

JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2021-22 Batch Onwards
Programme: B.Sc.
FIRST SEMESTER SYLLABUS
Title: ELECTRONIC DEVICES AND CIRCUITS

Course Code: ELE-CT-1

No. of Hours: 60

COURSE OBJECTIVE:

- To understand Network theorems and concepts of AC circuits and DC circuits.
- To Apply concepts of Semiconductor diodes and transistors in the basic circuit.
- To analyze number systems and Boolean algebra.

LEARNING OUTCOME

At the end of this course, students will be able to

- Analyze AC and DC Circuits.
- Construct Basic circuits with Diode and Transistors.
- Realize the function of logic gates.

UNIT – 1

16 Hrs

Electronic Components: Passive and Active components, types and their properties, Concept of Voltage and Current Sources, equation for power (Qualitative only).

Network Theorems: Review of KCL & KVL, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems. DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits. (frequency response)

PN junction diode: Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode, Reverse saturation current, Zener and avalanche breakdown.

Rectifiers: Half wave and Full wave (centre tap and bridge) rectifiers, expressions for output voltage, ripple factor and efficiency (No Derivation), Shunt capacitor filter and Pi filter. Numerical examples wherever applicable.

UNIT – 2

12 Hrs

Voltage regulator: Block diagram of regulated power supply, Definition - Line and Load regulation. Zener diode as voltage regulator – circuit diagram, load and line regulation, Advantages and disadvantages.

Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317), Clippers (shunt type) and clampers (Qualitative analysis only), Voltage Multipliers – Working of Tripler

Special semiconductor devices: LED, LCD and solar cell – construction, operation and applications, 7-segment display, concept of common anode and common cathode types. Numerical problems, wherever applicable.

UNIT – 3

16 Hrs

Bipolar Junction Transistor: Construction, types, CE, CB and CC configurations (mention only), I-V characteristics of a transistor in CE mode, Regions of operation

(active, cut off and saturation), leakage currents (mention only), Current gains α , β and γ and their inter-relations, dc load line and Q point. Applications of transistor as switch - circuit and working. Numerical examples wherever applicable.

Transistor biasing and Stabilization circuits: Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor. Transistor as a two-port network, h-parameter equivalent circuit for CE.

Amplifier: Small signal analysis of single stage CE amplifier using re- model. Input and Output impedances, Current and Voltage gains. (only equations).
CC as emitter follower.

Types of coupling, two stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product, Darlington transistor, Current gain.

UNIT – 4

16Hrs

Number System: Decimal, Binary, Octal and Hexadecimal number systems and interbase conversions. Representation of signed and unsigned numbers.

Binary arithmetic: addition, subtraction by 1's and 2's complement method.

BCD code (8421, 2421, Excess-3), Self-complementing property of Excess-3, Gray code, error checking and correction codes (Only parity check). ASCII and EBCDIC codes.

Boolean Algebra: Constants, variables, operators, Positive and negative logic, basic logic gates- AND, OR, NOT, Boolean laws, Duality Theorem, De Morgan's Theorems, simplification of Boolean expressions. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates.

Text Book

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition., Universal Book 2003.
2. R S Sedha, "A Text book of Applied Electronics", 7th edition., S. Chand and Company Ltd.2011.
3. A.P. Malvino, "Principles of Electronics", 7th edition, TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky, 11th edn., Pearson, 2013
5. David A. Bell "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2015
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, (1994)

Suggested References

1. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Edn., TMH, 2011.
2. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
3. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
4. Digital Systems: Principles & Applications, R.J. Tocci, N.S. Widmer, PHI Learning, 2001
5. M. Nahvi & J. Edminister, "Electrical Circuits", Schaum's Outline Series, TMH, 2005
6. S. A. Nasar, "Electrical Circuits", Schaum's outline series, Tata McGraw Hill, 2004
7. J. Millman and C. C. Halkias, "Integrated Electronics", Tata McGraw Hill, 2001
8. A.S. Sedra, K.C. Smith, A.N. Chandorkar "Microelectronic circuits", 6th Edn., Oxford University Press, 2014
9. J. J. Cathey, "2000 Solved Problems in Electronics", Schaum's outline Series, TMG, 1991

ELECTRONIC DEVICES AND CIRCUITS – Lab

(Hardware implementation and Analysis of Circuit using Simulation Software)

Part – A (Any Six experiments including 2 Simulation Experiments)

1. Demonstration Experiments:

Hands on Experimental Skills and Familiarization with

- a) Electronic components
- b) Resistance in series, parallel and series-parallel
- c) Capacitors and inductors in series and parallel
- d) Multimeter and LCR meter – checking of components / measurements.
- e) Voltage sources in series, parallel and series-parallel
- f) Voltage and current dividers
- g) Measurement of Amplitude, Frequency & Phase difference using Oscilloscope

2. Verification of Thevenin's and Maximum Power Transfer Theorem.
3. Verification of Superposition Theorem.
4. Study of the I-V Characteristics of (a) P-n junction diode, and (b) Zener diode.
5. Study of the I-V Characteristics of LEDs of two different colours and 7-segment display.
6. Study of Half wave rectifier without and with shunt capacitor filter– ripple factor for different values of filter capacitors.
7. Study of full wave bridge rectifier without and with shunt capacitor filter – ripple factor for different values of filter capacitors.
8. Study of Zener diode as a Voltage Regulator using bridge rectifier with shunt capacitor filter [Load and line regulation].
9. Study of Clipping, Clamping and Voltage Multiplier circuits.

Part – B (Any Six experiments including 2 Simulation Experiments)

1. Study of Transistor characteristics in CE configuration – determination of h-parameters.
2. Study of single stage CE amplifier (frequency response, input and output impedances in mid-band
3. Study of two-stage RC-coupled CE amplifier (A_{V1} , A_{V2} , A_V) at mid-band frequency.
4. Study of Series and Parallel Resonance circuits – determination of its
 - a. Resonant frequency
 - b. Impedance at resonance
 - c. Bandwidth
 - d. Quality Factor
5. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs. Realization of XOR and XNOR using basic gates.
6. Universal property of NAND and NOR gates.
7. Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC 7486.
8. Verification of Demorgan's Theorem.