrical energy
    - b. Single-Phase Rectification Systems
- B. Electrical power distribution systems
  1. Electrical Power Distribution Fundamentals
    - a. Overview of Electrical Power Distribution
    - b. Power Transmission and Distribution
    - c. High Voltage Direct Current (HVDC) Transmission
    - d. Use of Transformers for Power Distribution Systems
    - e. Use of Conductors and insulators for Power Distribution Systems

2. Power Distribution Equipment
    - a. Equipment Used at Substations
    - b. Power System Protective Equipment
    - c. Power Distribution Inside Industrial and Commercial Buildings
  3. Single-Phase and Three-Phase Power Distribution Systems
    - a. Transformer turns ratio
    - b. Types of three phase transformers
  4. Grounding of Distribution Systems
    - a. System Grounding
    - b. Equipment Grounding
    - c. Ground Fault Protection
  5. Distribution System Wiring Design Considerations
  6. The National Electric Code (NEC)
- C. Electrical power conversion systems
1. Characteristics of electrical loads and power factor correction
  2. Balanced and unbalanced loads
  3. Electrical heating and lighting loads
  4. Mechanical Power Conversion Systems
    - a. Basic Motor Principles
    - b. Direct Current Motors
    - c. Single-Phase Alternating Current Motors
    - d. Three-Phase AC Motors
    - e. Specialized Mechanical Power Systems such as synchro and servo systems
- D. Electrical power control systems
1. Definition of power control
  2. Electric Motor Power Control Equipment
    - a. Motor Starting
    - b. Motor Contactors
    - c. Manual Starters
    - d. Motor Overload Protection
    - e. Combination Starters
- E. Electrical power measurement systems
1. Measuring Electrical Energy
  2. Measuring Three-Phase Electrical Energy
  3. Measuring Power Factors, frequency, phase

**COURSE REQUIREMENTS:**

Student are expected to:

Attend each lecture and laboratory session.

Complete all assignments and laboratory activities on time.

Take all assessments.

## EVALUATION:

Each student will be evaluated as follows:

Assessments (40%),

Homework (10%),

Lab assignments (40%),

3 two-page write-ups on electrical power systems related topics (10%)

1<sup>st</sup> assessment – (in-class) covering power production systems; and labs

2<sup>nd</sup> assessment – (take-home) covering power distribution systems, part of conversion systems; and labs

Final Assessment – (in-class, **Comprehensive**; and labs)

Assessment average = 
$$\frac{\text{Equally weighted (1}^{\text{st}} + 2^{\text{nd}} + \text{Final) Assessments}}{3}$$

The take-home assessment must be turned in on time to be graded. Late submissions will be awarded only partial credit.

You may rework and resubmit your labs, homework and assessments for limited partial credit.

*Homework:* There will be around 10 homework assignments covering material from the text and topics discussed in class.

*Lab Assignments:* There will be approximately 15-20 labs as time permits, each weighed equally. As needed, midway in the semester there may be a lab skills assessment which will count as 2 lab sessions.

*Electrical power technology topics write-ups:* 3 articles related to electrical power technology topics are required, each of length at least 2 pages. One of the papers must cover electrical safety.

Topics for the paper include but are not limited to: practical applications of power technology, current advancements in this field of generating environment friendly power, energy smart devices, power grids & blackouts, principles of electromagnetic energy conversion, high speed, power, precision motors, etc. A complete bibliography of the sources referred to while preparing the articles is to be provided, including any material summarized from any internet web sites.

## Attendance Policy:

After the second unexcused absence, each unexcused absence will cause one percent deduction from the “Attendance and Professional Evaluations” average.

Eight (8), and nine (9) unexcused absence, will result in one letter grade lower.

Your grade will be an automatic F if you have more than ten (10) unexcused absences. Makeup labs/exams will be permitted only if you had sought and received my approval prior to the absence which caused you to miss the related lab/exam. You will benefit most by way of understanding the content of the course by completing all the assignments in a timely manner. If you know in advance that you will be absent, please send me a dated note or email.

At least one **field-trip** is tentatively planned to a local power distribution facility.

**Grades:**

100%-90% = A

89.9%-80% = B

79.9%-70% = C

69.9%-60% = D

59.9%-0% = F

Mid-term grades would be available for the students who wish to know their grades from the class for the first half of the semester.

**STATEMENT OF DISABILITY:****ADA**

If you are registered with the Office of Services for Individuals with Disabilities, please make an appointment with the course instructor to discuss any academic accommodations you need. If you need academic accommodations and are not registered with the Office of Services for Individuals with Disabilities, please contact the office on the third floor of the Student Services Building, by email at [disabilities@eku.edu](mailto:disabilities@eku.edu) or by telephone at (859) 622-2933 V/TDD. Upon individual request, this syllabus can be made available in alternative forms.

☺ The work you do in the laboratory, and the grade you earn, should reflect your personal abilities, and accomplishments. Individual homework and lab reports are required from each student. I encourage you to discuss your assignments with other students. However any work you submit must be your own.

☺ Any suggestions leading to improvements in the content or presentation of the course, especially in the laboratory work, are most welcome.