A. **Academic Division:** Business, Industry, and Technology

B. **Discipline:** Electronic Engineering Technology

C. **Course Number and Title:** ELET1520 AC Electricity

D. **Course Coordinator:** Lenny Eaken  
   **Assistant Dean:** Daniel Wanger

   **Instructor Information:**
   - Name: Click here to enter text.  
   - Office Location: Click here to enter text.  
   - Office Hours: Click here to enter text.  
   - Phone Number: Click here to enter text.  
   - E-Mail Address: Click here to enter text.

E. **Credit Hours:** 3  
   Lecture: 2 hours  
   Laboratory: 2 hours

F. **Prerequisites:** ELET1510  
   **Co-requisite(s):** MATH1051

G. **Syllabus Effective Date:** Fall, 2017

H. **Textbook(s) Title:**
   
   *Foundations of Electronics Circuits & Devices Electron Flow Version*
   - Author(s): Meade  
   - Copyright Year: 2006  
   - Edition: 5th  
   - ISBN #: 978-1418-0053-75

I. **Workbook(s) and/or Lab Manual:**
   
   *Laboratory Projects to Accompany Foundations of Electronics*
   - Author(s): Meade  
   - Copyright Year: 2006  
   - Edition: 5th  
   - ISBN #: 978-1418-0418-30

J. **Course Description:** A course covering alternating circuit theory including basic concepts of voltage, current, resistance, impedance, inductance, capacitance, phase angle, and their relationships to each other in an AC circuit. Transformers, resonance and use of AC instruments is also included.  
   OET 003
K. College-Wide Learning Outcomes

<table>
<thead>
<tr>
<th>College-Wide Learning Outcome</th>
<th>Assessments - - How it is met &amp; When it is met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication – Written</td>
<td></td>
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<tr>
<td>Communication – Speech</td>
<td></td>
</tr>
<tr>
<td>Intercultural Knowledge and Competence</td>
<td></td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>Class discussions, class activities, tests, and labs - weekly</td>
</tr>
<tr>
<td>Information Literacy</td>
<td>Research, circuit simulation – Regularly throughout the semester</td>
</tr>
<tr>
<td>Quantitative Literacy</td>
<td>Class discussions, class activities, tests, and labs - Regularly throughout the semester</td>
</tr>
</tbody>
</table>

L. Course Outcomes and Assessment Methods:

Upon successful completion of this course, the student shall:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Assessments – How it is met &amp; When it is met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sinusoidal wave properties: Safely measure the RMS values of voltage and current of an AC sine wave using both digital and analog multimeters or clip-on ammeters.</td>
<td>Lecture, Labs, and Quizzes during week 1 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>2. Safely measure AC sine wave voltages and phase shifts of voltage and current in RLC circuits on an oscilloscope.</td>
<td>Lecture, Labs, and Quizzes during weeks 3 and 4 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>3. Compute the peak voltage, peak-peak voltage, RMS voltage, frequency and cycle time period from a calibrated oscilloscope display of an AC sine wave.</td>
<td>Lecture, Labs, and Quizzes during week 2 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>4. Behavior of transformers: Describe the electromagnetic principles of transformer action: a. The pulsating magnetic field in the primary. b. The induced voltage in the secondary. c. The use of high permeability cores to maximize coupling. d. The techniques used to minimize core losses.</td>
<td>Lecture, Labs, and Quizzes during week 5 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>5. Compute the following transformer parameters: a. Turn ratio (given primary and secondary voltages) b. Turns ratio (given primary and secondary currents) c. Secondary voltage (given turns ratio and primary voltage) d. Secondary voltage (given rated VA and secondary current) e. Secondary current (given turns ratio and primary current) f. Secondary current (given rated VA and secondary voltage) g. Power losses and efficiency (given power input and output) h. Volt-ampere rating (given rated secondary voltage and current)</td>
<td>Lecture, Labs, and Quizzes during week 6 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>6. Complex numbers and phasors: Analyze RC, RL, and RLC circuits and state the results in rectangular and polar form.</td>
<td>Lecture, Labs, and Quizzes during weeks 10 and 11 and throughout the remainder of the semester.</td>
</tr>
</tbody>
</table>
Outcomes | Assessments – How it is met & When it is met
--- | ---
7. AC network theorems such as Superposition, Thevenin’s and Norton’s theorems | Lecture, Labs, and Quizzes during weeks 7 and 8 and throughout the remainder of the semester.
8. Power factor analysis, Three-phase and/or poly-phase systems Compute the per-phase voltage, current, volts, power and power factor for both wye-connected and delta-connected loads on balanced three-phase line when given line voltage, line current and total load power. | Lecture, Labs, and Quizzes during weeks 8 and 9 and throughout the remainder of the semester.
9. Steady-state behavior of RC circuits under AC conditions, Steady-state behavior of RL circuits under AC conditions, Steady-state behavior of RLC circuits under AC conditions: Describe graphically the relative frequency response at the output of simple R-C, R-L and R-L-C networks for changing frequency. | Lecture, Labs, and Quizzes during weeks 12 and 13 and throughout the remainder of the semester.
10. Analysis of basic filter circuits: Be able to determine resonant frequency and Q of series/parallel resonant circuits. | Lecture, Labs, and Quizzes during weeks 14 and 15

M. Topical Timeline (Subject to Change):

**Week 1**
- Basic AC Quantities and Measurements
- Draw a graphic illustrating an ac waveform
- Define cycle, alternation, period, peak, peak-to-peak, and effective value (rms)
- Compute effective, peak, and peak-to-peak values of ac voltage and current
- Explain average with reference to one-half cycle of sine-wave ac
- Define and calculate frequency and period
- Describe the phase relationships of V and I in a purely resistive ac circuit

**Week 2**
- List the key sections of the oscilloscope
- List precautions when using scopes
- List procedures when measuring voltage with a scope
- List procedures to display and interpret waveforms
- List procedures relating to phase measurement

**Week 3**
- List procedures when determining frequency with a scope
- Use the computer to solve circuit problems
- Define inductance and self-inductance

**Week 4**
- Reactive components
- Explain Faraday’s and Lenz’s laws
- Calculate induced emf values for specified circuit conditions
- Calculate inductance values from specified parameters
- Calculate inductance in series and parallel
- List common problems of inductors

**Week 5**
- Illustrate V-I relationships for a purely resistive ac circuit
- Illustrate V-I relationships for a purely inductive ac circuit
- Explain the concept of inductive reactance
- Write and explain the formula for inductive reactance
- Use Ohm’s Law to solve for XL
• Use the XL formula to solve for inductive reactance at different frequencies and with various inductance values
• Use the XL formula to solve for unknown \( L \) or \( f \) values
• Determine \( XL \), \( IL \), and \( VL \) values for series- and parallel-connected inductances

**Week 6**
• Use vectors to determine magnitude and direction
• Determine circuit impedance using the Pythagorean theorem
• Determine \( VT \) and \( IT \) using the Pythagorean theorem
• Determine ac circuit parameters using trigonometry

**Week 7**
• Calculate ac electrical parameters for series \( RL \) circuits
• Calculate ac electrical parameters for parallel \( RL \) circuits

**Week 8**
• Define mutual inductance
• Calculate turns, voltage, current, and impedance ratios

**Week 9**
• Define capacitor, capacitance, dielectric, dielectric constant, electric field, farad, \( RC \) time constant, and leakage resistance
• Describe capacitor charging action and discharging action
• Calculate charge, voltage, capacitance, and stored energy, using the appropriate formulas

**Week 10**
• Determine total capacitance in circuits with more than one capacitor (series and parallel)
• Calculate circuit voltages using appropriate \( RC \) time-constant formulas
• Illustrate \( V-I \) relationships for purely resistive and purely capacitive circuits

**Week 11**
• Explain capacitive reactance
• Use Ohm’s Law to solve for \( XC \) value(s)
• Use the capacitive reactance formula to solve for \( XC \) value(s)
• Use the \( XC \) formula to solve for unknown \( C \) and \( f \) values
• Use Ohm’s Law and reactance formulas to determine circuit reactances, voltages, and currents for series- and parallel-connected capacitors

**Week 12**
• Draw or describe operation of simple \( R \) and \( C \) circuits
• Analyze appropriate series and parallel \( RC \) circuit parameters using the Pythagorean theorem

**Week 13**
• Use vector analysis to analyze series and parallel \( RC \) circuit parameters

**Week 14**
• Solve \( RLC \) circuit problems using the Pythagorean approach and trig functions
• Define and illustrate ac circuit parameters using both rectangular and polar form notation
• Define real numbers and imaginary numbers
• Analyze \( RLC \) circuits and state results in rectangular and polar forms
• List the key characteristics of series and parallel resonant circuits

**Week 15**
• Calculate the resonant frequency of circuits
• Calculate \( L \) or \( C \) values needed for resonance at a given \( fr \)
• Calculate \( Q \) factor for series and parallel resonant circuits
• Determine bandwidth and bandpass of resonant circuits
• Draw circuit diagrams for three types of filters
• Use the computer to solve circuit problems

**N. Course Assignments:**

1. Class activities and discussions
2. Learning checks: Selected Learning Checks are completed during chapter reviews.
3. Homework: Selected problems and questions for each chapter must be completed and turned in as homework.
4. Labs: Selected labs will be completed for each chapter throughout the semester.
5. Tests: A test will be given at the end of each chapter during the semester.
6. Final: There will be a comprehensive final at the end of the semester.

O. Recommended Grading Scale:

<table>
<thead>
<tr>
<th>NUMERIC</th>
<th>GRADE</th>
<th>POINTS</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>93–100</td>
<td>A</td>
<td>4.00</td>
<td>Superior</td>
</tr>
<tr>
<td>90–92</td>
<td>A-</td>
<td>3.67</td>
<td>Superior</td>
</tr>
<tr>
<td>87–89</td>
<td>B+</td>
<td>3.33</td>
<td>Above Average</td>
</tr>
<tr>
<td>83–86</td>
<td>B</td>
<td>3.00</td>
<td>Above Average</td>
</tr>
<tr>
<td>80–82</td>
<td>B-</td>
<td>2.67</td>
<td>Above Average</td>
</tr>
<tr>
<td>77–79</td>
<td>C+</td>
<td>2.33</td>
<td>Average</td>
</tr>
<tr>
<td>73–76</td>
<td>C</td>
<td>2.00</td>
<td>Average</td>
</tr>
<tr>
<td>70–72</td>
<td>C-</td>
<td>1.67</td>
<td>Below Average</td>
</tr>
<tr>
<td>67–69</td>
<td>D+</td>
<td>1.33</td>
<td>Below Average</td>
</tr>
<tr>
<td>63–66</td>
<td>D</td>
<td>1.00</td>
<td>Below Average</td>
</tr>
<tr>
<td>60–62</td>
<td>D-</td>
<td>0.67</td>
<td>Poor</td>
</tr>
<tr>
<td>00–59</td>
<td>F</td>
<td>0.00</td>
<td>Failure</td>
</tr>
</tbody>
</table>

P. Grading and Testing Guidelines:

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Q. Examination Policy:

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R. Class Attendance and Homework Make-Up Policy:

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S. Classroom Expectations:

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T. College Procedures/Policies:

**Attendance Requirements:** All students are required to attend all scheduled classes and examinations. Each faculty member has the right to establish regulations regarding attendance that he/she considers necessary for successful study.

Students who do not attend classes may be administratively withdrawn from those classes. However, failure to attend classes does not constitute withdrawal, and students are expected to process a formal withdrawal through the Student Records Office in Kee Hall.

**Student engagement requirements:**
Student engagement is based on the “active pursuit” of learning which can be measured by class attendance, class participation (in class or online), taking required quizzes/examinations, and submission of work assignments or papers. Student engagement consists of a student attending at least 60% of the class sessions (there should be attendance throughout the term) and/or completing 75% of the assignments listed.
on the syllabus at the midpoint in the term. Exceptions can be made when there is on-going communication between the student and faculty member. The communication must be documented and the faculty member and student must be in agreement regarding the exception. Students not meeting the expectation will be administratively withdrawn from class. If a student believes he/she was administratively withdrawn in error, he/she may file an appeal. Being administratively withdrawn may have program and financial aid implications.

**Academic Misconduct** is any activity that tends to compromise the academic integrity of the college, or subvert the educational process. Examples of academic misconduct include, but are not limited to:

1. **Violation of course or program rules** as contained in the course syllabus or other information provided to the student; violation of program requirements as established by departments and made available to students.

2. **Plagiarism** including, but not limited to, submitting, without appropriate acknowledgment, any written, visual or oral material that has been copied in whole or in part from the work of others (whether such source is published or not) even if the material is completely paraphrased in one’s own words. This includes another individual’s academic composition, compilation, or other product, or a commercially prepared paper. Plagiarism also includes submitting work in which portions were substantially produced by someone acting as a tutor or editor.

   Such practices constitute plagiarism regardless of motive. Those who deny deceitful intent, claim not to have known that the act constituted plagiarism, or maintain that what they did was inadvertent are nevertheless subject to penalties when plagiarism has been confirmed.

3. **Cheating** and dishonest practices in connection with examinations, papers and projects, including but not limited to using unauthorized notes, study aids or information on an examination; obtaining help from another student during an examination; taking an exam or doing work for another student; providing one’s own work for another student to copy and submit as his/her own; or allowing another student to do one’s work and then submitting the work as one’s own. Also included would be altering a graded work after it has been returned, then submitting the work for re-grading; or submitting identical or similar papers for credit in more than one course without prior permission from the course instructors.

4. **Fabrication** including but not limited to falsifying or inventing any information, data or citation; presenting data that were not gathered in accordance with defined appropriate guidelines, and failing to include an accurate account of the method by which data were collected.

5. **Obtaining an Unfair Advantage** including, but not limited to stealing, reproducing, circulating, or otherwise gaining access to examination materials prior to the time authorized by the instructor; unauthorized collaborating on an academic assignment; taking, hiding or altering resource material; or undertaking any activity with the purpose of creating or obtaining an unfair advantage over another student’s academic work.

6. **Aiding and Abetting Academic Dishonesty** including, but not limited to providing material, information or other assistance to another person with the knowledge that such aid could be used in any of the violations stated above, or providing false information in connection with any inquiry regarding academic integrity.

7. **Alteration of Grades or Marks** including but not limited to, action by the student in an effort to change the earned credit or grade.

In addition, cases of academic dishonesty may involve photocopied materials. Materials used may fall under the Copyright Act. Violations of said Act may subject the user and/or the College to sanctions.
Statement on Disabilities: Any student who requires reasonable accommodations related to a disability should inform the course instructor and the Coordinator of Specialized Services (Room 138 in Kee Hall; phone 419-755-4727).

Students who encounter difficulty in any of their courses are encouraged to visit the Tutoring Resource Center (Room 119 in Fallerius Technical Education Center) for tutoring assistance, and the Student Success Center (Room 136 in Kee Hall) for academic assistance, advising services, referrals for personal counseling and Learning Disability (LD) Testing.

Statement on Withdrawals: As a student, you are expected to attend class. If you are unable or choose not to attend class, or if for whatever reason you are unable to keep up with the requirements of a course, you need to officially drop the class at the Student Records Office. Refund dates and withdrawal dates will vary slightly from term to term. Contact the Student Records Office for applicable dates. Additionally these dates are posted on the academic calendar available on the college’s website, www.ncstatecollege.edu, under the Academics heading on the home page and are available at the Student Records Office in Kee Hall. Students should go to the Student Records Office (Room 142 in Kee Hall) to process their withdrawal from any class.

If you choose to walk away from your class without officially withdrawing from it, the faculty member teaching the class must grade your classroom performance on the material available to him or her. This normally results in an "F" grade. An "F" grade can lower your grade point average considerably depending on the total credits accumulated.