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4	Nevzat G. Gençer	DZ-02	ngencer@metu.edu.tr	http://www.eee.metu.edu.tr/~ngencer/
5	Haluk Külah	DZ-05	kulah@metu.edu.tr	http://www.eee.metu.edu.tr/~kulah/

Course Description:

We live in an almost purely analog world. All events have a continuous nature and event variations occur gradually over a certain amount of time. Our perception of the world-visually, physically, sonically-is continuous (analog) for all practical purposes. Thus, although many of today's electronic systems are based on digital circuits, from hand-held calculators to the most sophisticated supercomputers, all of these systems eventually need to be interfaced with the analog world. The analog signals received from (or transmitted to) the outside world will often require amplification, processing to remove noise, and filtering to enhance the signal spectrum of interest before they are fed into digital computers. Almost all of these functions require analog circuits. Analog circuit design is a major branch of electronics that is necessary and vital for any person who is graduating with a degree in electrical engineering and electronic circuits and systems. This course is designed to introduce you to this branch of electrical engineering.

The course will cover basic single stage and multistage transistor amplifiers (both bipolar junction transistors and field-effect transistors), biasing, gain, and frequency response of analog circuits, operational amplifiers, feedback amplifiers, differential input stages, output stages, and amplifier stability.

Textbook:

A. S. Sedra & K. C. Smith, *Microelectronic Circuits*, 5th. Ed., Oxford University Press, 2004

Reference Books:

- Richard C. Jaeger, Travis N. Blablock, *Microelectronic Circuit Design*, 2003
- M. N. Horenstein, *Microelectronic Circuits and Devices*, 2nd Ed., Prentice Hall, 1996

Take-home exams:

Take-home exams are *essential part* of this course, and due to the nature of these assignments, you are expected to work on them by yourself. Observation of any unethical conduct on your submitted work will naturally result in disciplinary action and no grade will be given as the Take Home Exam Grade. Your work will be collected on the due date in class just before the lecture starts. Late submissions will not be accepted.

Attendance:

Any attendance rate below **%75** will result in NA grade, which does not mean that any attendance rate higher than the above will be sufficient to be successful in this course. Good attendance rate is %100. If you must miss a lecture in the case of emergency or sickness, you must present a legal document to your section instructor as soon as this situation is over. Please also make sure that you cover the topics presented in this lecture before you attend the next one.

Grading:

Take-Home Exams	: % 8
Midterm 1	: % 28
Midterm 2	: % 28
Final Exam	: % 36

Course Web Site: http://www.eee.metu.edu.tr/~askar/EE311/

Topics	Section in the Text Book	Dur. (hrs)	Total (Hrs)
Review of Amplification with transistors	1.5, 4.7.1, 4.7.2, 5.7.1, 5.7.2	3	3
Small signal operation and models	4.6	RA	3
The Common-Source (CS) Amplifier	4.7.3, 4.7.4	1	
The Common Gate (CG) Amplifier	4.7.5	1	
The Common Drain (Source Follower)	4.7.6	1	
Small signal operation and models	5.6	RA	3
The Common-Emitter (CE) Amplifier	5.7.3, 5.7.4	1	
The Common Gate (CB) Amplifier	5.7.5	1	
The Common Collector (Emitter Follower)	5.7.6	1	
Summary and Comparisons	5.7.7	RA	
Example on Multistage Amplifiers	Class Notes	1	3
Bode Plots	Class Notes	2	
The Gate and Junction Capacitances	4.8.1, 4.8.2	2	3
The High Frequency MOSFET Model	4.8.3		
The Unity-gain frequency	4.8.4		
The Three Frequency Bands	4.9.1		
The High Frequency Response	4.9.2		
The Low Frequency Response	4.9.3	1	
The SPICE MOSFET Model	4.12	R.A	
The Diffusion and Junction Capacitances	5.8.1, 5.8.2, 5.8.3	2	3
The High Frequency Hybrid π Model	5.8.4		
The Unity-Gain Frequency	5.8.5		
The Three Frequency Bands	5.9.1		
The High Frequency Response	5.9.2		
The Low Frequency Response	5.9.3	1	
The SPICE BJT Model	5.11	R.A	
Comparison of the MOSFET and the BJT	6.2	R.A	6
High & Low Frequency Response	6.4 & Class Notes	2	
The BJT Cascode Amplifier	6.8.3	1	
Some Useful Tranistor Pairings	6.11	1	
The Basic MOSFET Current Source	6.3.1	2	
MOS Current Steering Circuits	6.3.2.		
BJT Current Mirror	6.3.3.		
The SPICE Simulation Examples	6.13	RA	
The MOS Differential Pair	7.1.1, 7.1.2	1.5	7
Large-signal Operation	7.1.3	RA	
Small Signal Operation of the MOS Differential Pair	7.2	1.5	
The BJT Differential Pair	7.3.1, 7.3.3	2	
Large-signal Operation	7.3.2	RA	
Other Nonideal Characteristics of the Differential Amplifier	7.4	1	
The Differential Amplifier with Active Load	7.5.1-7.5.4	1	
SPICE Simulation Example	7.8	RA	
The General Feedback Structure	8.1	2	6
Some Properties of Negative Feedback	8.2		
The Four Basic Feedback Topologies	8.3		
The Series-Shunt Feedback Amplifier	8.4	1	
The Series-Series Feedback Amplifier	8.5	1	
The Shunt-Shunt and Shunt-Series Feedback Amplifiers	8.6	1	
Determining the Loop Gain	8.7	RA	
Stability Study Using Bode Plots	8.10	2	
Frequency Compensation	8.11		
SPICE Simulation Example	8.12	RA	
Classification of Output Stages	14.1	1	3
Class A Output Stage	14.2		
Class B Output Stage	14.3	1	
Class AB Output Stage	14.4	1	
Biasing the Class AB Circuit	14.5		
Power BJTs	14.6	RA	
Variations on the Class AB Configuration	14.7	RA	
SPICE Simulation Example	14.10	RA	
The Two Stage CMOS OPAMP	9.1	2	2