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

B. **Discipline:** Electronic Engineering Technology

C. **Course Number and Title:** ELET2450 Electronics

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

   **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:** ELET1520

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 #: 9781418041830

J. **Course Description:** This course explores the use of diode applications, bipolar and unipolar transistors, Field Effect Transistors, oscillators, feedback, thyristors and the 555 timer. Topics will include power supplies, multi-stage amplifiers, inverting and non-inverting op-amps, filters, SCRs and Triacs. OET 005
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>
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<tr>
<td>Communication – Speech</td>
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<td>Intercultural Knowledge and Competence</td>
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<td>Critical Thinking</td>
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<td>Information Literacy</td>
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<td>Quantitative Literacy</td>
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</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. Explain the conditions that exist at the PN junction of an unbiased, reverse biased, or forward biased diode.</td>
<td>Lecture, Labs, and Quizzes during week 1 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>2. Draw diagrams of half-wave, full-wave, and bridge rectifier circuits and explain how each works.</td>
<td>Lecture, Labs, and Quizzes during weeks 4 and 5 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>3. Measure RMS, Peak, and average voltages of various rectifier circuits.</td>
<td>Lecture, Labs, and Quizzes during weeks 2 and 3 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>4. Describe how a zener diode is used and calculate the various values related to zener circuits.</td>
<td>Lecture, Labs, and Quizzes during weeks 4 and 5 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>5. Given a NPN or a PNP transistor, student will be able to determine the proper bias polarity and current flow.</td>
<td>Lecture, Labs, and Quizzes during weeks 6 and 7 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>6. Given specific values, student will be able to interrelate alpha, beta, IC, IE, IB, ICEO, ICBO.</td>
<td>Lecture, Labs, and Quizzes during weeks 7 and 8 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>7. Given a common base transistor circuit with component values, student will be able to determine the Q point and plot the load line. Analyze the voltage gain, and input/output impedances of multi-stage amplifiers. Determine the power gains and efficiencies of Class A and Class B amplifiers.</td>
<td>Lecture, Labs, and Quizzes during weeks 7 and 8 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>8. Given a Junction Field Effect transistors values, the student will be able to interrelate IDSS, VGS(off), gm, gmo, and ID. Given the operating parameters, the student will be able to design both a JFET current source and a JFET analog switch</td>
<td>Lecture, Labs, and Quizzes during weeks 9 and 10 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>9. Describe the characteristics and operation of both depletion-mode and enhancement mode MOSFETs. Describe how E-MOSFETs are used in digital switching. Calculate voltage gains of common-source JFET amplifiers.</td>
<td>Lecture, Labs, and Quizzes during weeks 9 and 19 and throughout the remainder of the semester.</td>
</tr>
<tr>
<td>10. Calculate cut-off frequencies and the bandwidths of various op-amp circuits.</td>
<td>Lecture, Labs, and Quizzes during weeks 11 and 12 and throughout the remainder of the semester.</td>
</tr>
</tbody>
</table>
Outcomes | Assessments – How it is met & When it is met
--- | ---
11. Given an amplifier the student will be able to calculate the values of all coupling and bypass capacitors. | Lecture, Labs, and Quizzes during weeks 11 and 12 and throughout the remainder of the semester.
12. The student will be able to calculate, for a differential or operational amplifier, the: a. output voltage. b. voltage gain. c. common-mode rejection ratio (CMRR). | Lecture, Labs, and Quizzes during weeks 11 and 12 and throughout the remainder of the semester.
13. Using operational amplifiers, the student will be able to design: a. an inverting amplifier. b. a non-inverting amplifier. c. a voltage follower. d. a summing amplifier. | Lecture, Labs, and Quizzes during weeks 11 and 12 and throughout the remainder of the semester.
14. Describe the operation of both RC and LC sinusoidal oscillators. | Lecture, Labs, and Quizzes during weeks 13 and 14 and throughout the remainder of the semester.
15. Use the 555 timer in both its monostable and astable modes. | Lecture, Labs, and Quizzes during weeks 13 and 14 and throughout the remainder of the semester.
16. Given a circuit, the student will be able to identify the type of negative feedback being used. | Lecture, Labs, and Quizzes during weeks 13 and 14 and throughout the remainder of the semester.
17. Describe the operation of various thyristors and how they are turned on and off. | Lecture, Labs, and Quizzes during week 15 and throughout the remainder of the semester.
18. Describe the operation of series and shunt voltage regulators. Describe the operation and characteristics of IC voltage regulators. | Lecture, Labs, and Quizzes during weeks 1 and 2 and throughout the remainder of the semester.

M. Topical Timeline (Subject to Change):

**Devices and Circuits**

**Week 1**
- Describe the difference between valence electrons and conduction-band electrons
- Describe the main difference between n-type semiconductor materials and p-type semiconductor materials
- Draw a diagram of a P-N junction, including the depletion region
- Draw a P-N junction that shows the polarity of applied voltage for forward biasing the junction
- Draw a P-N junction that shows the polarity of applied voltage for reverse biasing the junction

**Week 2**
- Explain the difference between the barrier potential and reverse breakdown voltage for a P-N junction
- Sketch the $I-V$ curve for a typical P-N junction, showing both the forward and reverse bias parts of the curve
- Describe how to connect a dc source to a junction diode for forward bias and for reverse bias
- Sketch the waveforms found in an ac circuit consisting of a diode and resistor
- Explain the function of diode clamping and clipper circuits
- Describe the operation and specifications for zener diodes

**Week 3**
- Explain the function of a simple zener diode circuit
- Describe the operation of LEDs
- Determine the value of a resistor to be placed in series with an LED for proper operation

**Week 4**
- List the basic elements of a power supply system
- Draw the three basic types of rectifier circuits: half-wave, center-tapped full-wave, and bridge circuits
- Explain the paths for current flow through the three basic types of rectifier circuits
- Describe the waveforms found across the diode(s) and at the output of the three basic types of rectifier circuits

**Week 5**
- Determine the unfiltered dc output voltage of specified rectifier circuits
- Briefly describe power supply filter action
- Identify power supply filter configurations
- Explain the purpose of a power supply voltage regulator

**Week 6**
- Draw the symbols and identify the emitter, base, and collector leads for NPN and PNP transistors
- Draw the symbols for NPN and PNP transistors and show the proper voltage polarities for the base-emitter terminals and for the collector-base terminals
- Explain the meaning and cite the mathematical symbols for emitter current, base current, collector current, base-emitter voltage, and collector-emitter voltage

**Week 7**
- Describe how increasing the forward-bias base current in a BJT amplifier decreases the voltage between the emitter and collector
- Describe the operation of a BJT when applied as a switch
- Explain the meaning of the curves shown on a family of collector characteristic curves
- Describe the meaning of the maximum voltage, current, and power ratings listed in BJT data sheets

**Week 8**
- Explain the basic transistor amplification process
- Describe the input and output characteristics of common transistor amplifier stages
- List the advantages of each common type of transistor amplifier stage
- Describe the difference between small-signal and power amplifier circuits
- Classify amplifiers by class of operation

**Week 9**
- Describe the classification of amplifiers and their operation from their load lines
- List typical applications for each classification of amplifier
- Perform a basic analysis of a common-emitter, Class A BJT that uses voltage-divider biasing

**Week 10**
- Describe the semiconductor structure and identify the schematic symbols for N- and P-channel JFETs, D-MOSFETs, and E-MOSFETs
- Determine the proper voltage polarities for operating N- and P-channel FETs
- Explain the difference between depletion and enhancement modes of operation for FETs
- Identify and explain the operation of common-source, common-drain, and commongate FET amplifier circuits
- Name some common practices for storing and handling MOSFET devices to ensure that they are not destroyed by static electricity

**Week 11**
- Explain the derivation of the term operational amplifier (op-amp)
- Draw op-amp symbol(s)
- Define the term differential amplifier
- Draw a block diagram of typical circuits used in op-amps
- List the key characteristics of an ideal op-amp
- Identify linear and nonlinear applications circuits for op-amps
- Distinguish between inverting and noninverting op-amp circuits

**Week 12**
- Perform voltage gain and resistance calculations for standard inverting and noninverting op-amp circuits
- Describe the operation of op-amps in voltage amplifiers, voltage followers, comparators, and Schmitt-trigger amplifiers
- Describe the function of op-amps in circuits originally designed for analog computers: summing amplifiers, differential amplifiers, differentiators, and integrators

**Week 13**

- Identify from schematic diagrams the BJT, FET, and op-amp versions of the Hartley, Colpitts, and Clapp oscillators
- Identify the tuning components and describe the procedure for determining the oscillating frequency of the Hartley, Colpitts, and Clapp oscillators
- Explain the operation of a crystal oscillator
- Identify from schematic diagrams the phase-shift and Wien-bridge oscillators
- Identify the tuning components and describe the procedure for determining the oscillating frequency of the phase-shift and Wien-bridge oscillators
- Define the operation of a monostable multivibrator and calculate the duration of the output pulse
- Define the operation of an astable multivibrator and determine the operating frequency for both symmetrical and nonsymmetrical output waveforms

**Week 14**
- Describe what a thyristor is
- Describe in detail the way an SCR can be switched on and off
- Explain the operation of simple SCR circuits including a power “on/off” push-button control circuit and an electronic “crowbar”
- Identify the symbols for, and describe the operation of, the gate-controlled switch, silicon-controlled switch, and light-activated VSRCR
- Identify and explain the purpose of thyristors connected in inverse parallel, or back-to-back
- Identify the schematic symbol and explain the operation of a diac
- Explain the details for starting and ending the conduction of a triac
- Identify phase-control power circuits that use thyristors
- Describe basic troubleshooting procedures for thyristors

**Week 15**
- Describe the operation of LEDs and photodiodes
- Determine the value of a resistor to be placed in series with an LED for proper operation
- Describe the purpose of laser diodes
- Understand the operation of seven-segment displays
- Understand the operation of optocouplers
- Understand fiber-optic cables
- Understand photoemitters and photodetectors

**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>
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</tbody>
</table>

Updated: 2/14/2017
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 though 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.