ESE 372 Electronics

Spring 2018

The pertinent elements of solid-state physics and circuit theory are reviewed and applied to the study of electronic devices and circuits, including junction diodes, transistors, and gate and electronic switches; large- and small-signal analysis of amplifiers; amplifier frequency response; and rectifiers and wave-shaping circuits.

The course is designed to provide the necessary theoretical support for lab courses ESE 211, 314 and 324.

Text Books: A.S. Sedra, K.C. Smith, "Microelectronic circuits", 7th edition, Oxford, ISBN 978-0-19-933913-6

Prerequisites: ESE 271

Corequisites: ESE 211 for ECE/ESE majors only

Goals: To develop perception of the role and performance of semiconductor devices in modern electronics. To build the foundation for design and analysis of an advanced integrated circuits.

Course Learning Outcomes:

Ability to design and analyze rectifying and signal shaping circuits. Ability to design and analyze single stage amplifier circuits based on bipolar junction and field effect transistors. Ability to control the frequency response of the filter and amplifier circuits.

Topics Covered:

Tentative lecture list.

L01. Introduction. Signals. Voltage amplifiers. Bias. Amplifier bandwidth.
L02. Operational Amplifiers. Negative feedback. OpAmp-based linear amplifiers.
L03. Miller Integrator. Lossy integrator. Sallen-Key circuits.
L04. Intrinsic and doped semiconductors. Electric current in semiconductors.
L05. Schottky and pn-junction diodes. Diode IV. Zener diodes. Circuits with diodes.
L06. Half wave rectifiers. Filtering capacitor.
L07. Full wave rectifiers.
L08. Operation of BJT. BJT input/output characteristics. Early effect. Ebers-Moll model.
L09. BJT circuits at DC. Gain of BJT-based circuit.
L10. Bias of BJTs. BJT small signal parameters.
L11. Common emitter amplifier – resistive bias. Common emitter amplifier – current source bias.
L12. Common base amplifier. Common collector amplifier.
L13. Low frequency response of BJT amplifiers – effect of coupling and bypass capacitors.
L14. BJT internal capacitances. Unity gain bandwidth.
L15. High frequency response of CE amplifiers.
L16. BJT differential pair.
L17. Metal-Oxide-Semiconductor capacitor. MOSFET's IV. Body effect. PSpice models.
L18. MOSFET circuits at DC. MOSFET current mirrors.
L19. MOSFET gain. MOSFET bias and small signal parameters.
L20. MOSFET Common Source, Gate and Drain amplifiers.
L21. Low frequency response of CS amplifier. MOSFET internal capacitances.
L22. Frequency response of CS amplifier and CG/CD discussion.
L23. MOSFET differential pair.
L24. Active load.
L25. MOSFET large signal analysis. Transistor as a switch.
L26. CMOS Inverter.

Class/laboratory Schedule: Lecture: 1hour 20min/2 days per week

Recitation: 55min/1 day per week

Grading: Exams - 70%, Homework - 30%.

Disability Support Services (DSS) Statement:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities]

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management Statement:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.