Course Number & Name: ELC 221 Electronics II: Amplifiers

Credit Hours: 4.0  Contact Hours: 6.0  Lecture: 3.0  Lab: 3.0  Other: N/A

Prerequisites: Grade of “C” or better in ELC 120

Co-requisites: None  Concurrent Courses: None

Course Outline Revision Date: Fall 2010

Course Description: This course extends ELC 120 to include AC analysis of transistor circuits. Electronic amplification is examined in considerable detail. Field effect transistors (FET) and integrated circuits (IC) are introduced. Laboratory work, complementing the theoretical work, is emphasized.

Course Goals: Upon successful completion of this course, students should be able to do the following:

1. design and analyze various amplifiers;
2. conduct, analyze and interpret experiments and apply experimental results to improve processes; and
3. write and orally present technical reports related to amplifiers.

Measurable Course Performance Objectives (MPOs): Upon successful completion of this course, students should specifically be able to do the following:

1. Design and analyze various amplifiers:
   1.1 explain the concept of amplification;
   1.2 describe the mechanism by which transistors can produce signal amplification;
   1.3 analyze various BJT bias circuits;
   1.4 analyze various FET bias circuits;
   1.5 draw separate equivalent transistor circuits for AC and DC signals;
   1.6 analyze and design common-emitter-configured amplifier circuits;
   1.7 analyze and design emitter-follower amplifier circuits; and
   1.8 analyze FET amplifier circuits
Measurable Course Performance Objectives (MPOs) (continued):

2. Conduct, analyze and interpret experiments and apply experimental results to improve processes:
   2.1 choose values for circuit components to separate AC from DC;
   2.2 select optimum operating point for large signal unclipped amplification;
   2.3 connect breadboard amplifiers and measure bias point and gain using a multimeter and an oscilloscope;
   2.4 access the manufacturer’s data sheet via the internet; and
   2.5 interpret the manufacturer’s data sheet

3. Write and orally present technical reports related to amplifiers:
   3.1 measure and record data in amplifier circuits in a precise manner;
   3.2 write technical reports at different formal levels; and
   3.3 communicate effectively in oral and written communications and technical presentations

Methods of Instruction: Instruction will consist of a combination of lectures, class discussions, classroom demonstrations, laboratory experiments, board work, group work and individual study.

Outcomes Assessment: Quiz, test, and exam questions are blueprinted to course objectives. Checklist rubrics are used to evaluate the laboratory reports for the presence of course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

Course Requirements: All students are required to:

1. Maintain regular attendance and participate in classroom discussions.
2. Complete homework assignments and lab reports on time.
3. Sit for all quizzes, tests, and exams as scheduled.
4. Read all assigned textbook pages.

Methods of Evaluation: Final course grades will be computed as follows:

<table>
<thead>
<tr>
<th>Grading Components</th>
<th>% of final course grade</th>
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<tbody>
<tr>
<td>Homework, quizzes, class participation, and attendance</td>
<td>25 – 30%</td>
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<tr>
<td>8 or more Laboratory Reports</td>
<td>20 – 25%</td>
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A perusal of homework problems and quizzes and an analysis of class discussion will indicate the extent to which students master course objectives.

Students will be expected to show that they have read assigned lab manual sections, can follow written procedures, measure and record data, perform calculations and write reports including all specified components. Lab reports will provide evidence of the extent of student mastery of course objectives.
Methods of Evaluation (continued):

<table>
<thead>
<tr>
<th>Grading Components</th>
<th>% of final course grade</th>
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<tr>
<td>• Midterm Exam</td>
<td>20 – 25%</td>
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<td>The midterm exam will show evidence of the extent to which students meet course objectives, including but not limited to identifying and applying concepts, analyzing and solving problems, estimating and interpreting results and stating appropriate conclusions using correct terminology, based on course material covered during the first half of the semester.</td>
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• Final Exam (comprehensive)        | 25 – 30%                |
| The same objectives apply as with the Midterm Exam, but it is anticipated that students will provide increased evidence of synthesizing a combination of concepts covered throughout the semester. |

NOTE: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

Academic Integrity: Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

• plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
• cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
• interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
• fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

Student Code of Conduct: All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, Lifeline, for more specific information about the College’s Code of Conduct and attendance requirements.

<table>
<thead>
<tr>
<th>Week</th>
<th>Content/Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Small-Signal Operation, Base-Biased Amplifier, Emitter-Biased Amplifier (Chapter 9)</td>
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</table>
| 2    | AC Current Gain, AC Resistance of the Emitter Diode, T Model & π Model (Chapter 9)  
**Lab 1:** The CE Amplifier (exp.23) |
| 3    | AC Voltage Gain, Loading Effect of Input Impedance, Multistage Amplifier (Chapter 10)  
**Lab 2:** CC and CB Amplifiers (exp.26) |
| 4    | Swamped Amplifier, Two-Stage Feedback (Chapter 10)  
**Lab 3:** Class A Amplifiers (exp.28) |
| 5    | Emitter Follower, Output Impedance, Cascading CE and CC (Chapter 11)  
**Lab 4:** Cascaded CE Stages (exp.25) |
| 6    | Darlington Connections, Voltage Regulation, Common-Base Amplifier (Chapter 11) |
| 7    | Review and **Midterm Exam** |
| 8    | Coupling Capacitors, DC Load Line and AC Load Line, MPP (Chapter 12)  
**Lab 5:** Coupling and Bypass Capacitors (exp.22) |
| 9    | Power Gain, Output Power, Efficiency of a VDB Amplifier (Chapter 12) |
| 10   | Push-Pull Circuit, Resonant Frequency, Bandwidth, Duty Cycle (Chapter 12)  
**Lab 6:** Class B Push-Pull Amplifiers (exp.29) |
| 11   | Drain Curve and Trans-conductance Curve of JFET (Chapter 13) |
| 12   | JFET Amplifiers and JFET Analog Switch (Chapter 13)  
**Lab 7:** JFET Amplifiers (exp.33) |
| 13   | Depletion-Mode and Enhancement-Mode MOSFET, Digital Switching (Chapter 14) |
| 14   | CMOS, Power FETs, E-MOSFET Amplifiers (Chapter 14)  
**Lab 8:** Power FETs (exp.35) |
| 15   | **Final Exam** |