



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173913

Semester – VII

Subject Name: PHYSICS OF SOLID STATE DEVICES

Type of course: Solid state electronics and physics

Prerequisite: Basic knowledge of Physics

Rationale: Solid State Physics has the most striking impact on the solid state electronics. The industries of electronics, telecommunication and instrumentation will recognize this course.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

6	Content	Total Hrs
1	Introduction Evolution and uniqueness of Semiconductor Technology Equilibrium carrier concentration Thermal Equilibrium and wave particle duality Intrinsic semiconductor Extrinsic semiconductor Bond and band models	9
2	Carrier transport Random motion Drift and diffusion Excess carriers Injection level Lifetime Direct and indirect semiconductors Procedure for analyzing semiconductor devices Basic equations and approximations	9
3	P-N Junction Device structure and fabrication	9



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	Equilibrium picture DC forward and reverse characteristics Small-signal equivalent circuit Switching characteristics Solar cell P-N Junction Device structure and fabrication Equilibrium picture DC forward and reverse characteristics Small-signal equivalent circuit Switching characteristics Solar cell	
4	Bipolar Junction Transistor History Device structures and fabrication Transistor action and amplification Common emitter DC characteristics	8
5	MOS Junction C-V characteristics, threshold voltage, body effect Metal Oxide Field Effect Transistor History Device structures and fabrication Common source DC characteristics	7

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	35	35	-		

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Text Books :

- [1] Robert Pierret, "Semiconductor Device Fundamentals," Pearson Education, 2006
- [2] B. G. Streetman and S. K. Banerjee, "Solid State Electronic Devices," Prentice Hall India, 2014
- [3] M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Wiley, 2004

References :

- [1] B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th ed., Person Prentice Hall 2006
- [2] Robert Pierret, "Advanced Semiconductor Fundamentals," Pearson, 2002
- [3] C.T. Sah, "Fundamentals of Solid State Electronics", World Scientific Publishing, 1991
- [4] Amitava DasGupta and Nandita DasGupta, "Semiconductor Devices: Modelling And Technology", Prentice Hall India, 2004



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Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the fundamental semiconductor properties.	25%
CO-2	Describe the principle and analyze the operation of p-n diodes.	25%
CO-3	Describe the principle and analyze the operation of BJTs	25%
CO-4	Describe the principle and analyze the operation of MOS junction	25%

Extra Material

S. Karmalkar, "Solid state devices", NPTEL video lectures available on youtube; transcripts available at <http://textofvideo.nptel.iitm.ac.in/video.php?courseId=117106091>