ECE 343 Electronics II Course Syllabus

Catalog Description: Introduces design and analysis of semiconductor circuits. Analog networks include amplifiers, power supplies and oscillators. Digital efforts are concentrated in the CMOS and pseudo-NMOS areas with a brief look at the BJT logic. Explores basic concepts of frequency response, feedback and data conversion. Lec 3, Lab 3. (Spring.) Credits: 4

Prerequisites: ECE 342 or permission

Instructor Information:

Instructor:	Nuri W. Emanetoglu
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Class & Laboratory Schedule:

Lectures: M-W-F 10:00-10:50 Barrows 130
Laboratories: 3 hour sections, Monday and Wednesday 2:10 – 5:00

Textbook: "Microelectronic Circuits", 6th ed., Sedra & Smith, 2010, Oxford University Press, ISBN: 978-0-19-532303-0

Course Web Access:

Blackboard will be used for distributing laboratory manuals, homework assignments and ancillary material, as well as to administer interactive homework assignments and/or quizzes.

Course Goals: Basic understanding of semiconductor circuit design with emphasis on analog circuits and microelectronics. Major topics include biasing, multi-stage amplifiers, frequency response, and feedback.

Topics:

- *Basic specs:* Current, power and voltage gain, input and output impedances. dynamic range, distortion, frequency response.
- *Basic techniques:* Small signal models, transfer functions, feedback using 2-port network approach, Barkhausen Criteria, modifying small signal models to account for device frequency limitations, dominant pole and zero-value time constant analysis.
- *Discrete and integrated circuit design techniques:* active loads, current mirrors, differential amplifiers, multistage amplifiers, power amplifiers, feedback amplifiers, oscillators
- *Technical Writing:* Generate clear, complete, concise and correct reports. Emphasizes theoretical support for design decisions, accurate and detailed laboratory procedure, proper use of figures and diagrams

Learning Objectives: By the end of the semester students should be able to:

- Explain current and voltage biasing techniques
- Analyze and design moderate frequency amplifiers
- Use circuit simulation tools
- Choose amplifier types so that specific design goals can be met
- Determine the factors that limit an amplifier's frequency bandwidth
- Use test equipment to design, build and verify performance of circuits
- Determine if an amplifier with feedback will be stable
- Utilize negative feedback in amplifier design and positive feedback in oscillator design
- Bring a design from paper to prototype
- Work with colleagues in organizing activities in completing labs/reports
- Write technical documents that are clear, concise, correct and complete
- Explain the differences between discrete and integrated circuit design

A more detailed list of learning objectives will be presented at the beginning of every chapter.

Laboratory/Computer Use

- Converting theoretical design to working prototype, use of simulation to verify and improve initial design, use of SPICE, Matlab, Mathcad, and standard test tools (signal generators, oscilloscopes, etc.) with computer interface. Students are given a basic set of specifications. They are expected to design, test and evaluate a circuit to meet and exceed those requirements.
- Writing of technical reports.
- Digilent's *Analog Discovery* module is mandatory. This USB data acquisition (DAQ) system will be used in class, for homework assignments and your lab experiments. The complete package includes the Analog Discovery USB DAQ, a BNC break out board, two 10x oscilloscope probes and mini grabber hooks. If you do not already have the kit from ECE 342 in Fall 2013, you can purchase the kit with a student discount at: http://www.digilentinc.com.

Grading Scheme:

Three graded exams:	110 points each (11% each, total of 33% of course grade)
Final exam:	180 points (18% of course grade)
Quizzes and Homework:	140 points (14% of course grade)
Project:	300 points (30% of course grade)
Instructor Evaluation:	50 points (5% of course grade)
	1000 points total

- A short quiz may be administered at the start of the Friday lecture or one homework problem may be collected instead.
- Quizzes/Homework may not be made up.
- Most assigned homework will not be collected or graded. However, homework problems which have been identified as being "required" should be prepared

before the due date, and be available to turn in upon request. These problems may (or may not) be collected instead of a Friday quiz.
- Homework assignments that require building and testing a circuit will be collected and graded.
- The "Instructor Evaluation" will be based on your participation level in the class, and your perceived contribution to your lab group. You are expected to attend lectures, and interact with the instructor an appropriate amount during the lecture. All students are expected to start homework assignments early. A sure way to get a poor evaluation is to put off asking questions about homework or lab until close to the due date.
- Project grades are based upon documentation presented in bound lab notebooks, technical reports describing the lab design and implementation, and demonstration of circuit performance where applicable.
- The project is a Discrete Transistor Op-Amp Design and Implementation, and Integrated Circuit Op-Amp Design. The project has multiple tasks. Each task must be completed and reported by a set deadline (see Blackboard). Seventy percent of the lab grades will be based on completing the assigned tasks by their deadlines (i.e. meeting specifications). The remaining thirty percent will be assigned based on how well the project exceeds specifications.

Professional Component Contributions:
This course contributes to the one and one-half years of engineering science and design requirement. Students learn how practical limitations such as tolerances, available range of values (for reasonable cost) impinge on final design choices. Students become aware of the significance of testability in their designs and become cognizant of the importance of accurate simulation models when using simulation to finalize a design. Students gain experience working as a team.

Course Policies
Class/laboratory attendance: No formal requirement for lecture attendance. Absence from a Friday quiz will result in a zero for that quiz.

The Al Whitney Electronics Laboratory is available to students from 8am to 5pm M-F with attendance expected during briefings which occur on Mondays or Wednesdays from 2:10 to 3:00. Lab TAs are available during scheduled lab times (Monday-Thursday 2:10- 5:00pm). Students must attend individually scheduled task demonstrations, or receive a zero for that portion of the lab grade.

Students are encouraged to communicate with each other on homework assignments. However, each student is expected to hand in their own work and write-up. Solutions copied from other students, or copied from the web will receive no credit.

Makeup Exams: Given under exceptional circumstances.

Academic honesty (plagiarism, etc.): Academic dishonesty includes cheating, plagiarism and all forms of misrepresentation in academic work, and is unacceptable at

The University of Maine. As stated in the University of Maine's online undergraduate "Student Handbook," plagiarism (the submission of another's work without appropriate attribution) and cheating are violations of The University of Maine Student Conduct Code. An instructor who has probable cause or reason to believe a student has cheated may act upon such evidence, and should report the case to the supervising faculty member or the Department Chair for appropriate action. If you have any questions about w hat constitutes plagiarism, cheating, or fabrication, please discuss this with your instructor.

Students with disabilities: If you have a disability for which you may be requesting an accommodation, please contact Ann Smith, Director of Disabilities Services, 121 East Annex, 581-2319, as early as possible in the term.

Course Schedule Changes: In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Orderly Conduct: The instructional facility must be kept organized and clean. Each student is responsible for ensuring that the equipments on his/her workbench are neatly arranged and there are no scrap papers and garbage left on his/her workstation. There is no eating or drinking in the Electrical and Computer Engineering classes/laboratories.

Use Of Course Materials As Research Data: Materials gathered as part of regular classroom activities (lecture, lab, recitation) may be used for research purposes. Data will have identifying information removed prior to publication or public presentation to protect students' identities. Data include any of the following, which are part of normal classroom activities: exams, homework assignments, quizzes, lab reports, BlackBoard communications, and any extra credit assignments. These data may come from graded elements of the course, but the collection of the data will not affect your grade. If at any time you would like to opt out of having your materials used for research purposes please contact John Thompson (thompsonj@maine.edu) or Michael Wittmann (mwittmann@maine.edu). Allowing or disallowing the inclusion of materials for research purposes will have no impact on your grade.

Prepared by Nuri W. Emanetoglu, January 2014.