National Institute of Science Education and Research
School of Physical Sciences
Academic Session: 2016-2017 (III Semester)
P203: Electronics

Instructors	Office	Contact Numbers	E-Mail
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Lectures	Tutorial Hour	Venue
T 11:30-12:30; W 10:30-11:30; Th 9:30-10:30	F 8:30-9:30	LH-2

Course contents:

Foundations, passive elements, sources: dependent sources, survey of network theorems and network analysis, more on dependent sources, transient response of R-L circuit, R-C circuits, sinusoidal steady state response, diodes and diode circuits, power supply: rectifiers, full wave rectifier without center tapped transformer, bipolar junction transistors, constant current source, constant voltage source, field effect transistors, basic differential amplifier circuits, feedback and operational amplifiers, digital electronics, gates, universality of certain gates: using NAND gates, Boolean expressions, other ways of realizing logic functions, multiplexers, flip-flops and latches, counters, sequential circuits: master slave flip-flop (S-R), edge triggered flip-flops, signal averaging, lock-in amplifier, D/A & A/D converter, multi channel analyzer etc..

References:

- Paul Horowitz, Winfield Hill, The art of electronics, Cambridge University Press
- Thomas L. Floyd, Electronics Fundamentals/ Digital Fundamentals, Prentice Hall
- A. Agarwal and J. Lang, Foundations of Analog and digital Circuits, Morgan Kaufmann Publishers
- R. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory, Prentice Hall
- C. H. Roth and L. Kinney, Fundamentals of Logic design, Cengage Learning series
- R. A. Gayakwad, Op-amps and linear integrated circuits, Prentice Hall of India
- Ralph J. Smith, R. C. Dorf, *Circuits, devices and systems,* John Wiley
- Albert Malvino and David J. Bates, Electronic Principles, McGraw-Hill
- Millman and Grabel, Microelectronics, McGraw-Hill

Grading Policy:

Grading will be done based on your performance in assignments and quizzes (30%), mid semester test (30%) and comprehensive exam (40%). No make-up is granted under normal circumstances.

Discipline:

- Each individual has to submit his/her own handwritten home-assignments. The assignments are expected to be completed within a week.
- Attendance in all lectures is mandatory. Any absence will have to be sanctioned by the UGCS to be acceptable. You will have to have minimum of 80% attendance, to write the end semester examination.

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Course outline: Approximate lecture hours are mentioned in brackets.

1. Passive components: Resistance, Inductance, Capacitance; lumped element model; series, parrallel combinations; kirchoff's law: voltage, current; assumptions for the models; linearity - how to define it? (1)
2. Signalling sources: voltage and current sources; nonideal sources; representation under assumption of linearity; controller sources: VCVS, CCVS, VCCS, CCCS; concept of gain, transconductance, transimpedance. (1)
3. DC circuit analysis: node and loop analysis; Choice of nodes and branches for efficient analysis (Graph theoritic representation of circuit) (1)
4. Superposition theorm; Thevenin's theorm; Norton's theorm (1)
5. Time domain response of RL and RC circuits (2)
6. Sinusoidal steady state repsonse; phasor; impedance; transfer function of two port networks (1)
7. Frequencey response: concept; amplitude and phase response; Bode plots (2)
8. Passive filter circuits; computation of transfer function (1)
9. Two port networks: modeling; T and Π model; Π-T transformation and vice-versa (1)
10. Discrete electronic devices: Diode, zener diode, BJT (Bipolar junction transistor), LED, Photodiode, Phototransistor, varactor; characteristic and operation (qualitative description and quantitative behavior with blackbox approach) (1)
11. Diode circuits; clipper, clamper circuits. (1)
12. DC power supply: rectifier- half wave, full wave (center tapped, bridge), zener regulated power supply, regulation (with regulator IC- LM317). (2)
13. BJT characteristics; BJT biasing; CE-biasing circuits: operating point; h-parameter model of transistor; large/small signal models (concept); large/small signal models of CE-BJT amplifier (3)
14. Design of amplifier; Differential amplifier (using BJT). (2)
15. Operational amplifier: basic model; virtual ground concept; inverting amplifier; non-inverting amplifier; integrator; differentiator; Schmitt trigger; a stable multivibrator (3)
16. Basic feedback theory; +ve and -ve feedback; concept of stability; oscillator (1)
17. Waveform generator using op-amp schimitt trigger for Square wave, triangular wave Wien bridge oscillator for sinusoidal waveform (1)
18. Simple active filters: low pass, high pass, bandpass, notch filter (2)
19. Logic gates: OR, NOT, AND, NOR and NAND; universal gates; XOR and XNOR gate; Truth tables. (1)
20. Multiplexer; Gate base implementation (1)
21. Logic function representation, truth table from problem, combinatorial circuits. (1)
22. Designing combinatorial circuits: SOP, POS form; K-map; Optimization. (1)
23. Flip-flop; S-R flip-flop; JK masterslave flipflop; D-flip flop (2)
24. Sequencial circuits: Generic block diagram; finite state machine model. (1)
25. Counters: configruation, operation; up/down counters; shift registers; Sequence generators (2)
26. 555 timer: description, data sheet, multivirators (2)
27. D/A (Digital to Analog) convertor, A/D (analog to digital) convertor (2)

Objectives of the course

- To understand the language of electronics, elements and their functionality
- To understand methods to analyses and characterize the circuits
- To know analog and digital signals
- Basic processing of analog signals with analog circuits
- Digital systems - basic understanding for implementation of logic machines.

References present in the Library:

- Thomas L. Floyd, Electronics Fundamentals, Prentice Hall- -5 copies
- Thomas L. Floyd, Digital Fundamentals, Prentice Hall- -5 copies
- R. A. Gayakwad, Op-amps and linear integrated circuits, Prentice Hall of India- -5 copies
- A. Agarwal and J. Lang, Foundations of Analog and digital Circuits, Morgan Kaufmann Publishers -5 copies
- R. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory, Prentice Hall – 2 more
- C. H. Roth and L. Kinney, Fundamentals of Logic design, Cengage Learning series- -5 copies
- Ralph J. Smith, R. C. Dorf, *Circuits, devices and systems*, John Wiley - 5 copies