



SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Physics

T.Y. B.Sc. Physics (Minor)

**Syllabus for the Academic Year 2025-2026 based on
the National Education Policy 2020**



SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

DEPARTMENT OF PHYSICS

COURSE DETAILS FOR MAJOR:

	SEMESTER 5		SEMESTER 6
TITLE	Solid State Physics - I		Solid State Physics - II
TYPE OF COURSE - DSC	Minor		Minor
CREDITS	4		4

Preamble:

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics. Physics, a third -Year program, embarks on a journey of discovery through the fundamental principles of physics. Throughout this program, we will explore the diverse and fascinating realms of classical mechanics, optics, thermodynamics, modern physics, solid state physics and electronics. From the laws of motion to the mysteries of quantum theory, our aim is to cultivate a deep understanding of the natural world and its underlying principles. Through experimentation, analysis, and critical thinking, we will strive to unravel the complexities of the universe and lay the groundwork for further exploration and innovation. Join us as we embark on this exciting intellectual adventure, where curiosity and inquiry are the guiding lights on our path to knowledge and understanding.



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PROGRAMME OBJECTIVES

PO 1	Students will be able to identify major classes of engineering materials and explain their internal structure, including interatomic forces, bonding, and crystalline arrangements that govern material behavior.
PO 2	Students will develop the ability to analyze mechanical, electrical, magnetic, and thermal properties of materials, and understand how lattice defects, diffusion mechanisms, and structural imperfections influence these properties.
PO 3	Students will be equipped to evaluate and apply modern materials—including nanomaterials, biomaterials, and shape-memory alloys—and understand their significance in engineering applications, with emphasis on mechanical behavior such as elastic and plastic deformation.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	Students will be able to classify materials based on their bonding nature, explain interatomic forces, and describe atomic and crystal structures, enabling them to analyze how these structural features influence the properties of solids.
PSO 2	Students will demonstrate the ability to interpret mechanical, electrical, magnetic, and thermal properties of solids and analyze the role of lattice defects, configuration entropy, and diffusion mechanisms in determining the behavior of metals and other materials.
PSO 3	Student will be able to apply concepts of elastic constants, plastic deformation, and modern material science to evaluate and explain the practical use of biomaterials, nanomaterials, and smart alloys in technological, industrial, and biomedical applications.



SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Programme: Sciences Physics Minor	Semester – 5
Course Title: Solid State Physics - I	Course Code: SPHY355MN
<u>COURSE OBJECTIVES:</u>	
CO 1.	To introduce the basic types of engineering materials and their internal structure.
CO 2.	To develop understanding of various physical properties of materials including mechanical, electrical, magnetic, and thermal.
CO 3.	To acquaint students with modern and smart materials such as nanomaterials, biomaterials, and shape-memory alloys and their applications.
<u>COURSE OUTCOMES:</u>	
CLO 1.	Students will be able to classify different types of materials and describe their atomic and crystal structures.
CLO 2.	Students will demonstrate an understanding of material properties such as elasticity, conductivity, and magnetism, and relate them to their practical applications.
CLO 3.	Students will identify and explain the uses of advanced materials like biomaterials, nanomaterials, and smart alloys in technological and biomedical fields.



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Theory Lectures per week (1 Lecture is 60 minutes)		2	
Total number of Hours in a Semester		30	
Credits		2	
Evaluation System	Semester End Examination	1 Hour	25 marks
	Internal Assessment	--	NIL

UNIT 1 (1 Credit)	1	Solid State Physics: Crystalline state and amorphous state, Primitive, Unit cell, Seven Crystal System, Bravais lattice, Miller indices, Diffraction of X-ray with crystal lattice, Specific Heat of Solids and Lattice Vibration, Free electron theory of metals, The Band theory of Solids.	15 Hours
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PRACTICAL		Course Code: SPHY355MNP	
Course Title: Solid State Physics - I			
COURSE OUTCOMES:			
CLO 1.	Plot and interpret graphs accurately to determine relationships between physical quantities.		
CLO 2.	Evaluate thermal, dielectric, and magnetic properties of materials through standard experimental procedures.		
CLO3.	Analyze experimental data, estimate errors, and present results scientifically.		

Lectures per week (1 Lecture is 120 minutes)		2	
Total number of Hours in a Semester		60	
Credits		2	
Evaluation System	Semester End Examination	1 Hours	50 marks
	Internal Assessment	--	NIL

A		Skill Experiment	60 hours
	1	Ohm's Law	
2	Graph Plotting		
:		Regular Experiment	
	1	Electrical conductivity by four probe method	
	2	Thermal properties of material	
	3	Dielectric properties of material	
	4	Magnetic properties of material	
5	Young's modulus of material		



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ASSESSMENT DETAILS:

1. Internal Assessment (IA): Any one activity / assignment / test of 20 marks
2. Semester End Examination (SEE): Theory exam of 30 marks – One hour duration
3. Semester End Examination (SEE): Practical exam of 50 marks – Three hours duration

REFERENCES:

1. Engineering Materials and Metallurgy, Er. R K Rajput
<http://books.google.co.in/books?id=7y8xqSqu3gwC&printsec=copyright#v=onepage&q&f=false>
2. Material Science, S L Kakani & Amit Kakani, New Age international (P) Limited
3. Materials Science and Engineering– by V. Raghavan,
4. Introduction to Materials Science for Engineers – by James F. Shackelford, 8th Edition, Pearson Higher Education, INC., Upper Saddle River, NJ 07458
5. A Textbook of Engineering Materials – by O.P. Gupta

Solid State Physics – A J Dekkar



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Programme: Sciences Physics Minor		Semester – 2
Course Title: Solid State Physics – 2		Course Code: SPHY366
<u>COURSE OBJECTIVES:</u>		
CO 1.	1. To develop an understanding of interatomic forces and their role in determining the structure and properties of solids.	
CO 2.	2. To study the structure and defects in metals, including lattice imperfections and diffusion mechanisms.	
CO 3.	3. To understand the mechanical behavior of metals through elastic and plastic deformation concepts.	
<u>COURSE OUTCOMES:</u>		
CLO 1.	Explain the types of interatomic forces and classify solids based on bonding nature.	
CLO 2.	Describe the structure of metals and analyze the effect of lattice defects and configuration entropy on material properties.	
CLO 3	Interpret the mechanisms of interstitial diffusion in metals and their influence on material behavior.	
CLO 4	Apply the concepts of elastic constants and plastic deformation to understand mechanical properties of metals.	



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Theory Lectures per week (1 Lecture is 60 minutes)		2	
Total number of Hours in a Semester		30	
Credits		2	
Evaluation System	Semester End Examination	1 Hour	25 marks

UNIT 1 (1 Credit)	1.1	Solid State Physics – II - Interatomic forces and the classification of solids, Structure of metals, Lattice defects and configuration entropy, formation of lattice defects in metals, Interstitial diffusion in metals, elastic constants in metal, plastic deformation of metals.	15 hours
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PRACTICAL COURSE Course Title: Solid State Physics - 2	Course Code: SPHY300MNP
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COURSE OUTCOMES:

CLO 1.	Students will gain hands-on experience in conducting experiments related to optics and digital electronics, using tools such as lasers, photodetectors, and digital trainers.
CLO 2.	They will become proficient in using measuring instruments such as multimeters and oscilloscopes.
CLO 3.	They will develop troubleshooting skills for identifying and resolving issues in practical circuits.

Lectures per week (1 Lecture is 120 minutes)	2
Total number of Hours in a Semester	60
Credits	2

Evaluation System	Semester End Examination	3 Hours	50 marks
	Internal Assessment	--	

Sr. No.	Course Content
A	Skill Experiment:
	Travelling microscope
	Vernier caliper & Screw guage
B	Regular Experiment:
1	Determination of Elastic Constants of a Metal Wire using Searle's Apparatus or Beam Deflection Method
2	Study of Plastic Deformation of Metals using Stress-Strain Curve
3	Specific heat of solid and liquid: To determine the specific heat capacity of a given solid or liquid using the method of mixture and a calorimeter.
4	Quinck's Method: To determine the magnetic susceptibility of a given solution by Quincke's method.
5	Study of magnetic field pattern of various materials using bar magnet.
6	Millikan's oil drop method: To determine the terminal velocity of the drop and find the charge on the drop.
7	Young's modulus: To determine the modulus of elasticity of a solid material.
8	Hysteresis loop B -H curve: To determine the magnetic properties of a material by plotting magnetic flux density (B) against magnetizing force (H).



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2. Semester End Examination (SEE): Theory exam of 30 marks – One hour duration
3. Semester End Examination (SEE): Practical exam of 50 marks – Three hours duration

REFERENCES:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B. Sc PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.

Note:

1. For practical examinations, the learner will be examined in one experiment.
2. Each experiment will be of two hours' duration.
3. Skill experiments are required to be completed compulsorily. Students are required to report experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments.
4. A learner will be allowed to appear for the semester end practical examination only if he/she submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester VI as per the minimum requirements.