EET 2220

Electronic Devices and Circuits.

Alex Sergeyev
Objective

Communication, electronics and power have converged to provide more efficient manufacturing process for various types of industry.

Industrial and commercial equipment installed with electronic devices, programmable logic controllers is finding widespread application, and communications networks at the device, control, and information levels are used to monitor many industrial processes.

Engineers and technologists today, and in the future, will require a broad background in all of these areas.
Course Description

• Introduction to solid-state electronic devices and their applications.
• Topics related to diodes, transistors, and operational amplifiers ICs are to be discussed.
• Transistor biasing, temperature stabilization and gain calculations of single and multistage amplifiers.
• Study power amplifiers, frequency response, heat sinking, and power supply design.
Course Objectives

• Discuss the basic structure of semiconductors.
• Describe the construction and characteristics of diodes, bipolar junction transistors (BJTs), field-effect transistors (FETs), and operational amplifiers.
• Explain the operation of basic biasing circuits
• Analyze, design, and describe the operating characteristics of basic single and multistage amplifier configurations.
• Explain how diodes and BJTs can be used in switching circuits and DC power supplies.
• Describe the characteristics of operational amplifiers.
• Understand the operation of inverting and non-inverting amplifiers.
Laboratories

The weekly lab experiments are selected from the following list to reinforce the topics discussed in recitation. The order in which these experiments are performed will be determined by the recitation topics. Some of these may be omitted and other experiments may be added as needed.

Electrical Measurements
The Diode Characteristic
Diode Rectifiers
Bipolar Junction Transistor Characteristics
Bipolar Transistor Biasing
The Common-Emitter Amplifier
Multi-stage Amplifiers
JFET Characteristics
FET Amplifiers
Class-B power Amplifier
Lower and Copper Cutoff Frequencies
Operational Amplifier Characteristics
Low Pass and High Pass Active Filters
Voltage Regulators
MTU

Electronic Devices and Circuits.

Course Number: EET2220
Course Name: Electronic Devices and Circuits
Credits: 4 semester credits (0-3-1)
Semester: Spring 2011
Section: R01 – L01

Day / Time:
  Recitation: MWF 10:05 to 10:55
  Lab: L01 Th 2:05 to 4:55

Rooms:
  Recitation: Room EERC314
  Lab: Room EERC431

Textbook:
  Note: Retain this textbook for future courses.
Course Description: Introduction to solid-state electronic devices and their applications. Topics related to diodes, transistors, and operational amplifiers ICs are to be discussed. Transistor biasing, temperature stabilization and gain calculations of single and multistage amplifiers. Study power amplifiers, frequency response, heat sinking, and power supply design.

Course Objectives:  
Upon successful completion of this course students should have the knowledge to:

- Discuss the basic structure of semiconductors.
- Describe the construction and characteristics of diodes, bipolar junction transistors (BJTs), field-effect transistors (FETs), and operational amplifiers.
- Explain the operation of basic biasing circuits
- Analyze, design, and describe the operating characteristics of basic single and multistage amplifier configurations.
- Explain how diodes and BJTs can be used in switching circuits and DC power supplies
- Describe the characteristics of operational amplifiers.
- Understand the operation of inverting and non-inverting amplifiers.

Class Sessions: Class time will be devoted to presenting new topics and working through example problems.
<table>
<thead>
<tr>
<th>Course Evaluation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework (will be assigned but not graded)</td>
<td>0%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Lab Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Presentation\Report</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grading Scale</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% or greater</td>
<td>A</td>
</tr>
<tr>
<td>85 – 89</td>
<td>AB</td>
</tr>
<tr>
<td>80 – 84</td>
<td>B</td>
</tr>
<tr>
<td>75–79</td>
<td>BC</td>
</tr>
<tr>
<td>70 – 74</td>
<td>C</td>
</tr>
<tr>
<td>65 – 69</td>
<td>CD</td>
</tr>
<tr>
<td>60 – 64</td>
<td>D</td>
</tr>
<tr>
<td>&lt; 60%</td>
<td>F</td>
</tr>
<tr>
<td>Homework:</td>
<td>Assigned weekly and solutions sent out via e-mail. Homework assignment will not be graded but should be worked thoroughly to prepare for the following quiz.</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Quizzes:</td>
<td>Short, announced quizzes will be given upon receiving the homework assignment on the related material. Homework problems or similar will appear on weekly quizzes.</td>
</tr>
<tr>
<td>Laboratory Assignments:</td>
<td>Laboratory assignments must be completed as indicated by the instructor. A week is allowed for report to be written when required. No late assignments will be accepted unless prior arrangements with the instructor were made. All work must be completed neatly; assignments that are difficult to read or follow will not be graded. Before leaving the lab, components should be returned to their proper drawers in the parts cabinet, lead wires should be returned to the racks, and all instruments should be turned off. The weekly lab experiments are selected from the following list to reinforce the topics discussed in recitation. The order in which these experiments are performed will be determined by the recitation topics. Some of these may be omitted and other experiments may be added as needed.</td>
</tr>
</tbody>
</table>
|                | *Electrical Measurements*  
|                | *The Diode Characteristic*  
|                | *Diode Rectifiers*  
|                | *Bipolar Junction Transistor Characteristics*  
|                | *Bipolar Transistor Biasing*  
|                | *The Common-Emitter Amplifier*  
|                | *Multi-stage Amplifiers*  
|                | *JFET Characteristics*  
|                | *FET Amplifiers*  
|                | *Class-B power Amplifier*  
|                | *Lower and Copper Cutoff Frequencies*  
|                | *Operational Amplifier Characteristics*  
|                | *Low Pass and High Pass Active Filters*  
|                | *Voltage Regulators* |
Presentation: Each student will give 20 minute lecture/presentation on the related to the class topics material with the goal to develop and enhance student’s presentation skills. Upon presenting the material the student will write a concise report on the presented topic. Possible sources, due dates, and the format of the report will be announced in the class.

Examination: Two-hour final exam will be given at the completion of this class. If you must miss the scheduled exam date, you must make arrangements with the instructor before the exam. If no arrangements are made and your absence is unexcused, your grade will be a zero.

Expectations of Students:
- You will attend class every session, and come to each session prepared, having read the assigned sections of the textbook.
- You will attempt all homework: problems in order to prepare for the quiz.
- You will be respectful to your classmates.
- You will ask for help if needed and contact the instructor to receive assignments you may have missed.
- You are responsible for the material covered in required reading whether that material is covered in lectures or not
- Proper professional and ethical behavior is expected of all students in this class. If cheating is suspected, the Dean of Students will be notified and standard MTU policies will be followed.
University Policies: Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled in accordance with the University's policies.

If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please see me as soon as possible so that we can make appropriate arrangements. The Affirmative Action Office has asked that you be made aware of the following:

_Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office, at 487-2212. For other concerns about discrimination, you may contact your advisor, department head or the Affirmative Action Office, at 487-3310._

Academic Integrity: [http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html](http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html)

Affirmative Action: [http://www.admin.mtu.edu/aae/](http://www.admin.mtu.edu/aae/)

Disability Services: [http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability](http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability)

Tentative Schedule:

Week:  
1  Jan 10- Jan 16  No labs  
2  Jan 17- Jan 23  Lab 1  
   Jan 17 No class  (Martin Luther King Jr. recess)  
3  Jan 24- Jan 30  Lab 2  
4  Jan 31- Feb 6  Lab 3  
5  Feb 10 No labs  (Winter Carnival)  
   Feb 11 No classes  (Winter Carnival)  
6  Feb 14- Feb 20  Lab 4  
7  Feb 21- Feb 27  Lab 5  
8  Feb 28- Mar 6  Lab 6  
   Mar 2 Midterm Exam  
   Mar 7- Mar 13 Spring break  
9  Mar 14-Mar 20  Lab 7  
10 Mar 21- Mar 27 Lab 8  
11 Mar 28- Apr 3  Lab 9  
12 Apr 4- Apr 10  Lab 10  
13 Apr 11- Apr 17 No labs  
14 Apr 18- Apr 24 Final Exam  
15 Apr 26- Apr 30 SPIE Conference (out of town)
Learning Techniques

• Attend the lectures: “Receive and Capture”

• Go through your notes and slides repeatedly

• Read the book: “Extremely important”

• Make an attempt to solve the homework problems without looking in the provided solutions

• Try to gain as much practical experience from the labs (if any)

• Participation in presentations will broaden your scope, make the learning curve steeper, and build your confidence.

• Ask questions: “There are no stupid questions”

• Work in teams: “Learning through discussion”