



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3162114

Semester – VI

Subject Name: Electronic materials

Type of course: Science & Engineering

Prerequisite: Basic knowledge of physics

Rationale: Electronic materials as an interdisciplinary genre of the subject help the students to the deep insight into the electronic devices and instrumentation. The booming era of semiconducting material miniaturizing the devices makes them smarter and easier. The knowledge of the subject is useful for the demand of the era. The main objective of the subject is to become familiar with the science, synthesis, evaluation, and applications of electronic materials and also to know the manufacturing processes associated with the use of electronic materials for devices and instruments.

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)	
2	1	0	3	70	30	00	00	100

Content:

Sr. No.	Content	Total Hours	% Weightage
1	Module 1: Intrinsic semiconductors. Electron and hole (carrier) concentrations. Fermi energy level, effect of temperature on Fermi energy. Carrier mobility. Direct vs. indirect band gap materials.	6	30
2	Module 2: Elemental vs. compound semiconductors. Extrinsic semiconductors. Doping – p and n type semiconductors. Carrier concentration and Fermi level as a function of temperature. Drift mobility. Light and heavy doping.	6	25
3	Module 3: Semiconductor diodes – p-n junctions at equilibrium. Forward and reverse bias. IV characteristics. Band diagram. Diode breakdown mechanisms.	6	25
4	Module 4: LEDs and solar cell materials. Transistors – MOSFETs. Band diagram and channel formation. Threshold voltage. I-V characteristics. Introduction to semiconductor manufacturing – history, process flow, manufacturing goals. Bulk Si crystal growth.	6	10
5	Module 5: Overview of manufacturing technology – oxidation, photolithography, etching, doping, deposition, planarization.	4	10
	Total	28	100

Suggested Specification table with Marks (Theory):



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Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
20	30	35	10	05	00

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.

Reference Books:

1. Semiconductor Materials, Devices and Fabrication, Parasuraman Swaminathan, Wiley 2017.
2. Principles of Electronic Materials and Devices, S. O. Kasap, McGraw Hill Education, 2017
3. Electronic Materials: Principles and Applied Science, Yuriy Poplavko, 1st edition, Elsevier, 2018.
4. Principles of Electronic Materials and Devices, S.O. Kasap, 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007
5. Semiconductor Devices: Physics and Technology, S.M.Sze, 2nd edition, Wiley, 2008.
6. Solid State Electronic Devices, B.G. Streetman and S. Banerjee, 6th edition, PHI Learning, 2009.
7. Introduction to solid state physics, C.Kittel, 8th edition, Wiley, 2012.

Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	Understand important scientific parameters associated with electronic materials.	40
CO-2	Indicate the features and functioning of several electronic devices associated with electronic materials.	25
CO-3	Identify different semiconductors and their properties for desired application and their manufacturing processes.	35

List of Open Source Software/learning website:

<https://nptel.ac.in/>