Syllabus Major SEM II

(Only for 2024-25 Session)

Major-2 (Theory): Electronics Foundation-II: ELSDSC202T (Credit: 3, Full Marks: 50, 45 Lecture-Hour)

Unit–I: Network Analysis - II **(Lectures - 30)**

1. Introduction to Laplace transform method, Convergence of the integral, Initial and final value theorems, Differentiation, Integration and time shifting in t and s domain, Transform of standard functions and their inverse.
2. Principle of duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer theorem, Millman's Theorem, Reciprocity Theorem, Compensation Theorem (Substitution Theorem), Star-Delta transformation Theorem, circuit analysis using network theorems.
3. Transient responses of series CR, LR and LCR circuits with DC excitation (using differential equation and Laplace transform).
4. Power in AC circuits (average power, instantaneous power), Power factor, Phasor diagram, Bode plot, AC analysis of CR, LR, and LCR circuits, Resonance in series and parallel LCR circuits and their frequency responses, Quality factor and bandwidth.
5. Passive filters: Lowpass, Highpass, Bandpass, Bandstop (First order only).
6. Two-port Networks–Impedance (Z) parameters, Admittance (Y) Parameters, h-parameters, Transmission (ABCD) parameters.

Unit – II: Physics of Crystalline Solids **(Lectures - 10)**

Crystalline materials: Crystal Structure in solids, Concept of Lattice, Basis, Crystal axes and planes, Miller indices. Primitive cells- of simple cubic cubic (s.c.), face centred cubic (f.c.c.) and body centred cubic(b.c.c.). Expressions for interplanar distance, Packing density, Coordination number of s.c., f.c.c and b.c.c. lattice, Reciprocal lattice and Brillouin zone, Bonding in Solids, Structure of Si and GaAs.

Unit – III: Semiconductor Band structure **(Lectures - 05)**

Band structure of homo and heterojunctions: E-K diagram. Direct and indirect bandgap semiconductors, Semiconductor heterostructures – Concept of creating semiconductor quantum wells using compound semiconductors. 2DEG. Its significance in optoelectronics, High speed switching and nanoelectronics

Recommended Books:

1. Solid State Electronic Devices: Ben G. Streetman, S.K. Banerjee, Pearson.
2. Electronic Devices: Floyd, Pearson
3. Solid State Physics: S.O. Pillai, New Age International (P) Ltd. International (P) Ltd.
4. Solid State Physics: A.J. Dekker, Macmillan Education.
5. The Art of Electronics: Paul Horowitz, Winfield Hill, Cambridge University Press.
6. Circuits And Networks: Analysis And Synthesis, Sudhakar and Shyammohan Tata McGraw Hill.
7. Circuit Theory Analysis and Synthesis: Salivahanan, Pearson
8. Electronics Fundamentals and Applications: Chattopadhyay and Rakshit, New Age International (P) Ltd.

Major–2 (Practical): Electronics Foundation-II Lab: ELSDSC202P (Credit:2, Full marks: 50, 60 Laboratory-Hour)

Expt. 1: Verification of Thevenin's theorem.

Expt. 2: Verification of Norton's theorem.

Expt. 3: Verification of maximum power transfer theorem.

Expt. 4: Verification of Superposition Theorem.

Expt. 5: Verification of equivalence of Star-Delta conversion and vice-versa.

Expt. 6: Study of RC circuit as lowpass and highpass filter (plot gain in dB as a function of frequency, use semi-log graph paper). Determine passband gain, 3 dB point, slope beyond the cut-off from the graph.

Expt. 7: Study frequency responses (amplitude of current Vs frequency) of a series and a parallel LCR circuits. Find the resonance frequency, Q factor and bandwidth for each these circuits