Washtenaw Community College Comprehensive Report

ELE 111 Electrical Fundamentals
Effective Term: Spring/Summer 2022

Course Cover

College: Advanced Technologies and Public Service Careers
Division: Advanced Technologies and Public Service Careers
Department: Advanced Manufacturing
Discipline: Electricity/Electronics
Course Number: 111
Org Number: 14400
Full Course Title: Electrical Fundamentals
Transcript Title: Electrical Fundamentals
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Consultation with all departments affected by this course is required.
Course description
Outcomes/Assessment
Objectives/Evaluation
Rationale: Updated as a result of assessment report.
Proposed Start Semester: Winter 2022
Course Description: In this course students will learn the fundamentals of DC and AC components and circuits. Topics of study will include proper circuit operation, component identification and testing procedures. Students will be instructed on the proper use of various test equipment for the purposes of verifying proper component and circuit operation and also troubleshooting circuit faults. The course is designed to foster an intuitive understanding of electrical concepts appropriate for occupations involved with the installation, maintenance, and troubleshooting of electrical circuits and devices. Students must have good numerical and algebraic skills to be successful in this course.

Course Credit Hours

Variable hours: No
Credits: 4
Lecture Hours: Instructor: 60 **Student:** 60
Lab: Instructor: 30 **Student:** 30
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

General Education

Request Course Transfer

Proposed For:

Eastern Michigan University
Ferris State University
Grand Valley State University
Jackson Community College
Wayne State University
Central Michigan University

Student Learning Outcomes

1. Read and interpret wiring diagrams for the purpose of trouble shooting and wiring circuits.
   Assessment 1
   Assessment Tool: Successful completion of panel wiring and troubleshooting lab.
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Rubric
   Standard of success to be used for this assessment: 70% of students will be successful on their first attempt
   Who will score and analyze the data: Full-time ELE 111 Faculty
   Assessment 2
   Assessment Tool: Outcome-related departmental final exam questions
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Answer key and/or rubric
   Standard of success to be used for this assessment: 70% of students will score 70% or higher on the outcome-related questions
   Who will score and analyze the data: Full-time ELE 111 Faculty

2. Identify the concepts and principles used to describe the operation of relays, inductors and capacitors.
   Assessment 1
   Assessment Tool: Outcome-related departmental final exam questions
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Answer key and/or rubric
   Standard of success to be used for this assessment: 70% of students will score 70% or higher on the outcome-related questions
   Who will score and analyze the data: Full-time ELE 111 Faculty

3. Demonstrate the proper use of electrical test equipment, including the multimeter, function generator and oscilloscope.
   Assessment 1
   Assessment Tool: Departmental midterm lab exam

Assessment Date: Winter 2024
Assessment Cycle: Every Three Years
Course section(s)/other population: All sections
Number students to be assessed: All students
How the assessment will be scored: Departmentally-developed rubric
Standard of success to be used for this assessment: 70% of the students will be successful on their first attempt
Who will score and analyze the data: Full-time faculty teaching ELE 111

4. Analyze DC series, parallel, and series-parallel circuits and determine selected voltage, current, resistance, and power values.
   Assessment 1
   Assessment Tool: Outcome-related departmental final exam questions
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Answer key and/or rubric
   Standard of success to be used for this assessment: 70% of students will score 70% or higher on the outcome-related questions
   Who will score and analyze the data: Full-time ELE 111 Faculty

5. Analyze AC series and parallel circuits and determine selected voltage, current, impedance, and phase angle of the circuit.
   Assessment 1
   Assessment Tool: Outcome-related departmental test questions (multiple-choice/matching)
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Answer key
   Standard of success to be used for this assessment: 70% of students will be successful will score 70% or higher on the outcome-related questions
   Who will score and analyze the data: Full-time ELE 111 faculty will score and analyze the resultant data.

6. Troubleshoot faults (opens and shorts) in series, parallel, and series-parallel circuits.
   Assessment 1
   Assessment Tool: Departmental midterm and final lab exams.
   Assessment Date: Winter 2024
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 70% of the students will score 75% or higher on each lab exam
   Who will score and analyze the data: Full-time faculty teaching ELE 111

Course Objectives

1. Identify the physical parameters that determine: resistance, inductance and capacitance.
2. Determine the value of resistors using the register color code.
3. Determine the total resistance of lengths of wire.
4. Analyze the behavior of inductors and capacitors when a DC voltage is applied.
5. Identify the current and voltage waveforms during the time that current increases or decreases in an RC or RL DC circuit.

6. Identify the physical and electrical characteristics of step-up and step-down transformers. Determine voltage, current, and impedance values in a transformer circuit.
7. Demonstrate the use of the multimeter to measure voltage, current, and resistance.
8. Demonstrate the use of the oscilloscope to analyze sinusoidal and nonsinusoidal waves including the measurement of amplitude, period, time constant, and phase angle.
9. Determine voltage, current, resistance, and power values in series, parallel, and series-parallel circuits.
10. Estimate voltage drops in a series circuit using the proportional method.
11. Determine total voltage and current capacity when voltage sources are connected in series, parallel, and series-parallel combinations.
12. Determine values characteristic of a sine wave including: period, frequency, peak, average, and effective values.
13. Determine voltage, current, reactance, impedance and phase angle values in RL, RC, and RLC series or parallel circuits.
14. Determine the phase angle between current and voltage of AC circuits.
15. Determine the apparent power, reactive power, and true power of AC circuits.

New Resources for Course

Course Textbooks/Resources

Textbooks

Frank D. Petruzella. *Electricity For The Trades*, 3rd ed. McGraw Hill, 2019, ISBN: 978126043738.

Manuals

Popovich. ELE 111 Course Pack, Xanedu, 08-11-2021

Periodicals

Software

Equipment/Facilities

Level III classroom

Data projector/computer

Other: ELE 111 lab kit, Multimeter, DC power supply, Function Generator, Dual channel oscilloscope, power leads

Reviewer	Action	Date
Faculty Preparer:		
Jim Popovich	*Faculty Preparer*	*Aug 12, 2021*
Department Chair/Area Director:		
Thomas Penird	*Recommend Approval*	*Aug 16, 2021*
Dean:		
Jimmie Baber	*Recommend Approval*	*Aug 19, 2021*
Curriculum Committee Chair:		
Randy Van Wagnen	*Recommend Approval*	*Nov 29, 2021*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*Nov 30, 2021*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Nov 30, 2021*

WASHTENAW COMMUNITY COLLEGE

MASTER SYLLABUS

Course Discipline Code & No: ELE 111 **Title:** Electrical Fundamentals **Effective Term** ~~Spring~~ Fall 2006

Division Code: BCT **Department Code:** ELED **Org #:** 14300

Don't publish: ☐ College Catalog ☐ Time Schedule ☐ Web Page

Reason for Submission. Check all that apply.

- ☐ New course approval
- ☒ Three-year syllabus review/Assessment report
- ☐ Course change
- ☐ Reactivation of inactive course
- ☐ Inactivation (Submit this page only.)

Change information: Note all changes that are being made. Form applies only to changes noted.

- ☐ Consultation with all departments affected by this course is required.
- ☐ Course discipline code & number (was _____)*
  *Must submit inactivation form for previous course.
- ☐ Course title (was _____)
- ☒ Course description
- ☒ Course objectives (minor changes)
- ☐ Credit hours (credits were: _____)
- ☐ Total Contact Hours (total contact hours were: _____)
- ☐ Distribution of contact hours (contact hours were: lecture: _____ lab _____ clinical _____ other _____)
- ☒ Pre-requisite, co-requisite, or enrollment restrictions
- ☒ Change in Grading Method
- ☒ Outcomes/Assessment
- ☒ Objectives/Evaluation
- ☐ Other _____

Rationale for course or course change. Attach course assessment report for existing courses that are being changed.

Changes are meant to align syllabus with current thinking on Outcomes/Assessment and Objectives/Evaluation.

Approvals Department and divisional signatures indicate that all departments affected by the course have been consulted.

Department Review by Chairperson ☐ New resources needed ☒ All relevant departments consulted

Print: Gary W. Downen (Faculty/Preparer) Signature: Gary W. Downen Date: 1/11/06

Print: Gary W. Downen (Department Chair) Signature: Gary W. Downen Date: 1/11/06

Division Review by Dean

☐ Request for conditional approval

Recommendation ☒ Yes ☐ No _____ (Dean's/Administrator's Signature) Date: 2/2/06

Curriculum Committee Review

Recommendation _____

☐ Tabled ☑ Yes ☐ No _____ (Curriculum Committee Chair's Signature) Date: 2/23/06

Vice President for Instruction Approval

Roger M. Balay. (Vice President's Signature) Date: 3/3/06

Approval ☒ Yes ☐ No ☐ Conditional

Do not write in shaded area.
Entered in: Banner 3/8 C&A Database 3/8 Log File 2/9/06 3/8 Basic skills spreadsheet updated ☐ Contact fee ☐

Please return completed form to the Office of Curriculum & Assessment and email an electronic copy to sjohn@wccnet.edu for posting on the website.

WASHTENAW COMMUNITY COLLEGE

MASTER SYLLABUS

***Complete ALL sections which apply to the course, even if changes are not being made.**

Course:	**Course title:**
ELE 111	Electrical Fundamentals

Credit hours: 4

If variable credit, give range:

_____ to _____ credits

Contact hours per semester:

	Student	Instructor
Lecture:	60	60
Lab:	30	30
Clinical:		
Practicum:		
Other:		
Totals:	90	90

Are lectures, labs, or clinicals offered as separate sections?

☐ Yes - lectures, labs, or clinicals are offered in separate sections

☒ No - lectures, labs, or clinicals are offered in the same section

Grading options:

☐ P/NP (limited to clinical & practical)

☐ S/U (for courses numbered below 100)

☒ Letter grades

Prerequisites. Select one:

☒ College-level Reading & Writing

☐ Reduced Reading/Writing Scores
(Add information at Level I prerequisite)

☐ No Basic Skills Prerequisite
(College-level Reading and Writing is not required.)

In addition to Basic Skills in Reading/Writing:

Level I (enforced in Banner)

	Course	Grade	Test	Min. Score	Concurrent Enrollment (Can be taken together)	Corequisites (Must be enrolled in this class also during the same semester)
			COMPASS Algebra	46	☐	
☐ and ☒ or	MTH 097	C			☐	
☐ and ☒ or	MTH 151	C			☐	
☐ and ☐ or					☐	

Level II (enforced by instructor on first day of class)

	Course	Grade	Test	Min. Score
☐ and ☐ or				
☐ and ☐ or				

Enrollment restrictions (In addition to prerequisites, if applicable.)

☐ and ☐ or Consent required

☐ and ☐ or Admission to program required
Program: _____

☐ and ☐ or Other (please specify):
_____

Please send syllabus for transfer evaluation to:

Conditionally approved courses are not sent for evaluation.
Insert course number and title you wish the course to transfer as.

☐ E.M.U. as _____

☐ U of M as _____

☐ _____ as _____

☐ _____ as _____

☐ _____ as _____

☐ _____ as _____

MASTER SYLLABUS

Course	Course title
ELE 111	Electrical Fundamentals

Course description State the purpose and content of the course. Please limit to 500 characters.	This is an introductory course in DC and AC concepts and circuits. The course is designed to foster an intuitive understanding of electrical concepts appropriate for occupations involved with the installation, maintenance, and troubleshooting of electrical circuits and devices. Lab exercises deal with the use of test equipment for the purpose of verifying circuit operation and troubleshooting circuit faults. Students must have good numerical and algebraic skills to be successful in this course.

Course outcomes List skills and knowledge students will have after taking the course. **Assessment method** Indicate how student achievement in each outcome will be assessed to determine student achievement for purposes of course improvement.	**Outcomes** (applicable in all sections)	**Assessment** Methods for determining course effectiveness
	1. Identify the physical and electrical properties of resistive, inductive, and capacitive devices and analyze their behavior in DC and AC circuits.	Departmental test questions (Multiple Choice/Matching) included as part of instructor developed tests. (See attachment 1.)
	2. Read and interpret wiring diagrams for the purpose of wiring circuits, determining the normal operation of circuits, and for troubleshooting circuit faults.	Successful completion of panel wiring and troubleshooting lab. (See attachment 2.)
	3. Identify the concepts and principles used to describe the operation of magnetic and electromagnetic devices.	Departmental test questions (Multiple Choice/Matching). (See attachment 1.)
	4. Demonstrate the proper use of electrical test equipment, including the multimeter, watt meter, and oscilloscope.	Departmental lab exams. (See attachment 3.)
	5. Analyze DC series, parallel, and series-parallel circuits and determine selected voltage, current, resistance, and power values.	Departmental test questions (Multiple Choice/Matching). (See attachment 1.)
	6. Analyze AC series and parallel circuits and determine selected voltage, current, impedance, and power values and the phase angle and power factor of the circuit.	Departmental test questions (Multiple Choice/Matching). (See attachment 1.)
	7. Troubleshoot faults (opens and shorts) in series, parallel, and series-parallel circuits.	Successful completion of troubleshooting labs. (See attachment 4.)

Course Objectives Indicate the objectives that support the course outcomes given above. **Course Evaluations** Indicate how instructors will determine the degree to which each objective is met for each student.	**Objectives** (applicable in all sections)	**Evaluation** Methods for determining level of student performance of objectives
	Identify the physical and electrical properties of resistive, inductive, and capacitive devices and analyze their behavior in DC and AC circuits.	
	1.1 Identify the physical parameters that determine: • resistance. • inductance. • capacitance.	Instructor developed quizzes, tests, midterm, and/or final exams (Multiple Choice/Matching/Short Answer).
	1.2 Use the resistor color code to determine the value of resistors.	
	1.3 Identify the functional difference between a potentiometer and a rheostat.	
	1.4 Determine the total resistance of lengths of wire.	
	1.5 Analyze the behavior of inductors and capacitors when a DC voltage is applied including: • determine the time constant (□) for resistor-capacitor (RC) and resistor-inductor (L/R) series DC circuits. • identify the current and voltage waveforms during the charge and discharge times in a resistor-capacitor series DC circuit. • identify the current and voltage waveforms during the time that current increases or decreases in a resistor-inductor series DC circuit.	
	1.6 Determine the reactance of inductors and capacitors in AC circuits.	
	Read and interpret wiring diagrams for the purpose of wiring circuits, determining the normal operation of circuits, and for troubleshooting circuit faults.	
	2.1 Read and interpret various forms of schematic diagrams.	Department approved lab assignments.
	2.2 Demonstrate workmanlike procedures when wiring simple series, parallel, and series-parallel circuits.	
	2.3 Read and interpret a ladder diagram and related engineering drawings to determine the normal operation of a control circuit.	
	2.4 Demonstrate workmanlike procedures when wiring a control panel.	
	Identify the concepts and principles used to describe the operation of magnetic and electromagnetic devices.	
	3.1 Identify magnetic concepts including flux, flux density, retentivity, and permeability.	Instructor developed quizzes, tests, midterm, and/or final exams.
	3.2 Identify the factors that determine the magnetic field strength of an electromagnet.	
	3.3 Identify the factors that determine the induced voltage across a coil.	

	3.4 Identify the physical and electrical characteristics of step-up and step-down transformers. Determine voltage, current, and impedance values in a transformer circuit.	
	Demonstrate the proper use of electrical test equipment, including the multimeter, wattmeter, and oscilloscope.	
	4.1 Demonstrate the use of the multimeter to measure voltage, current, and resistance. 4.2 Demonstrate the use of the wattmeter to determine apparent power and true power. 4.3 Demonstrate knowledge of the location, operation, and function of the controls, connectors, and indicators on an oscilloscope's front panel. 4.4 Demonstrate the use of the oscilloscope to analyze sinusoidal and nonsinusoidal waves including the measurement of amplitude, period, time constant (□), and phase angle (ø).	Departmental lab exams. **(Students must score 75% or better on both lab exams in order to pass the course.)**
	Analyze DC series, parallel, and series-parallel circuits and determine selected voltage, current, resistance, and power values.	
	5.1 Identify and manipulate numerical values expressed in engineering notation or using standard prefixes. 5.2 Determine unknown voltage, current, resistance, and power values using ohm's law and watt's law. 5.3 Determine voltage, current, resistance, and power values in series, parallel, and series-parallel circuits. 5.4 Estimate voltage drops in a series circuit using the proportional method. 5.5 Estimate branch currents in a parallel circuit using the inverse proportional method. 5.6 Determine total voltage and current capacity when voltage sources are connected in series, parallel, and series-parallel combinations.	Instructor developed quizzes, tests, midterm, and/or final exams (Multiple Choice/Matching/Short Answer). and Department approved lab assignments.
	Analyze AC series and parallel circuits and determine selected voltage, current, impedance, and power values and the phase angle and power factor of the circuit.	
	6.1 Determine values characteristic of a sine wave including: period, frequency, peak, average, and effective values. 6.2 Identify and manipulate AC values expressed as phasor diagrams. 6.3 Determine voltage, current, reactance, and impedance values in RL, RC, and RLC series and parallel circuits. 6.4 Determine the phase angle and power factor of AC circuits. 6.5 Determine the resonant frequency of RLC circuits. 6.6 Determine the apparent power, reactive power, and true power of AC circuits.	Instructor developed quizzes, tests, midterm, and/or final exams (Multiple Choice/Matching/Short Answer). and Department approved lab assignments.

	Troubleshoot faults (opens and shorts) in series, parallel, and series-parallel circuits. 7.1 Localize circuit faults with the aid of circuit schematics by determining the first action in a control cycle that fails to occur. 7.2 Isolate circuit faults by making and interrupting voltage, current, and/or resistance measurements. 7.3 Complete service reports by documenting observed symptoms, troubleshooting procedures, and actions taken to correct circuit faults.	Instructor developed quizzes, tests, midterm, and/or final exams. and Department approved lab assignments.

List all new resources needed for course, including library materials.
None

Student Materials:

List examples of types		Estimated costs
Texts Supplemental reading Supplies Uniforms Equipment Tools Software	*Essentials of Electronics*, Second Edition, by Frank D. Petruzella *ELE 111 Lab Manual,* by Gary W. Downen TI-30X IIS Scientific Calculator	$

Equipment/Facilities: Check all that apply. (All classrooms have overhead projectors and permanent screens.)

Check level only if the specified equipment is needed for all sections of a course.

- ☒ Level I classroom
  Permanent screen & overhead projector
- ☐ Level II classroom
  Level I equipment plus TV/VCR
- ☐ Level III classroom
  Level II equipment plus data projector, computer, faculty workstation

- ☐ Off-Campus Sites
- ☐ Testing Center
- ☐ Computer workstations/lab
- ☐ ITV
- ☐ TV/VCR
- ☒ Data projector/computer
- ☒ Other Document Camera

Assessment plan:

Learning outcomes to be assessed (list from Page 3)	Assessment tool	When assessment will take place	Course section(s)/other population	Number students to be assessed
Identify the physical and electrical properties of resistive, inductive, and capacitive devices and analyze their behavior in DC and AC circuits.	Departmental test questions (Multiple Choice/Matching) included as part of instructor developed tests. (See attachment 1.)	Every three years fall and winter semester.	All sections	All students
Read and interpret wiring diagrams for the purpose of wiring circuits, determining the normal operation of circuits, and for troubleshooting circuit faults.	Successful completion of panel wiring and troubleshooting labs. (See attachment 2.)	Every three years fall and winter semester.	All sections	All students
Identify the concepts and principles used to describe the operation of magnetic and electromagnetic devices.	Departmental test questions (Multiple Choice/Matching) included as part of instructor developed tests. (See attachment 1.)	Every three years fall and winter semester.	All sections	All students
Demonstrate the proper use of electrical test equipment, including the multimeter, wattmeter, and oscilloscope.	Departmental lab exams. (See attachment 3.)	Every three years fall and winter semester.	All sections	All students
Analyze DC series, parallel, and series-parallel circuits and determine voltage, current, resistance, and power values for each component in the circuit.	Departmental test questions (Multiple Choice/Matching) included as part of instructor developed tests. (See attachment 1.)	Every three years fall and winter semester.	All sections	All students
Analyze AC series and parallel circuits and determine selected voltage, current, impedance, and power values and the phase angle and power factor of the circuit.	Departmental test questions (Multiple Choice/Matching) included as part of instructor developed tests. (See attachment 1.)	Every three years fall and winter semester.	All sections	All students
Troubleshoot faults (opens and shorts) in series, parallel, and series-parallel circuits.	Successful completion of troubleshooting labs. (See attachment 4.)	Every three years fall and winter semester.	All sections	All students

Scoring and analysis of assessment:

1. Indicate how the above assessment(s) will be scored and evaluated (e.g. departmentally developed rubric, external evaluation, other). Attach the rubric.

   Departmentally developed assessment test questions will be graded according to the answer key.
   Lab assessment instruments will be scored using departmentally developed rubrics.

2. Indicate the standard of success to be used for this assessment.

   75 % of the students will successfully complete all of the lab assessment tasks and score 70% or better on the departmentally developed assessment test questions.

3. Indicate who will score and analyze the data.

   The instructors who teach the Industrial Electronics courses.

4. Explain the process for using assessment data to improve the course.

   At the end of the Winter semester, the Industrial Electronics faculty will analyze the results of the assessment data for areas of strengths and weaknesses. Ideas will be generated to addresses the areas of weaknesses.