

**Somaiya Vidyavihar University**  
K. J. Somaiya College of Engineering, Mumbai -77  
(A Constituent College of Somaiya Vidyavihar University)

Course Code	Course Title							
116U06O561	Engineering Materials and Characterization Techniques							
	TH			P	TUT			Total
Teaching Scheme (Hrs.)	03			-	-			03
Credits Assigned	02			-	-			02
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	-	-	-	--	--	50

**Course prerequisites:** knowledge of semiconductor physics and basic electrical engineering is desirable

**Course Objectives:** The objective of the course is to provide the knowledge of different properties of materials, its characterization and their potential applications.

**Course Outcomes:**

At the end of successful completion of the course the student will be able to

CO1: Understand different properties of engineering materials

CO2: Identify materials at difference scales

CO3: Analyze materials using different characterization techniques

CO4: Understand potential applications of different engineering materials

Module No.	Unit No.	Details	Hrs.	CO
1		<b>Fundamentals Properties of Materials</b>	10	1
	1.1	Mechanical Properties		
	1.2	Thermal Properties		
	1.3	Electronic Properties		
	1.4	Optical Properties		
	1.5	Magnetic Properties		
2		<b>Materials at Different Scales</b>	10	2
	2.1	Macro-materials		
	2.2	Micro-materials		
	2.3	Nano-materials		
3		<b>Soft Materials</b>	06	2
	3.1	Liquid Crystals		

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	3.2	Polymers		
	3.3	Liquid Crystal Elastomers		
4		<b>Spectroscopy, Microscopy and Mechanical Analysis</b>	10	3
	4.1	Fourier Transform Infrared (FTIR) Spectroscopy Ultraviolet-Visible (UV-VIS) Spectroscopy, Raman Spectroscopy, Polarizing Optical Microscopy (POM)		
	4.2	Differential Scanning Calorimetry (DSC) and Differential Thermal Analysis (DTA)		
	4.3	Ultrasonic Interferometry		
5		<b>XRD and Electron Microscopy</b>	09	4
	5.1	X-Ray Diffraction (XRD)		
	5.2	Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM)		
	5.3	X-ray photoelectron spectroscopy (XPS)		

Books recommended

Sr. No.	Title	Name/s of Author/s	Name of Publisher	Edition and Year of Publication	Country
1.	Materials Science and Engineering	William F. Smith, Javed Hashemi, Ravi Prakash	McGraw Hill Higher Education	Fifth 2017	INDIA
2.	Materials Science and Engineering: A First Course	V. Raghavan	Prentice Hall Of India	Sixth 2015	India
3.	Introduction to Liquid Crystals: Chemistry and Physics	Peter J. Collings Michael Hird	CRC Press	1997	UK
4.	Materials Characterization Techniques	Sam Zhang, Lin Li, Ashok Kumar	CRC Press	2008	USA

**Mapping of Course Outcomes with Program Outcomes with levels:**

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3			2								1		
CO2	3			2								1		
CO3	3			2								1		
CO4	3			2								1		

**Justification for CO-PO mapping:**

CO	PO	PO Short Name	Justification	Level of mapping
CO1	PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Understanding and describing the knowledge of different properties of Engineering materials such as semiconducting and dielectric materials in various electronic devices applications.	3
	PO4	Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Applying the knowledge of various engineering materials can be used in semiconducting devices applications and designing of experiments for the synthesis of some such materials in the laboratory.	2
	PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Applying the problem solving approach using semiconducting material principles for life-long learning.	1
CO2	PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering	Understanding and describing the knowledge of different types of Engineering materials in various electronic devices such as OLED and OFET.	3

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		fundamentals, and an engineering specialization to the solution of complex engineering problems.		
	PO4	Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Applying the knowledge of these type of materials can be used in semiconducting devices applications and designing of experiments for the synthesis of some such materials in the laboratory.	2
	PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Applying the problem solving approach using semiconducting material principles in optoelectronic devices.	1
CO3	PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Understanding and describing the knowledge of different types of smart engineering materials in Organic LASERS application.	3
	PO4	Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Applying the knowledge of various materials can be used in device fabrication and applications and designing of experiments for the synthesis of some such materials in the laboratory.	2
	PO12	Life-long	Applying the problem solving	1

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		learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	approach using smart functional material principles in laser applications for life-long learning.	
CO4	PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Understanding and describing the knowledge of different types of functional materials in various electronic devices such as Organic solar cells and photovoltaic cells.	3
	PO4	Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Applying the knowledge of various types of engineering materials can be used in fabrication of semiconducting devices for future applications	2
	PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Applying the problem solving approach using the smart materials for applications in solar cells device applications for life-long learning.	1