Course Code – 212302

Electronic Devices & Circuits - I

Credit Points	Teaching Hrs/Week	Practical Hrs/Week
5	3	2

Objective	To study Semiconductor devices & circuits in details
Prerequisites	None

Unit	Topic Name	Details	Hrs
1	**Semiconductor Physics And Materials**	Intrinsic and extrinsic semiconductors, Conduction mechanism in extrinsic semiconductors, Carrier concentrations, Semiconductor equations and carrier statistics: Excess carriers, Recombination process, Conductivity, Mobility, Mass action law, Einstein relationship. Graded semiconductor, drift and diffusion currents, Open circuited step graded junction	7
2	**Semiconductor Diode**	Theory of p-n junction, Depletion region, Barrier potential, Forward and reverse biased diode operation, V-I characteristic equation of diode, Temperature dependence of V-I characteristics, Forward and reverse dynamic resistance, Small signal and large signal diode models, junction capacitances, Diode data sheet specifications.	7
3	**Bipolar Junction Transistor**	BJT as a device, concept of amplification, BJT configurations, biasing BJT, DC analysis of BJT circuits, Voltage divider bias and its analysis for stability factors, Bias compensation. Thermal resistance and power dissipation safe operating area (SOA) Small signal-low frequency h-parameter model, Variation of h-parameters with operating point, Other small signal models, Single stage BJT amplifiers (CE, CB, CC), Analysis of CE configuration for A_V, R_i, R_O, A_I, A_{VS}, A_{IS} in terms of h-parameters, Comparison of performance parameters with CB and CC configurations. Small signal and DC data sheet specifications for BJT. Power BJT construction, Data sheet specifications,	9
4	**Field Effect Transistor**	JFET construction, Symbol, Basic operation, V-I Characteristics, Transfer Characteristics (Shockley's Equation), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance. Drain to Source resistance. Biasing of JFET - Biasing against device variation, biasing for zero current drift.	4

5	**MOSFET**	MIS structures, two terminal structure: MOS capacitor, concept of accumulation, depletion and inversion; four terminal structure: MOSFET, its I-V characteristics, drain current equation in terms of W/L, second order effects, brief introduction to MOS scaling and scaling issues viz. short channel effects. Power MOSFET Construction, Comparison with power BJT	9
6	**Frequency Response of Amplifiers**	Concept of frequency response, Human ear response to audio frequencies, significance of Octaves and Decades. The decibel unit. Square wave testing of amplifiers, Miller's theorem. Effect of coupling, bypass, junction and stray capacitances on frequency response for BJT and FET amplifiers. Concept of dominant pole.	5

Lab/ Term Work

1. Study of JFET drain and transfer characteristics.
2. JFET biasing arrangement Graphical method.
3. Build and Test JFET CS amplifier.
   Find performance parameters for JFET amplifier - A_V, R_i, R_O.
4. Simulation of JFET CS amplifier using multisim/spice.
   Find performance parameters for JFET amplifier - A_V, R_i, R_O and compare with theoretical and practical results.
5. Input and Output Characteristics of BJT CE configuration. Find h parameters from characteristics.
6. Build and Test BJT in CE amplifier and find performance parameters - A_V, R_i, R_O, A_I
7. Simulation of BJT CE amplifier using multisim/spice
   Find performance parameters for BJT amplifier - A_V, R_i, R_O, A_I and compare with theoretical and practical results.
8. Comparison of CE, CC, CB configurations in terms of A_V, R_i, R_O, A_I.
9. Study of MOSFET drain and transfer characteristics
10. Frequency response - For BJT/ FET single stage amplifiers - Effect of unbypassed R_E and R_S. Effect of coupling and bypass capacitors on low frequency cut-off.

Text Books	1. Millman Halkias, Electronic Device & Circuits, Tata McGraw Hill 2. Thomas L. Floyd, Electronic Devices, Pearson Education
Reference Books	1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi. 2. Millman Halkias, Integrated Electronics, Tata McGraw Hill 3. Millman Grabel, Microelectronics, Tata McGraw Hill 4. Thomas L. Floyd, Electronic Devices, Pearson Education

Related Websites	www.digikey.com For component selection and datasheets

Examination Scheme	Internal Assessment – 40 marks	
	Term Work – 25 marks Final Theory Paper – 60 marks	