SARVAJANIK UNIVERSITY

SARVAJANIK COLLEGE OF ENGINEERING AND TECHNOLOGY

BACHELOR OF TECHNOLOGY

B. Tech.	1	Semester	1 / 2	Teaching Scheme				Evaluation Scheme	
Subject Name	Semiconductor Physics			**L**	**T**	**P**	**Credits**	**CCE**	**SEE**
Subject Code	BTAS21103			2	0	0	2	50	50
Type of course	BSC: Basic Science Course			CCE: Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	Basic understanding of Maths, Physics and Chemistry								
Rationale	The basic science - physics course is to prepare students for careers in engineering program where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.								

Course Outcomes (COs): At the end of the course, students will be able to		**Marks % Weightage**
CO – 1	Recall and interpret core concepts of solid-state physics and semiconductors using band theory and carrier statistics	27%
CO – 2	Explain the behaviour of charge carriers in semiconductors under various physical conditions.	27 %
CO – 3	Apply semiconductor principles to analyse junction behaviour, carrier transport, and basic device characteristics.	20 %
CO – 4	Demonstrate awareness of how semiconductor devices contribute to technological solutions and sustainable systems.	27 %

Course Contents			
Unit	**Content**	**Tentative Teaching Hours**	**Tentative Unit Weightage**
1	**Unit 1: Band theory of Solids** • Formation of energy bands • Kroning -Penny model • Effective mass. • E-k Diagram • Direct & Indirect bandgap materials	08	27%
2	**Unit 2: Fundamentals of Semiconductor** • Semiconductor Classification: intrinsic, extrinsic, and compound semiconductors.	08	27 %

	• Carrier concentration in intrinsic semiconductor • Fermi Dirac distribution and Fermi energy level • Fermi level in intrinsic semiconductor • Law of mass action • Carrier concentration in extrinsic semiconductor • Fermi energy level in extrinsic semiconductor and its dependence on temperature and concentration		
3	**Unit 3: Carrier Dynamics in Semiconductors** • Carrier Generation and Recombination • Radiative and non-radiative recombination mechanism • High-Field Effects • Diffusion and Drift current density • Quantum Carrier Transport: Tunneling phenomena	06	20 %
4	**Unit 4: Semiconductor interfaces and devices** • p-n junction under equilibrium and bias • Zener and Avalanche breakdown mechanism. • Resistivity carrier concentration measurement by Hall effect • Photonics: LED, Radiative transition, LED Materials, Lasers, Solar Cell • Metal- semiconductor interface, Schottkey junctions, Ohmic Contacts	08	27 %

Suggested Specification table with Marks

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	40	30	--	--	--

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

Recommended Reference Books

1. D. A. Neamen, *Semiconductor Physics and Devices*, 4th ed. New York, NY, USA: McGraw-Hill Education, 2011. ISBN: 978-0073529585.
2. S. M. Sze and K. K. Ng, *Physics of Semiconductor Devices*, 3rd ed. Hoboken, NJ, USA: Wiley-Interscience, 2006. ISBN: 978-0471143239.
3. R. Enderlein and N. J. M. Horing, *Fundamentals of Semiconductor Physics and Devices*, 1st ed. Singapore: World Scientific Publishing, 1997. ISBN: 978-9810206381.
4. M. S. Tyagi, *Introduction to Semiconductor Materials and Devices*, 1st ed. New Delhi, India: Wiley India, 2008. ISBN: 978-8126517022.
5. K. Seeger, *Semiconductor Physics: An Introduction*, 9th ed. Berlin, Germany: Springer, 2004. ISBN: 978-3540254703.
6. B. G. Streetman and S. Banerjee, *Solid State Electronic Devices*, 7th ed. Noida, India: Pearson

	Education, 2015. ISBN: 978-0133356038.
7	P. Y. Yu and M. Cardona, *Fundamentals of Semiconductors: Physics and Materials Properties*, 4th ed. Berlin, Germany: Springer, 2010. ISBN: 978-3642007092.
8	M. Grundmann, *The Physics of Semiconductors*, 3rd ed. Cham, Switzerland: Springer, 2021. ISBN: 978-3030332564.
9	R. E. Hummel, *Electronic Properties of Materials*, 4th ed. New York, NY, USA: Springer, 2011. ISBN: 978-1441981639.
10	P. Bhattacharya, *Semiconductor Optoelectronic Devices*, 2nd ed. New Delhi, India: Pearson, 2017. ISBN: 978-9332535187.
11	G. S. Higginbotham, *Introduction to Semiconductor Physics and Devices*, 1st ed. Cham, Switzerland: Springer, 2022. ISBN: 978-3030778478.
12	A. Chen, *Advances in Semiconductor Technologies*, 1st ed. Hoboken, NJ, USA: Wiley-IEEE Press, 2023. ISBN: 978-1119869604.
13	A. Babichev and F. Furtmayr, *Semiconductor Materials for Optoelectronics and Quantum Devices*, 1st ed. Amsterdam, Netherlands: Elsevier, 2021. ISBN: 978-0128231712.

CO-PO-Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO – 1	3	3	2	3	-	-	-	-	-	-	-	2
CO – 2	3	3	2	2	2	-	-	-	-	-	-	2
CO – 3	3	2	3	3	2	-	2	-	-	-	-	-
CO – 4	2	2	2	2	-	2	2	2	-	-	-	2

List of Open Source/learning website:

1. https://archive.nptel.ac.in/courses/115/102/115102025/
2. https://archive.nptel.ac.in/courses/115/102/115102103/