SYLLABUS
ENGR 370: Micro-Electronics I
(Required Course)
Fall 2014

INSTRUCTOR
- Dr. Il-Seop Shin
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- Office Hours: TBA (Open-door policy in the meantime - walk in when the door is open.)

CLASS SCHEDULE
- T/Th, 11:00 A.M. - 12:15 P.M. at Riverfront 120

CATALOG DESCRIPTION
- An electronics course for interdisciplinary engineers dealing with the design, analysis, and strategies for using Op Amps, semiconductor devices in both analog and digital power electronics, communications systems, sensor systems, and electric power applications as part of a Mechatronic System.

COURSE PREREQUISITES
- ENGR 271 Engineering Electrical Circuits

REQUIRED TEXTBOOK

REFERENCES

COMPUTER/SOFTWARE SKILLS
- NI ELVIS II+, MultiSim, LabView, MATLAB, MS Office, scientific calculator

TOPICS COVERED
- Ch. 6: Frequency Response and System Concepts
- Ch. 8: Operational Amplifiers
- Ch. 9: Semiconductors and Diodes
- Ch. 10: Bipolar Junction Transistors: Operation, Circuit Models, & Apps
- Ch. 11: Field-effect Transistors: Operation, Circuit Models, & Apps
- Ch. 13: Digital Logic Circuits
- Ch. 14: Digital Systems
# COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM OUTCOMES (ABET Criteria 3a-3k)

<table>
<thead>
<tr>
<th>ENGR 370 Micro-Electronics I</th>
<th>Student Outcomes</th>
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<tr>
<td><strong>Outcome-Related Course Learning Objectives</strong></td>
<td>3a</td>
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<tr>
<td>Analyze direct-current (DC) circuits by applying the basic concepts, laws, and sign conventions.</td>
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<td>Model alternating current (AC) circuits using phasor in frequency domain.</td>
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<td>Analyze 1st and 2nd order electrical filters using passive elements and determine their frequency response.</td>
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<td>Design various operational amplifier (op-amp) circuits, including active filters and determine their frequency response.</td>
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<td>Model and analyze circuit devices that employ both ideal and practical operational amplifiers.</td>
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<td>Explain semiconductor material properties, including the two types of majority carriers in a semiconductor, and describe the mechanism to generate currents in a semiconductor.</td>
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<td>Model the ideal and practical $pn$-junction diode circuits (and a few specialized diode circuits) from the nonlinear voltage-current characteristics in small-signal and large-signal sense.</td>
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<td>Calculate the conduction states of diodes in circuits and distinguish the operations and purposes of different types of diode circuits.</td>
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<td>Design rectifier circuits, voltage references, and other semiconductor signal processing applications.</td>
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<td>Explain the operations of practical circuits using photodiodes, solar cells and other similar specialty semiconductor devices.</td>
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<tr>
<td>Learn the characteristics of Bipolar Junction Transistor (BJT) and conduct load line analysis for proper DC biasing of BJT circuits.</td>
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<td>Specify voltage transfer characteristics and process by which a BJT circuit can amplify a small input signal without output distortion.</td>
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<td>Design practical circuits using BJT such as amplifiers, small signal processors, and switches.</td>
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<td>Explain the characteristics and operations of Field Effect Transistor (FET).</td>
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<td>Model Metal-Oxide Semiconductor (MOS) FET circuits by following the similar steps, stated above for BJT, such as load line analysis.</td>
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<td>Design and analyze MOSFET transistors used in large signal amplifiers, switches, and digital logic circuits.</td>
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<td>Find out the difference between three distinct BJT and FET amplifier configurations, such as common-emitter (or-source) circuit, and explain the advantages and disadvantages in terms of signal power gain in the circuits.</td>
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<td>Differentiate the concepts of digital and analog signals, quantization, and number systems.</td>
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<td>Convert between decimal, binary, and hexadecimal number systems.</td>
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</table>
Apply Boolean logic and algebra to simplify the digital logic gates.

Structure truth tables, design logic gates and functions, and simplify them using Karnaugh maps (K-maps).

Design and analyze practical circuits using various combinatorial logic modules including buffer, multiplexer, memory, and decoder.

Analyze the operation of various sequential logic circuits, such as latch, flip-flop, counter, and register.

Analyze synchronous sequential digital circuits, and validate the functionality and timing of design.

**CONTRIBUTION OF COURSE TO PROFESSIONAL COMPONENT**

- This course contributes to the engineering science component of the Engineering curriculum.

**Prepared by:** Dr. Shin  
**Date:** 08/18/2014  
**Last Updated:** 08/22/2014
DISCLAIMER STATEMENT

- Information contained in this syllabus, other than grading, late assignments, makeup work, and attendance policies, may be subject to change with advance notice, as deemed appropriate by the instructor.

COURSE ORGANIZATION

- **Student Centered Learning Model**
  Students are expected to take appropriate responsibility for their own learning. I will lead you through the steps necessary to do this, and will provide you with opportunities in every class to test your learning and receive feedback.

- **Lecture and Laboratory Formats**
  The course consists of two 75-minute sessions per week. Class time will be divided into: (1) explaining and discussing basic concepts and solving relevant problems and (2) working on lab exercises. It is impossible to cover the entire course content during the lecture period; hence you will have to spend extra hours of study on your own. Students will have opportunities to improve (1) interpersonal skills by cooperative learning in group settings, (2) critical thinking to solve problems, and (3) written and oral communication and presentation skills by delivering technical reports and PPT presentations.

- **Cooperative Learning**
  Students must find group project member(s) and work together for the entire project period to achieve a common goal. They should have positive interdependence (need to rely on one another and learn from each other), individual accountability (must do their share and master all lab exercise material), and collaborative skills (communications, leadership, conflict management, etc.). If a team member is not participating, the other team members have a right to “fire” that person from the team. A “fired” team member is required to meet with the course instructor. However, students must switch their lab partner(s) for each lab exercise.

- **Class Attendance**
  Every student is expected to be on time every time and should not have unexcused absences. You are responsible for notes, homework assignments, lab exercises, and exams/quizzes missed while being absent. Medical or family emergencies should be discussed as soon as possible with the instructor, preferably before classes, test, etc.

- **Due Dates**
  Homework, papers, and reports should be converted/scanned to PDF files and submitted in WesternOnline Dropbox 10 minutes BEFORE the class begins on due date. The file name must include the title of the submission, last name, and first name (i.e., HW#04 – Frequency Response (Shin, Il-Seop).pdf). Acceptance of late submission of work, of any kind, is at the discretion of the instructor and generally not accepted. (When accepted, late submissions will be graded and then penalized 20% per day late. After 5 days, a perfect work has zero value.)

- **Course Grade**
  1. Assignments (four graded HWs and three research papers): 10%
  2. Five lab exercises and reports: 10%
  3. Nine quizzes: 20%
  4. A group design project: 15% (See the project grading policy)
5. One midterm exam: 20%
6. A comprehensive final exam: 20%
7. Professionalism/participation: 5%

The table below shows the grades guaranteed for the total percentage earned during the semester. If you are within one percentage point below the cutoffs, you may be awarded to the next higher grade depending on your performance on exams, homework assignments, attendance, etc.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93 - 100%</td>
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<tr>
<td>A-</td>
<td>90 - 92%</td>
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<tr>
<td>B</td>
<td>87 - 89%</td>
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<tr>
<td>B-</td>
<td>83 - 86%</td>
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<tr>
<td>C</td>
<td>77 - 79%</td>
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<tr>
<td>C-</td>
<td>73 - 76%</td>
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<tr>
<td>D</td>
<td>67 - 69%</td>
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<tr>
<td>D-</td>
<td>63 - 66%</td>
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<tr>
<td>F</td>
<td>&lt; 60%</td>
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**READING AND HOMEWORK**
- Reading the text and doing problems are essential to learning the material and developing professional engineering skills. Working with other students on homework assignments is encouraged, but your solutions must reflect your own efforts. In the end, you must be able to write up the solution to a problem on your own from scratch. The use of instructor solution manuals is not allowed. Please see the supplemental handout for more detailed comments on homework format.

**GENERAL GUIDELINES**
- If you have any problems or concerns with the course, please come and see me.
- Plan on spending at least 3 hours outside of class per lecture to read the text and work on problem assignments.
- Do not wait until the last day to start working on homework or preparing for an exam.
- I strongly suggest that you read the material before it is covered in class.
- Utilize the open-door office hours during the semester.
- There will be no make-up exams – except for a valid medical excuse or an absence based on an approved school activity. Make sure to provide sufficient notice – more than 1 week – if you must be gone for an approved school activity.
- Any forms of electronic communication devices, such as cellular phone, must be completely turned off. Unless specifically requested by the instructor, you are not allowed to use computers during the lecture.
- Food and drinks are NOT allowed in the classroom and laboratory.

**PROJECT ORGANIZATION**
- **Description**
  The class is divided into groups of 3-4 students. Each of these groups prepares a proposal and a Power Point presentation for an electronic circuit. They demonstrate their “working” system during the final presentation and deliver the final project report.
- **Deadlines** (Also, see Dropbox in the class website in WesternOnline)
  - Two-Page Proposal: **Tuesday, 10/28**
  - Final Project Presentation/Demonstration: **Tuesday, 12/09** and **Thursday, 12/11**
  - Deliverable in a CD or DVD: **Tuesday, 12/16**
Your two-page proposal consists of: (1) statement of the problem, (2) description of your system and approaches to solve the problem, (3) bill of materials, and (4) expected outcome.

- **Presentation**
  The Power Point presentation should not exceed 15 minutes (12 minutes and a 3-minute Q&A session). The final presentation is the highlight of your final report. (See the final report format items 1 and 6–11.) During the presentation, clear demonstration of “working” system must be made. The presentation slides must be submitted into Dropbox 10 minutes before the presentation.

- **Final Report**
  The final report presents all your activities, list of parts, hardware and software components, design criteria, etc. I suggest you to use your Power Point presentation as an outline for your paper. Also, you may want to incorporate some of your figures and diagrams in the Power Point slides within the paper. The report can be strengthened by following the guide “Mayfield Handbook for Technical & Scientific Writing.”

- **Final Report Format**
  1. Cover Page
  2. Abstract (summary of the project)
  3. Table of Contents (including page numbers for each section)
  4. List of Tables (with page numbers for each table)
  5. List of Figures (with page numbers for each figure)
  6. Overview
     - Statement of problem/motivation
     - Design objectives
     - Background and theory
  7. Design Approach and Decision Criteria
     - Details of the function of major parts and components used
     - Reasons to select the particular parts and components
     - Close-up photos of the parts and components
     - Way to put them together to achieve your purpose
     - Block diagrams or flow charts to enhance your explanation
     - Schematic and/or circuit diagrams (important!)
     - Close-up photos of the whole set up
  8. System Evaluation
     - Sample Calculations and Test results/performance
     - Unexpected findings
  9. Conclusions
  10. Recommendation and Future Work (if any)
  11. References (web addresses, books, journals, data books, etc. that you've referred to)
  12. Appendices
     - Appendix A: Bill of Materials (a table of four columns – product name, part number, quantity used, and its description, for each components used)
     - Appendix B: Program codes used for design, analysis, testing, etc. (important!)
     - Appendix C: Datasheets, user manuals, etc. of the components and parts used

- **Deliverable**
Each team must turn in every document used and/or created for the project, including the reports, presentation slides, references, specification sheets, and etc., saved in a CD or DVD by 10:50 A.M. on Tuesday, 12/16. Use the date on which the particular document is produced or presented as part of file name. No late submission will be accepted.

- **Group Project Grading (15% of the final grade)**
  The project is graded based on its complexity and completeness, written and oral presentations, and documentation. It is equally distributed to final report, final presentation, demonstration of working systems, and documentation. The system must be working for full or partial credit. There will be no credit if the proposed system is not working at all.

- **Notes**
  I strongly recommend you to get the components and parts necessary for your project as soon as possible. Students who cannot finish their project due to the delay in the delivery of components and parts will not be considered for partial credit. Again, there will be no credit if the proposed system is not working at all.

**WIU-QC UNIVERSITY WRITING CENTER**
- The U.S. Bank WIU-QC University Writing Center is available to assist you with general and specific questions on writing assigned in any discipline and at any academic level. The one-on-one assistance available is valuable for generating ideas, talking about global-level issues such as organization, and even working through grammatical problems. The writing center is located in Riverfront 2219. Call 309-762-9481 for an appointment and be sure to bring a copy of your assignment.

**ACADEMIC INTEGRITY POLICY**
- Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. Plagiarism and/or use of solution manuals on assignments are strictly forbidden and will not be tolerated.
- You are expected to have read and understood the current issue of the student handbook regarding student responsibilities & rights, policy information about procedures and what constitutes acceptable on-campus behavior. For more information, please see:
  - [www.wiu.edu/provost/students.php](http://www.wiu.edu/provost/students.php)
  - [www.wiu.edu/policies/acintegrity.php](http://www.wiu.edu/policies/acintegrity.php)

**AMERICANS WITH DISABILITIES ACT**
- In accordance with University policy and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation.
- For the instructor to provide the proper accommodations(s) you must obtain documentation of the need for an accommodation through Disability Support Services and provide it to the instructor. It is imperative that you take the initiative to bring such needs to the instructor’s attention, as he/she is not legally permitted to inquire about such particular needs of students.
- Students who may require special assistance in emergency evacuations (i.e. fire, tornado, etc.) should contact the instructor as to the most appropriate procedures to follow in such
an emergency. Contact Disability Support Services at 309-298-2512 for additional services.

BIOGRAPHY

- Students are asked to turn in their biographies. The instructor can better prepare for the course, depending on the individual’s background, educational objectives, and career objectives. It is due 10 minutes before the class on Thursday, 08/28 and should be typed in one page (8½”×11”) and submit a PDF file into Dropbox. Please, include:
  1. Brief background
  2. Engineering fields of your interest and educational objectives
  3. Career objectives