

Semester II

U21PH201	<b>MATERIALS SCIENCE</b> (Common to all branches except BME)	Category: BSC				
		L	T	P	J	C
		2	0	0	0	2

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To gain the knowledge of conducting and semiconducting materials
- To understand the concepts of magnetic, dielectric and optical properties of materials
- To enhance the knowledge of new engineering materials

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1:** Demonstrate the electrical characteristics of conducting materials (Understand)  
**CO2:** Interpret the properties and types of semiconducting materials (Understand)  
**CO3:** Compare various types of magnetic materials for engineering applications (Understand)  
**CO4:** Explain the fundamental concepts of dielectric and optical materials (Understand)  
**CO5:** Examine new engineering materials for industrial applications (Understand)

**CO-PO MAPPING:**

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	-	-	-	1	-	-	-	-	-	1	
CO2	3	2	-	-	-	1	-	-	-	-	-	1		
CO3	3	2	-	-	-	1	-	-	-	-	-	1		
CO4	3	2	-	-	-	1	-	-	-	-	-	1		
CO5	3	2	-	-	-	1	-	-	-	-	-	1		
CO	3	2	-	-	-	1	-	-	-	-	-	1		
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)			3: Substantial (High)						

**SYLLABUS:**

**UNIT I CONDUCTING MATERIALS**


6

Classical free electron theory – Expression for electrical conductivity and thermal conductivity – Wiedemann - Franz law – Drawbacks – Fermi distribution function – Density of energy states in metals

**UNIT II SEMICONDUCTING MATERIALS**

6

Intrinsic and Extrinsic semiconductor – Carrier concentration in n-type semiconductor – P-type semiconductor(qualitative) – Applications of semiconductors – Solar cell – LED – Hall effect and its experimental determination

  
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<b>UNIT III</b>	<b>MAGNETIC MATERIALS</b>	<b>6</b>
Origin of magnetism – Dia, para and ferro magnetic materials – Domain theory – Soft and hard magnetic materials – Magnetic bubble memories – GMR sensor		
<b>UNIT IV</b>	<b>DIELECTRIC AND OPTICAL MATERIALS</b>	<b>6</b>
Dielectrics – Types of polarisation – Electronic polarisation – Dielectric breakdown – Ferroelectrics – Applications of dielectrics – Classification of optical materials – Nonlinear optics – Applications		
<b>UNIT V</b>	<b>NEW ENGINEERING MATERIALS AND CHARACTERIZATION TECHNIQUES</b>	<b>6</b>

SMA – SiC – GaN – Rheological materials – Nanomaterials – Synthesis (Ball milling and CVD) – Quantum dot, quantum wire and quantum well(qualitative) – Characterisation techniques – Powder XRD(qualitative) – SEM

**Contact Periods:**

Lecture: 30 Periods      Tutorial: - 0 Periods      Practical: - 0 Periods      Project: - 0 Periods  
Total: 30 Periods

**TEXT BOOKS:**


1. Wahab M A, "Solid State Physics: Structure and Properties of Materials", 3<sup>rd</sup> edition, Narosa Publishing House, Chennai, 2018
2. Marikani A, "Materials Science", 1<sup>st</sup> edition, PHI publishers, Chennai, 2017

**REFERENCES:**

1. Pillai S O "Solid State Physics", 9<sup>th</sup> edition, New Age International Publishers, New Delhi, 2020
2. Bangwei Zhang, "Physical Fundamentals of Nanomaterials", Chemical Industry Press, China, 2018
3. Joginder Singh Galsin, "Solid State Physics – An Introduction to Theory", Academic Press, India, 2019
4. <https://nptel.ac.in/courses/108/108/108108122/>
5. <https://nptel.ac.in/courses/113/105/113105081/>

**EVALUATION PATTERN:**

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
Individual Assignment / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

  
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