



Master of Science) ( Electronics )  
M.Sc. (Electronics) Semester I

Course Code	PS01CELE51	Title of the Course	Semiconductor Science and Devices
Total Credits of the Course	4	Hours per Week	3+1=4 Hours

Course Objectives:	<ol style="list-style-type: none"><li>1. To introduce students about basic concepts of different materials.</li><li>2. To study the Band-Structure of Semiconducting Materials.</li><li>3. To make learners know about Types of contacts and various properties of materials.</li><li>4. To get aware about the applications of semiconducting materials for Electronics Devices.</li></ol>
--------------------	---

Course Content		
Unit	Description	Weightage* (%)
1.	Review of free electron theory : Assumptions and its draw backs, Energy bands in solids – Bloch theorem, Effect of lattice periodicity on the allowed states and the Kronig-Penney model, Origin of energy gap, Brillouin zones, Possible wave functions per band, Velocity of electrons according to band theory, Effective mass and concept of hole.	25
2.	Types of Materials – Metal, Semiconductor, Insulator, Hall effect in semiconductors, P-N Junction voltage and width (Diode Equation), Band shapes of real semiconductors, Density of states in the energy band, Distribution function, Fermi level in intrinsic and extrinsic case, Low and high doping cases, Amorphous semiconductors	25
3.	Types of PN Junction, Contacts between materials , Concept of workfunction and Electron affinity, Metal – Semiconductor contacts, Ohmic and NonOhmic contacts, Heterojunction, Metal – Insulator-Semiconductor structure, Accumulation, Depletion, Inversion, Surface space charge region, Interface traps and charges, Photonic devices, Optical Absorption in a semiconductor, Photoconduction in semiconductors.	25
4.	Photoelectric phenomena in a P-N junction, Solar cell, Types of solar cells. Display devices, AC and DC electroluminescent devices, Injection luminescence, Radiative recombination processes, Optoelectronic Devices - Light Emitting Diode (LED), LASER, Display Devices -Plasma display, Liquid crystal displays (LCD), OLED Display.	25





Teaching-Learning Methodology	Classroom Teaching (Offline/Online), Use of Power Point Presentation, Tutorial Problem Solving, Assignments, Group Discussion, Use of ICT Tools, Video Animation and Presentation, Experimental demonstration.
-------------------------------	--

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Identify different types of materials classification and its band structure.
2.	Understand the transport phenomena and related properties in Semiconducting Materials.
3.	Learn the fabrication and design aspect of various Electronic Devices.
4.	Use of semiconducting materials for different device applications.

Suggested References:	
Sr. No.	References
1.	Fundamentals of Solid State Physics B. S. Saxena, R.C. Gupta and P. N. Saxena, (Pragati Prakashan, Meerut, INDIA)
2.	Semiconductor Devices: Basic Principles Jasprit Singh, (John Wiley & Sons Inc.N.Y,USA)
3.	Physics of Semiconductor Devices S. M. Sze, (Wiley Eastern Limited, New Delhi, INDIA)
4.	Semiconductor Optoelectronics Devices P.Bhattacharya, (Prentice Hall Int. Inc. N.J, USA)





5.	Optoelectronics: An Introduction J.Wilson and J.F.B. Hawkes, (Prentice Hall of India, New Delhi, INDIA)
6.	Electronic Materials Science James W.Mayer,S.S.Lau, (Maxwell Macmillan International Editions, NY,USA)
7.	Principles of Electronic Materials and Devices S O Kasap (Tata McGraw-Hill Publishing Company Limited, New Delhi, INDIA )
8.	Fundamentals of Solid-State Electronics Chih-Tang Sah (Allied Publishers Limited, INDIA)
9.	Introduction to Solid-State Devices G.I.Yepifanov, Yu.A.Moma (Mir Publishers, Moscow)
10.	Electronic Devices and Circuits David A.Bell (Prentice-Hall of India, New Delhi, INDIA)

On-line resources to be used if available as reference material

On-line Resources

1. <https://www.sciencedirect.com/topics/materials-science/semiconductor-device>

2. <https://www.sciencedirect.com/referencework/9780444531537/comprehensive-semiconductor-science-and-technology>

3. <https://en.wikipedia.org/wiki/Semiconductor>

4. <https://lampx.tugraz.at/~hadley/psd/L0/index.php>

5. Online Video Lectures of course on Fundamentals of Semiconductor devices – Swayam

6. Online Video Lectures of course on Semiconductor devices – NPTEL

7. Online Video Lectures of course on Solid State Devices – NPTEL

\*\*\*\*\*

