

Sardar Patel Institute of Technology Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			0	Credits Assigned			
		L	Т	Р	L	Т	Р	Total	
EL31	Analog Electronics-I	03	01		03	01		04	
		Examination Scheme							
		ISE		MSE	ESE				
		10		30	100 (60% Weightage			ghtage)	

Pre-requisite Course Codes		Codes	BS12(Applied Physics I)			
			BS22 (Applied Physics II)			
			ES21 (Basic Electrical Technology)			
After successful completion of the course, student will be able to						
	CO1	Describe semiconductor devices through energy band diagrams				
	CO2	Analyze	Analyze the characteristics of semiconductor junctions			
Course	CO3	Differentiate between bipolar and unipolar conduction				
Outcomes	CO4	Discuss working principle of semiconductor devices				
	CO5	Discuss working principle of various optoelectronic devices				
	CO6	Identify t	he applications of semiconductor devices			

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Carrier Statistics and Transport	1,4	3
		Semiconductors, Electron Density, Hole Density, Temperature		
		Dependence of intrinsic concentration, Position of Fermi Level,		
		Computation of n and p		
	1.2	Drift current, Diffusion Current, Generation, Recombination and	1	
		Continuity Equation		
2	2.1	Junction Analysis	1, 6,7	12
		PN Junction Diode: Basic Structure, Band Diagrams, Zero		
		Applied Bias, Reverse Applied Bias, PN Junction current, Small		
		signal model of PN junction, Generation and recombination of		
		currents, junction breakdown.		
		Zener Diode: Breakdown mechanisms, Characteristics, Effect of		
		Temperature, Application as voltage regulator and backward diode		
	2.2	Metal semiconductor and Semiconductor Heterojunctions:	1	
		Schottkey barrier diode: qualitative characteristics, Ideal		
		junction properties, Nonideal effects on barrier height, V-I		
		characteristics		
		Metal-semiconductor Ohmic Contacts: Ideal Non rectifying		



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		barriers, Tunneling Barrier, Specific contact resistance		
		Heterojunctions: Heterojunction materials, Energy Band		
		Diagrams, Two dimensional electron gas		
	2.3	Diode Circuits: Simple diode model, Limiter circuits, Rectifiers,	2,4,5	
		Clamper Circuits, Peak Detector and Voltage Doubler		
3	3.1	Optoelectronics PN junction diodes	1,4, 6	3
		Optical absorption: Photon absorption coefficient, EHP		
		generation rate		
		Solar Cells: The pn junction, heterojunction and amorphous		
		silicon solar cells		
	3.2	Photodetectors: Photoconductor, photodiode, PIN photodiode,	1,2,6	
		APD (avalanche photodiode), phototransistor		
		LED: Generation of Light, Internal Quantum Efficiency, External		
		Quantum Efficiency, LED devices		
4	4.1	Bipolar Devices	1,4	12
		BJT: The bipolar transistor action, minority carrier distribution,		
		low-frequency common-base current gain, non-ideal effects,		
		Ebers-Moll Model, Gummel-Poon Model, Hybrid-Pi Model,		
		Frequency Limitations		
	4.2	HBT (Heterojunction bipolar transistor): Current gain in HBT,	1	
		Basic n-p-n HBT structure with band diagram		
	4.3	BJT Amplifiers: CE, CB and CC Amplifiers, Multistage	1,2,5	
		Amplifiers		
5	5.1	Field Effect Devices	1, 3,	12
		JFET: Construction, operation and device characteristics. V-1	4	
		relationship and transconductance. Small signal equivalent model,		
	=	Initiation factors and cutoff frequency		
	5.2	MOSFET: Two terminal MOS structure, MOSFET construction,		
		Band diagrams under equilibrium and external blas, Inreshold		
		Voltage, V-I and UV characteristics, Channel length modulation,		
	5.2	Short Channel effects, MOSFET Model	1 2	
	5.3	MESFET: Device structure, principle of operation, v-1	1, 5	
		MODEET (i.e. HEMT): Eurodemontals VI Characteristics		
		Cutoff frequency		
			Tatal	42
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References:

- [1] Donald A. Neamen, "Semiconductor Physics and Devices" Tata MCGraw Hill, Third Edition
- [2] RL Boylestad and Lous Nashelsky, "Electronic Devices and Circuits" Pentice Hall, second Edition



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- [3] Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits", Tata McGraw Hill, Third Edition
- [4] Mahesh B. Patil, "Basic Electronic Devices and Circuits," PHI, First Edition
- [5] David Bell, "Electronic Devices and Circuits", Oxford, Fifth Edition.
- [6] S Slivahanan and N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill, Third Edition
- [7] S. M. Sze, "Semiconductor Devices: Physics and Technology", Wiley, Second Edition