RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

Syllabus for B.Sc. Electronics (General)

Semester – I/III (July - December)
Course – ELTG1

Course Outcome:

i) Ability to study and identify various circuit elements and electronic devices.

ii) Ability to study and analyze different circuits and networks.

iii) Ability to obtain theoretical knowledge of construction and characteristics of various electronic devices and also to have the idea of working of those devices.

iv) Ability to design and study circuits based on those devices and motivate the students to do hands-on experiments in the laboratory.

Network Analysis and Analog Electronics
(Theory)
Paper: ELTG1

Marks: 50 **Credit:** 4

A: Network Analysis:

1. Electric Circuit Components: Resistors – types, configuration, colour coding, variable resistors, power rating; Capacitors – types, configuration, voltage rating, and capacitor coding; Inductor coils – self-inductance and mutual inductance, air-core and iron-core coils, variable inductance; Transformers: step up and step down. (To be discussed during laboratory introduction) [2]

2. Network Theorems: Voltage and Current sources, Conversion of Voltage source into Current source and viceversa, Dependent and Independent sources; Kirchoff's current law (KCL)

and Kirchoff's voltage law (KVL), Circuit analysis using KCL and KVL; Mesh analysis and Node analysis; Star (T or Y) and Delta (Pi or Δ) network, T to Pi and Pi to T conversions, Problem solving;

Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Superposition theorems, Reciprocity
theorem, Principle of Duality, Applications to simple problems. [7]

3. Transient response and resonance: Charging and discharging of a capacitor in CR circuit. Forced oscillations in a RLC circuit (qualitative), series resonance, Q factor, parallel resonance (basic idea). [3]

B: Analog Electronics:

4. Junction Diode and Its Applications: PN junction diode (Ideal and Practical), Constructions, Formation of Depletion layer, Diode Equation and I-V Characteristics, Reverse Saturation Current, Idea of Static and Dynamic resistance; Zener and Avalanche Breakdown, Zener Diode, Zener Diode as Voltage Regulator, Expressions for Load and Line Regulation; Qualitative idea of Schottky Diode.

DC Load Line analysis, Quiescent (Q) Point; Rectifiers, Half Wave Rectifier, Full Wave Rectifiers (Center tapped and Bridge), Circuit Diagrams, Working and Waveforms, Ripple factor and Efficiency; Filter, Shunt capacitor filter, Its role in Power Supply, Output Waveform and Working, Expressions for Load and Line Regulation. [8]

5. Bipolar Junction Transistor: Construction, Principle and Working of NPN/PNP Transistor, Terminology, CE, CB and CC configurations and characteristics, Regions of operation (Active, Cut-off and Saturation), Current Gains α and β, Relations between α and β, Leakage Currents. [4]

6. Transistor Biasing: Need for Biasing, DC Load Line and Operating (Q) Point, Thermal Runaway, Stability of Biased BJT circuit and Stability Factors, Fixed Bias, Collector to Base Bias, Voltage Divider Bias and Emitter Bias, Circuits and Working. [4]

7. BJT Amplifiers: Small Signal Analysis of Single Stage CE Amplifier, h-Parameter Equivalent Circuit, Frequency Response, Input and Output Impedance, Current and Voltage Gains;

Amplifier Classes: Class A, B, AB and C Amplifiers, Their operation principle with example circuits, Comparison of efficiency for various classes. (Basic Idea).

Cascaded Amplifiers: Two-stage RC coupled amplifier and its frequency response. [6]

8. Feedback Amplifiers and Sinusoidal Oscillators: Concept of Feedback, Feedback types: Negative and Positive Feedback, Feedback Fraction and Feedback Ratio, Topologies and Practical Circuits, Advantages of Negative Feedback (Basic Idea).

Concept of Oscillators: Advantages of Positive Feedback (Basic Idea), Barkhausen Criterion for Sustained Oscillations, Wien-bridge Oscillator, Colpitt's and Hartley Oscillators, Crystal Oscillator (Basic Idea only), Determination of Frequency and Condition of Oscillation. [8]

9. Unipolar Devices: Field Effect Transistors, Basic Structure and Types; JFET: n-channel and p-channel, Construction, Working and I-V Characteristics (Output and Transfer), Pinch-off voltage; MOSFET: Construction, MOS Capacitor, Channel Formation, n-channel (NMOS) and p-channel (PMOS), Threshold Voltage (Ideal and Real), Current-Voltage Relation, Depletion and Enhancement type (Normally ON/OFF) MOSFET, FET parameters. Advantages of FETs over BJTs; Complementary MOS (CMOS): Basic Idea;

Uni-Junction Transistor (UJT), Basic Construction, Working principle, Comparison with PN Diode and BJT, Equivalent Circuit and I-V Characteristics. [8]

Text / Reference Books:

1. Circuit Theory, A. Chakraborty, Dhanpat Rai & Co. (Pvt.) Ltd.
2. Foundations of Electronics, Chattopadhyay and Rakshit, New Age.
3. Fundamental Principle of Electronics, B. Ghosh, Books & Allied.
4. Basic Electronics, Theraja, S. Chand.
5. Electronic Devices and Circuit Theory, R. L. Boylestad and L. Nashelsky, Pearson Education.
6. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., TMH.
7. Analog and Digital Electronics, TaraprasadChattopadhyay, CBS Pub and Distributors.
8. Basic Electronics, K.K.Ghosh, Platinum Publisher.
9. Electronics (Classical and Modern), Dr. R. K. Kar, Books & Allied.
10. Foundations of Electronics, Cogdell, Pearson.
11. Electricity and Magnetism, Yearwood.
12. Network Analysis, D. Roychowdhury, New Age.
13. Circuits and Networks, SudhakarShyammohan, Tata McGraw Hill.
14. Electronics o BetarBigyanPorichoy (Bengali), Animesh Roy and Pradip Kr. Dutta, PoschimbongoRajyoPustokParsat.
15. Electricity and Magnetism, Chattopadhyay and Rakshit, New Central.
16. Electric Circuits: Schaum's Solved Problems Series, Nasar, Tata McGraw Hill.
17. Electric Circuits: Schaum's Outline Series, Nahvi and Edminister, Tata McGraw Hill.

18. Essentials of Circuit Analysis, Boylestad, Pearson.
19. Engineering Circuit Analysis, Hyat, Kemmerly and Durbin, Tata McGraw Hill.
20. Applied Circuit Analysis, Sadiku, Musa and Alexander, Tata McGraw-Hill.
21. Electric Circuits, Bel, Oxford.
22. Circuits, Carlson, Cengage.
23. Network Analysis and Synthesis, Kuo, Wiley.
24. Introduction to Electric Circuits, Dorf and Svoboda, Wiley.
25. Network Theory: Analysis and Synthesis, Ghosh, PHI.
26. Electrical Circuits: An Introduction, Smith and Alley, Cambridge.
27. Electronic Devices and Circuits, Bell, Oxford.
28. Electronic Circuits: Discrete and Integrated, Schilling and Belove, Tata McGraw Hill.
29. Microelectronic Circuits, Sedra, Smith and Chandorkar, Oxford.
30. Integrated Electronics: Analog and Digital Circuits and Systems, Millman and Halkias, Tata McGraw Hill.
31. Electronic Circuits: Analysis and Design, Neamen, Tata McGraw Hill.
32. 2000 Solved Problems in Electronics, Schaum's Outline Series, Cathey, Tata McGraw Hill.
33. Electronic Devices and Circuits: An Introduction, Mottershead, PHI.
34. Semiconductor Devices and Circuits, Dutta, Oxford.
35. Electronic Devices and Circuits, Rashid, Cengage.
36. Electronic Devices and Circuits, Bogart, Beasley and Rico, Pearson.

Network Analysis and Analog Electronics (Practical)
Paper: ELTG1

Marks: 25 **Credit: 2**

1. Introduction to electronic circuit components and use of them in practical circuits.

2. Familiarization with CRO and use it to measure amplitude, frequency and phase of an electric signal.

3. Verification of Thevenin's theorem and Norton's theorem.

4. Verification of Superposition theorem and Maximum power transfer theorem.

5. To study the series resonant RLC circuit and determine the resonant frequency, bandwidth and the Q factor.

6. To draw the static characteristic of forward-biased p-n junction diode and to determine the saturation current, diode quality factor, the dc and ac resistances at specified voltage.

7. To study the forward and reverse static characteristics of a Zener diode and to determine the breakdown voltage and dynamic resistance after breakdown.

8. To study the load and line regulation of a voltage regulator constructed using Zener diode.

9. To study half-wave and full-wave rectifier with and without capacitor filter. The waveform is to be studied with the help of a CRO.

10. To study the bridge-rectifier with and without filter. The waveform is to be studied with the help of a CRO.

11. Study of the I-V Characteristics of the Common Emitter Configuration of BJT and obtain r_i, r_o, β.

12. Design of a Single Stage CE amplifier of given Gain and study its Frequency Response.

13. Study of the I-V Characteristics of a JFET.

14. Study of the I-V Characteristics of a MOSFET.

15. To design a power supply and study its performance.

Text / Reference Books:

1. Advanced Practical Physics (Vol 1), B. Ghosh.
2. Advanced Practical Physics (Vol 2), B. Ghosh.
3. An advanced course in Practical Physics, Chattopadhyay and Rakshit, New Central Book Agency.
4. Basic Electronics: A Text Lab Manual, Zbar, TMH.
5. Laboratory Manual for Electronic Devices and Circuits, Bell.
6. Practical Physics,D. K. Maiti.