COURSE OUTLINE

ELEC 171 – ELECTRICAL CONSTRUCTION & MAINTENANCE 1
(Certificate Program)

Prepared By: Michael Spearance
A. **TITLE:** Electrical Construction and Maintenance 1

B. **COURSE NUMBER:** ELEC171

C. **CREDIT HOURS:** 7

D. **WRITING INTENSIVE COURSE:** NO

E. **COURSE LENGTH:** (15 weeks)

F. **SEMESTER(S) OFFERED:** Fall Semester

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   3 – 1 Hour Lectures, 4- 2 Hour Labs per Week

H. **CATALOG DESCRIPTION:** Instruction includes fundamentals of residential applications for AC circuits, use of electrical test instruments and National Electric Code. Laboratory projects include wiring installations plus projects related to the theoretical concepts listed below. Certificate/ AAS Elective Credit

I. **PRE-REQUISITES/CO-REQUISITES:** None

J. **GOALS (STUDENT LEARNING OUTCOMES):**
   By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tbody>
<tr>
<td>a. Identify electrical components (switches, receptacles, lighting fixtures, and etc.)</td>
<td>3. Professional Competence</td>
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<tr>
<td>b. Calculate and measure watts, amperage, voltage for series- parallel circuits</td>
<td>2. Crit. Thinking</td>
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<td>c. Determine the wire gauge and wire type to be used in a specific application</td>
<td>2. Crit. Thinking</td>
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<td>d. Understand the theory of electrical ac generation</td>
<td>2. Crit. Thinking</td>
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<td>e. Demonstrate their ability to work in a group setting</td>
<td>3. Professional Competence</td>
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L. **REFERENCES:** National Electric Code Book 2011

M. **EQUIPMENT:** Lab Computers, Benders, Meters and specialty equipment

N. **GRADING METHOD:** A-F

O. **MEASUREMENT CRITERIA/METHODS:**
   - Exams
   - Quizzes
   - Papers
P. DETAILED COURSE OUTLINE: (must use the outline format listed below)

I. ELECTRICAL COMPONENTS & SYMBOLS
   A. Residential Electrical
      1) switches
      2) receptacles
      3) lighting

II. ELECTRICAL THEORY & OHMS LAW
   A. Nature of Electricity
      1) displacement of electrons
      2) current: unit of measurement
      3) EMF: electrical pressure, voltage
      4) resistance
         a) opposition to current flow
         b) unit of measurement
         c) instrument- ohmmeter

III. ELECTRICAL CIRCUITS
   A. Series Circuit
      1) definition
      2) voltage drop
      3) current flow
      4) total resistance
   B. Parallel Circuit
      1) definition
      2) electrical characteristics
         a) voltage
         b) current
      3) resistance
         a) equal resistors
         b) two resistors
         c) unequal resistors
   C. Series-Parallel circuits
      1) equivalent circuit
   D. Short circuit
      1) accidental path of current flow to ground
   E. Ground fault
      1) a form of short circuit hot phase touching earth ground
   F. Open circuit
      1) a break in circuit no current flow

IV. ELECTRICAL ENERGY & POWER
   A. Work
      1) definition
      2) factors involved
      3) formula
         a) work = force x distance
4) units of work

B. Power
  1) definition
     a) rate of doing work
     b) power is work (ft. lbs./ time)

C. Units of Power
  1) Ft. lbs./ min.
  2) horsepower
  3) watts

D. Measurement of Electrical Power
  1) ammeter-voltmeter
     a) \( P = E \times I \)
  2) wattmeter

E. Electrical Energy
  1) power x time
  2) measure with watt hour meter

V. METERS
A. Ammeter
  1) movement of indicator needle
  2) ammeter applications
  3) multi range settings

B. Voltmeter
  1) voltage levels
  2) voltmeter applications
  3) multi range settings

C. Ohmmeter
  1) principal of operation
  2) ohmmeter applications

VI. ELECTRICAL CONDUCTORS
A. Introduction
  1) types of conductors
  2) resistivity
  3) American wire gauge

B. Conductor resistance
  1) total circuit resistance
     a) voltage drop
     b) current totals

C. Cross sectional area
  1) measurement
  2) circular mils
  3) numerical method for conductor sizing

D. Resistance of Conductors
  1) resistivity for copper 10.4 ohms/mil
  2) resistivity for aluminum 21 ohms/mil

E. Voltage drop single phase
  1) effects on electrical load
  2) resistance drop
     a) \( E = I \times R \)
     b) \( DVD = 2xKxLxI/CM \)
3) factors effecting voltage drop
   a) load
   b) inrush current
   c) conductor size

VII. MAGNETISM & ELECTROMAGNETISM
A. nature & theory
B. applications
C. polarity
D. magnetic materials
E. electromagnets
   1) construction
   2) factors effecting strength
      a) current
      b) number of turns
      c) reluctance

VIII. INDUCTION & GENERATION of EMF
A. induced EMF
   1) cutting lines magnetism
   2) relationship of current direction through magnetic field
      a) Flemings rule
   3) factors affecting magnitude of induced elf
B. lens law
C. self-induced EMF
D. self-induction of a coil
E. operation of a simple ac generator

Q. LABORATORY OUTLINE:

  LAB NUMBER:
  1  Wire connections & splices
  2  Crimp & ring terminals
  3  Box & switch identification
  4  Duplex receptacle & switch termination
  5  Voltage testing power supply
  6  Digital meter resistance measurements
  7  Series resistor circuits
  8  Parallel resistor circuits
  9  Series-parallel circuits
 10  Design build resistor circuits
 11  Light, switch, feed at switch
 12  Light, switch, feed at light
 13  Light, switch, hot receptacle feed at switch
 14  Double pole switch controls 240 v receptacle
 15  Single- three way lighting dimmers
 16  Bath ceiling fan- light- exhaust
 17  Light, switch hot receptacle feed at light
 18  Three way switch control feed at switch
 19  Three way switch control feed at light
 20  Light, two three ways, hot receptacle feed at receptacle
21 Light, two three ways, one four way feed at first three way switch
22 Light, two three ways, one four way feed at light
23 Light, switch, split wired receptacle feed at switch
24 Light, switch, duplex receptacle feed at light
25 Bathroom vanity light- GFCI receptacle-exhaust fan-light switch control
26 100 amp overhead service
27 100 amp underground service
28 Door chime with two push buttons