



**Master of Science – Materials Science**  
**(M.Sc.) (Materials Science) Semester –II**

Course Code	PS02CMTS51	Title of the Course	Semiconducting and Superconducting Materials
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	1.To learn mainly electrical properties of different materials like conductors, semiconductors and superconductors
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Course Content		
Unit	Description	Weightage* (%)
1.	Electrical resistivity and conductivity, Role of valence electrons, electrons in a field free crystal, electron gas approximation, behavior of electrons in applied electric field, drift velocity and its calculation, phonon scattering of electrons, temperature dependence of resistivity.	25%
2.	Formation of electron energy bands in solids, classification of materials, conductors, semiconductors and Insulators, electrons and positive holes, mobility, generation and recombination of electron-positive hole pairs.	25%
3.	Intrinsic semiconductors, n and p type (extrinsic) semiconductors, p-n junction, current flow through p-n junction, junction characteristics. Junction transistor, Field effect Transistor. Semiconductor purification, Epitaxial growth, Chemical Vapor Deposition and Molecular Beam Epitaxy techniques .	25%
4.	Introduction to superconductivity, electrical and magnetic properties, Meissner effect, two types ( type I and type II) of superconductors. Normal to superconductive transition, intermediate state, mixed state, surface superconductivity, boundary energy, Tunneling, Applications of superconductors.	25%

Teaching-Learning Methodology	Group discussion/ Panel/Presentation
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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.	Follow theoretical details related to electrical behaviour of different materials
2.	Distinction between different materials based on their electrical behaviour and applications
3.	Utilization of materials for different device applications

Suggested References:	
Sr. No.	References
1.	Callister, W. D., & Rethwisch, D. G. (2018). <i>Materials science and engineering: an introduction</i> (Vol. 9). New York: Wiley.
2.	Rawlings, R. D., Leever, P. S., Leaver, K. D., Anderson, J. (2004). <i>Materials Science for Engineers</i> . CRC Press.
3.	Gupta, S. C., Kulshreshtha, D. C., Bhargava, N. N. (2013). <i>Basic Electronics and Linear Circuits</i> . India: Tata McGraw-Hill.
4.	Bar-Lev, A. (1984). <i>Semiconductors and Electronic Devices</i> . Prentice-Hall International.

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

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