



<b>Semester: III / IV</b>						
<b>MATERIALS SCIENCE FOR ENGINEERS</b>						
<b>Category: BASKET COURSES - GROUP A</b>						
<b>(Theory)</b>						
<b>(Common to all Programs)</b>						
<b>Course Code</b>	<b>:</b>	<b>ME232TB</b>		<b>CIE</b>	<b>:</b>	<b>100 Marks</b>
<b>Credits: L:T:P</b>	<b>:</b>	<b>3:0:0</b>		<b>SEE</b>	<b>:</b>	<b>100 Marks</b>
<b>Total Hours</b>	<b>:</b>	<b>40L</b>		<b>SEE Duration</b>	<b>:</b>	<b>3 Hours</b>

<b>Unit-I</b>	<b>06 Hrs</b>
<b>The Fundamentals of Materials</b> The electronic structure of atoms, types of atomic and molecular bonds: ionic bond, covalent bond, metallic bond, secondary bonds, mixed bonding, hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of materials: polymers, metals and alloys, ceramics, semiconductors, composites.	
<b>Unit – II</b>	<b>10 Hrs</b>
<b>Material behavior:</b> Thermal properties: thermal conductivity, thermoelectric effects, heat capacity, thermal expansion coefficient, thermal shock, thermocouple. Electrical Properties: dielectric behaviours and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity, super conductor. Optical properties: luminescence, optical fibers, Mechanical Properties: Stress-strain diagram, elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, fracture toughness, fatigue.	
<b>Unit –III</b>	<b>10 Hrs</b>
<b>Materials and their Applications:</b> Semiconductors, dielectrics, optoelectronics, structural materials, ferrous alloys, nonferrous alloys, cement, concrete, ceramic, and glasses. Polymers: thermosets and thermoplastics, composites: fiber-reinforced, aggregated composites, electronic packaging materials, biomaterials, processing of structural materials.	
<b>Unit –IV</b>	<b>07 Hrs</b>
<b>Heat Treatment:</b> Post processing heat treatment of electronic devices: thermal oxidation, diffusion, rapid thermal processing. Heat treatment of ferrous materials: annealing, spheroidizing, normalizing, hardening, tempering. formation of austenite, construction of Time Temperature Transformation (TTT) curves. Special heat treatment processes: carburizing, nitriding, cyaniding, flame, and induction hardening. Defects in heat treatment.	
<b>Unit-V</b>	<b>07 Hrs</b>
<b>Nanomaterials:</b> Synthesis of nanomaterials: ball milling, sol-gel, vapour deposition growth, pulse laser, magnetron sputtering, lithography. Nano porous materials: zeolites, mesoporous materials, carbon nanotubes, graphene, nano FRPs, nano fabrics, bioresorbable and bio-erodable materials, nano ceramic, nano glasses, nano biomaterials, nano implant associated materials. Characterization of nano structures, spectroscopic techniques, automatic force microscopy.	

<b>Course Outcomes: After completing the course, the students will be able to:</b>	
<b>CO1</b>	Understand the classification of materials, their atomic structure, and properties.
<b>CO2</b>	Investigate the properties and applications of different materials.
<b>CO3</b>	Analyze the effect of different heat treatment processes.
<b>CO4</b>	Recognize different types of nanomaterials, synthesis methods and characterisation techniques.

**Reference Books**

1.	Material Science and Engineering, William D Callister, 6 <sup>th</sup> Edition, 1997, John Wiley and Sons, ISBN: 9812-53-052-5
2.	Introduction to Physical Metallurgy, Sydney H Avner, 1994, Mc. Graw Hill Book Company, ISBN: 0-07-Y85018-6
3.	Material Science and Engineering, William F Smith, 4 <sup>th</sup> Edition, 2008, Mc. Graw Hill Book Company, ISBN: 0-07-066717-9
4.	A.S. Edelstein and R.C. Cammarata, Nanomaterials: Synthesis, Properties and Applications, CRC Press 1996, ISBN:978-0849322749

**RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)**

#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	<b>40</b>
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	<b>40</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>100</b>

**RUBRIC FOR SEMESTER END EXAMINATION (THEORY)**

Q. NO.	CONTENTS	MARKS
<b>PART A</b>		
1	Objective type questions covering entire syllabus	20
<b>PART B</b> (Maximum of TWO Sub-divisions only)		
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>