MASTER SYLLABUS

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

Created by: Michael Spearance

Updated by: November 20, 2018

Canino School of Engineering Technology

Department: ENVIRONMENTAL, CIVIL AND CONSTRUCTION TECHNOLOGY

Semester/Year: FALL 2018
A. **TITLE:** Electrical Construction and Maintenance 1

B. **COURSE NUMBER:** ELEC171

C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

   # Credit Hours: 7
   # Lecture Hours: 3 per week
   # Lab Hours: 8 per week
   Other: per week

   Course Length: 15 Weeks

D. **WRITING INTENSIVE COURSE:** Yes ☐ No ☒

E. **GER CATEGORY:** None: ☒ Yes: GER
   If course satisfies more than one: GER

F. **SEMESTER(S) OFFERED:** Fall ☒ Spring ☐ Fall & Spring ☐

G. **COURSE DESCRIPTION:**

   This course provides students with hands on training and practical applications of electrical codes as they pertain to maintenance, installation and design of residential electrical systems. Lab will include electrical connections, electrical service entrances, meter applications, branch circuits, lighting circuits, receptacle circuits, GFCI, AFCI, protections with National Electric Code standards. The intent of this course is to prepare students for entry level electrical jobs.

H. **PRE-REQUISITES:** None ☒ Yes ☐ If yes, list below:

   **CO-REQUISITES:** None ☒ Yes ☐ If yes, list below:
I. **STUDENT LEARNING OUTCOMES:** *(see key below)*

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>Program Student Learning Outcome [PSLO]</th>
<th>GER [If Applicable]</th>
<th>ISLO &amp; SUBSETS</th>
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<tbody>
<tr>
<td>a. Ohms law, electrical circuit calculations</td>
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<td>3-Found Skills ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>b. Series, parallel circuits</td>
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<td>2-Crit Think ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>c. Power calculations, cost to operate electrical systems</td>
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<td>2-Crit Think 3-Found Skills ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>d. Box fill</td>
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<td>2-Crit Think ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>e. Combination circuits</td>
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<td>3-Found Skills ISLO ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>f. Residential electric heat systems</td>
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<td>2-Crit Think 3-Found Skills ISLO</td>
<td>Subsets Subsets Subsets Subsets</td>
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<td>g. Residential electrical service entrances</td>
<td>3-Found Skills</td>
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<td>ISLO #</td>
<td>Institutional Student Learning Outcomes [ISLO 1 – 5]</td>
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<td>Communication Skills</td>
<td>Oral [O], Written [W]</td>
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<td>2</td>
<td>Critical Thinking</td>
<td>Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
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<td>3</td>
<td>Foundational Skills</td>
<td>Information Management [IM], Quantitative Lit./Reasoning [QTR]</td>
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<td>4</td>
<td>Social Responsibility</td>
<td>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</td>
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<td>5</td>
<td>Industry, Professional, Discipline Specific Knowledge and Skills</td>
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*Include program objectives if applicable. Please consult with Program Coordinator*
J. **APPLIED LEARNING COMPONENT:**

Yes [ ]  No [x]

If YES, select one or more of the following categories:

- [x] Classroom/Lab
- [ ] Internship
- [ ] Clinical Placement
- [ ] Practicum
- [ ] Service Learning
- [ ] Community Service
- [ ] Civic Engagement
- [ ] Creative Works/Senior Project
- [ ] Research
- [ ] Entrepreneurship

K. **TEXTS:**


L. **REFERENCES:**

National Electric Code Book 2017

M. **EQUIPMENT:**

None [x]  Needed: Lab Computers, Benders, Meters and specialty equipment

N. **GRADING METHOD:**

A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

- Exams
- Quizzes
- Papers
- Participation

P. **DETAILED COURSE OUTLINE:**

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
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 x 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: None ☐ Yes ☑

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