

ESE 232 Introduction to Electronic Circuits

Credit:

3 units

Proposed Catalog Data for ESE 232:

Analysis and design of linear electronic circuits. Terminal characteristics of active semiconductor devices. Incremental and DC models for diodes, metal-oxide-semiconductor field effect transistors (MOSFETs), and bipolar junction transistors (BJTs). Design and analysis of single and multi-stage amplifiers. Volatile and non-volatile semiconductor memories. Understanding of common application circuits in integrated circuit chips. Semester-long design project (*e.g.*, designing circuits to process corrupted audio files).

Prerequisite:

ESE 230 Introduction to Electrical and Electronic Circuits

Textbook:

Microelectronic Circuits, A. S. Sedra and K. C. Smith, Oxford University Press

References:

1. Fundamentals of Microelectronics, B. Razavi, John Wiley & Sons, 2008
2. Microelectronic Circuit Design, R. C. Jaeger and T. N. Blalock, 3rd edition, McGraw Hill, 2006
3. MOSFET Modeling with SPICE, D. Foty, PTR Prentice Hall, 1997
4. Electronic Principles, A. Malvino, 6th edition, Career Education, 1998
5. Microelectronics Circuit Analysis and Design, D. Neamen, 3rd edition, McGraw Hill, 2006
6. The Art of Electronics, P. Horowitz and W. Hill, 2nd edition, Cambridge University Press, 2001
7. Schematic Capture with MicroSim PSpice, M. E. Herniter, 3rd edition, Prentice Hall, 1997
8. Nonvolatile Semiconductor Memory Technology, W. D. Brown and J. E. Brewer, IEEE Press, 1997
9. VLSI Memory Chip Design, K. Itoh, Springer, 2001

Prerequisite topics:

1. Circuit variables (current, voltage, impedance)
2. Elementary passive circuit elements
3. Steady state DC and AC circuit analysis
4. Linear circuits, superposition
5. Thevenin and Norton equivalence
6. Operational amplifiers
7. Single-time constant transient analysis
8. Complex-frequency variables
9. PSpice simulation tool

Course Objectives:

1. Terminal characteristics for diodes and transistors
2. Piece-wise linear models of diode and transistor circuits
3. Single and multi-stage amplifier circuits
4. MultiSim schematic entry and simulation tool
5. Commonly used integrated circuit chips such as operational amplifiers, memories
6. Project planning, coordination, and completion as a team

Topics Covered:

1. Review of signal sources, electrical variables, power source (1 lecture)
2. Model, theory, characteristics of diodes (1 lecture)
3. Different types of diodes (1 lecture)
4. Diode application circuits (1 lecture)
5. Model, theory, characteristics of MOSFETs (3 lectures)
6. Abstract models of amplifier (1 lecture)
7. Design and analysis of single-stage MOSFET amplifiers (3 lectures)
8. Multi-stage MOSFET amplifiers (2 lectures)
9. Model, theory, characteristics of BJTs (2 lectures)
10. Design and analysis of BJT amplifiers (2 lectures)
11. Ideal and non-ideal models for operational amplifier – inverting and non-inverting configurations (2 lectures)
12. Introduction to integrated-circuit chips (1 lecture)
13. Analog to digital conversion (1 lecture)
14. Signal to noise ratio, quantization, sample and hold (3 lectures)
15. Semiconductor memory (1 lecture)
16. In-class exam (1 lecture)
17. In-class review and project related discussions (2 lectures)

Total of 28 lectures

Class Schedule:

2 lectures per week, 90 minutes per lecture

Project:

Semester-long project

Student Evaluation:

1 midterm test, 1 final, bi-weekly homework, 1 project

Computer Usage:

MultiSim

Contribution of Course:

Engineering Topics:	3 units
Engineering Science:	2 units
Engineering Design:	1 unit