RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
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NBA Accredited (UG - 6Years)

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Department of Mechanical Engineering

CIE – I

Date	19 June 2024	Maximum Marks	50
Course Code	ME242AT	Duration	90 Min
Course Name	Material Science for Engineers	**USN:**	

#/	**Questions**	**M**	**BT**	**CO**
1a	Describe energy bands for metals, Semiconductors, and insulators with a neat sketch.	04	3	1
1b	With the help of neat sketches explain all the primary bonds with examples.	06	3	1
2a	Calculate Atomic packing factor for BCC unit cell.	04	4	1
2b	Enumerate the types of point defects using appropriate sketches	06	3	1
3a	Explain the dislocation mechanisms: Slip and Twinning	06	2	1
3b	Highlight the properties and applications of polymers giving examples.	04	2	1
4	List and explain different thermoelectric effects and state their applications	10	1,2	2
5	With the help of a neat, labelled stress-strain diagram illustrate properties in the plastic region	10	3	2

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	TEST	Marks	30	20	-	-	05	15	26	4		

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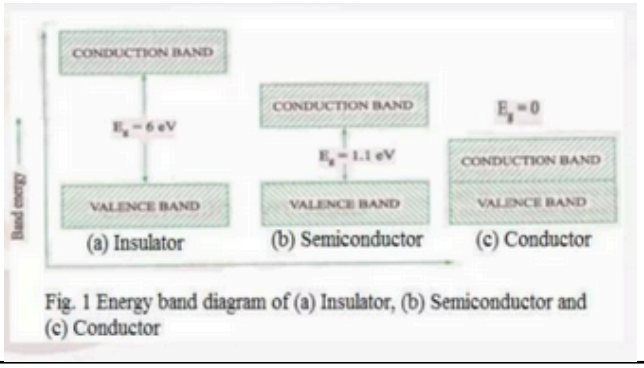
#/	Questions	M	BT	CO
1a	Describe energy bands for metals, Semiconductors, and insulators with a neat sketch. Sketch 2m Explanation of bands with energy gaps 2m  Fig. 1 Energy band diagram of (a) Insulator, (b) Semiconductor and (c) Conductor	04	3	1
1b	With the help of neat sketches explain all the primary bonds with examples. Brief explanation of Primary Interatomic Bonds with examples Covalent: CH_4, H_2 Ionic: NaCl, MgO. Metallic: Cu	06	3	1
2a	Calculate Atomic packing factor for BCC unit cell. Figure 1m Equation writeup and calculation 3m	04	4	1
2b	Enumerate the types of point defects using appropriate sketches Writing the classification 1m Sketches 2m Explanation 3m	06	3	1
3a	Explain the dislocation mechanisms: Slip and Twinning Sketch 3m Explanation 3m	06	2	1
3b	Highlight the properties and applications of polymers giving examples. Properties (any 2) with example 2m Applications (any 2) with example 2m	04	2	1
4	List and explain different thermoelectric effects and state their applications Seebeck, Peltier and Thomson effects Listing 1m	10	1,2	2

	Sketches 6m Applications 3m			
5	With the help of a neat, labelled stress-strain diagram illustrate properties in the plastic region. Diagram 4m Properties 6m (UTS, Fracture strength, toughness)	10	3	2

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CIE – II

Date	**22nd July 2024**	Maximum Marks	50 +10
Course Code	ME242AT	Duration	120 Min
Course Name	Material Science for Engineers	**USN:**	

Q. No.	PART A	M	BT	CO
1	Photodiodes serve as _____in optical communication systems.	1	1	2
2	A light controlled variable resistor, whose resistance decreases with increasing incident light intensity is known as _____.	1	1	2
3	Name the fundamental semiconductor devices that act as amplifiers or switch.	1	1	2
4	The insulating materials having ability to store and support the transmission of electric charge without conducting it are known as _____.	1	1	2
5	Name the alloying element mainly responsible for the high corrosion resistance property in stainless steel.	1	1	2
6	Mention two advantage of non-ferrous alloys over the ferrous alloys	2	1	2
7	The process involves shaping a material by forcing it through a die to create a specific cross-sectional shape is known as _____.	1	1	2
8	Name the type of polymer which become soft upon heating and become hard and rigid on cooling also do not have cross linking and branching.	1	1	2
9	Give an example of natural composites.	1	1	2

Q. No.	PART B	M	BT	CO
1	Illustrate the working principle and state the applications of the following optoelectronic devices: i) LED ii) Photo resistor iii) photo transistor	10	3	2
2a. **2b.**	List any five common dielectric materials along with their applications. Explain the effects of different alloying elements on steel.	05 05	2 3	2
3.	Explain the properties and applications of following materials with examples. i) Polymers ii) Metal matrix composites	10	3	2
4.	Illustrate the properties and applications of four types of cast iron.	10	3	2
5a **5b**	Explain the metal casting process. Write the advantages and disadvantages of any two casting processes. Write the properties and applications of bio-materials.	05 05	3 2	2

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
Marks Distribution	TEST	Marks	-	50	-	-		10	40			
	QUIZ			10			10					

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CIE – II SCHEME and SOLUTION

Date	22nd July 2024	Maximum Marks	50
Course Code	ME242AT	Duration	90 Min
Course Name	Material Science for Engineers	**USN:**	

Q. No.	Questions	M	BT	CO
1	Illustrate the working principle and state the applications of the following optoelectronic devices: i) LED ii) Photo resistor iii) photo transistor Explaining working principle 2m Applications 1m	10	3	2
2a.	List any five common dielectric materials along with their applications. Capacitors, Insulation in Electrical Systems, Dielectric Resonators, Microwave Devices, Dielectric Heating, Dielectric Constant Measurement, Elastomers, Dielectric Coatings any five.			2
2b.	.Explain the effects of different alloying elements on steel. ▫ Manganese contributes to **strength and hardness**; dependent upon the carbon content. Increasing the manganese content decreases ductility and weldability. Manganese has a significant effect on the hardenability of steel. ▫ Phosphorus **increases strength and hardness and decreases ductility** and notch impact toughness of steel. The adverse effects on ductility and toughness are greater in quenched and tempered higher-carbon steels. ▫ Sulfur **decreases ductility** and notch impact toughness especially in the transverse direction. Weldability decreases with increasing sulfur content. Sulfur is found primarily in the form of sulfide inclusions. ▫ Silicon is one of the principal **deoxidizers** used in steelmaking. Silicon is less effective than manganese in increasing as-rolled strength and hardness. In low-carbon steels, silicon is generally detrimental to surface quality. ▫ Copper in significant amounts is detrimental to hot-working steels. Copper can be detrimental to surface quality. Copper is beneficial to **atmospheric corrosion resistance** when present in amounts exceeding 0.20%. ▫ Nickel is a ferrite strengthener. Nickel does not form carbides in steel. It remains in solution in ferrite, strengthening and toughening the ferrite phase. Nickel increases the hardenability and impact strength of steels. ▫ Molybdenum increases the hardenability of steel. It enhances the creep strength of low-alloy steels at elevated temperatures.	05 05	2 3	
3.	Explain the properties and applications of following materials with examples. i) Polymers ii) Metal matrix composites	10	3	2

	Listing minimum five properties and five applications (5 marks for each material)			
4.	Illustrate the properties and applications of four types of cast iron. Grey cast iron, Malleable cast iron, Nodular cast iron, White cast iron Write properties and applications	10	3	2
5a	Explain the metal casting process. Write the advantages and disadvantages of any two casting processes. Explaining general casting process 2m Writing advantages and disadvantages 3m	05	3	2
5b	Write the properties and applications of bio-materials.	05	2	

Different Casting Processes

Process	Advantages	Disadvantages	Examples
Sand	many metals, sizes, shapes, cheap	poor finish & tolerance	engine blocks, cylinder heads
Shell mold	better accuracy, finish, higher production rate	limited part size	connecting rods, gear housings
Expendable pattern	Wide range of metals, sizes, shapes	patterns have low strength	cylinder heads, brake components
Plaster mold	complex shapes, good surface finish	non-ferrous metals, low production rate	prototypes of mechanical parts
Ceramic mold	complex shapes, high accuracy, good finish	small sizes	impellers, injection mold tooling
Investment	complex shapes, excellent finish	small parts, expensive	jewellery
Permanent mold	good finish, low porosity, high production rate	Costly mold, simpler shapes only	gears, gear housings
Die	Excellent dimensional accuracy, high production rate	costly dies, small parts, non-ferrous metals	gears, camera bodies, car wheels
Centrifugal	Large cylindrical parts, good quality	Expensive, few shapes	pipes, boilers, flywheels

- A biocompatible chemical composition to avoid adverse tissue reactions
- Excellent resistance to degradation (e.g., corrosion resistance for metals or resistance to biological degradation in polymers)
- Acceptable strength to sustain cyclic loading endured by the joint
- A low modulus to minimize bone resorption
- High wear resistance to minimize wear debris generation

1.Orthopedics
2.Cardiovascular Applications
3.Ophthalmics
4.Dental Applications

- Heart Valve
- Dental Implants
- Intraocular Lenses
- Vascular Grafts

	Any five			

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	TEST	Marks	-	50	-	-		10	40			

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Department of Mechanical Engineering

CIE – IMPROVEMENT

Date	**August 2024**	Maximum Marks	50 +10
Course Code	ME242AT	Duration	120 Min
Course Name	Material Science for Engineers	**USN:**	

Q. No.	**PART A**	**M**	**BT**	**CO**
1	Name a critical electronics manufacturing process primarily used in surface-mount technology.	1	1	3
2	Write two key advantages of RTP in Semiconductor manufacturing.	2	1	3
3	What are the two basic purposes of tempering.	2	1	3
4	The crystal structure of martensite is _____.	1	1	3
5	Mention the cause of warpage in heat treatment of mechanical structure.	1	1	3
6	Mention a property of a material which significantly defer from bulk material to nanomaterial.	1	1	4
7	CVD technique used for synthesis of a nanomaterial is a _____ type of approach.	1	1	4
8	How nanoFRP is different from FRP.	1	1	4

Q. No.	**PART B**	**M**	**BT**	**CO**
1a	Describe the steps followed in thermal oxidation process for the post processing heat treatment of electronic devices.	5	3	3
1b	Highlight the factors affecting thermal oxidation process of electronic devices.	5	2	
2	Highlight the advantages, disadvantages and microstructures of following heat treatment processes for eutectoid steels i) Annealing, ii) Normalizing and iii) hardening	10	2	3
3a	Describe the process of construction of Time Temperature Transformation (TTT) curves of eutectoid steel.	5	3	3
3b	Explain the induction hardening process with a neat sketch	5	3	
4a	Define and classify nanomaterials with examples.	5	2	4
4b	Illustrate the synthesis of nanopowder using sol-gel method.	5	3	
5a	Describe the properties and applications of carbon nanotubes and nano fabrics.	5	3	4
5b	Illustrate the working principle of Scanning Electron Microscope (SEM) for the characterisation of nanocomposites.	5	3	

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
Marks Distribution	TEST	Marks	-	-	30	20		20	30			
	QUIZ				7	3	10					

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