

**RV COLLEGE OF ENGINEERING®**  
 (An Autonomous Institution Affiliated to VTU)  
 III Semester B. E. Examinations April/May-2024  
 Common to All Branches  
**MATERIAL SCIENCE FOR ENGINEERS**

Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

- Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
- Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

**PART-A****M BT CO**

1	1.1	Ceramic materials are generally having _____ type of bonds.	01	1	1
	1.2	When the electrical behaviour of the material are dominated by the electronic structure of pure metal, the material can be called as _____ semi-conductors.	01	1	1
	1.3	Give an example of natural composite.	01	1	1
	1.4	$T_i$ is having _____ crystal structure at room temperature.	01	1	1
	1.5	For the application of extremely high temperatures, _____ type of basic materials are used.	01	1	1
	1.6	$Cu - Ni$ alloys are an example of _____ type of defect.	01	1	1
	1.7	Deformations by twins are commonly observed in _____ type of metals.	01	1	1
	1.8	Calculate the co-ordination number of BCC crystal systems.	01	1	1
	1.9	External surfaces are an example of _____ type of defects in crystal systems.	01	1	2
	1.10	Viscoelastic deformation is observed significantly in _____ basic material.	01	1	2
	1.11	Diamond pyramid indenter is used in _____ hardness testing.	01	1	2
	1.12	Addition of chromium (Cr) to steel enhances _____ property.	01	1	2
	1.13	Which property of dielectric materials is measured in materials testing?	01	1	2
	1.14	Photodiodes serves as a _____ in optical communication systems.	01	1	2
	1.15	Name the hardening process which introduces nitrogen into the surface layer of steel to produce nitrides at the surface layer of the component.	01	1	3
	1.16	_____ is a critical process in electronics manufacturing primarily used in surface-mount technology.	01	1	3
	1.17	Aggregated composites possess _____ strength compared to fiber reinforced composites.	01	1	3
	1.18	Sol-gel process is an example of _____ approach of synthesis of nanomaterials.	01	1	4
	1.19	Crystalline structures of materials are measured on the basis of lattice spacing and electron interaction with it, in _____ characterization technique.	01	1	4
	1.20	Name characterization technique for nanostructure in which atomic structures of the materials are observed using electrons passing through ultra-thin specimens.	01	1	4

## PART-B

2	a	Describe the following bonds for solid materials with examples. i) Ionic bonds ii) Secondary bonds and iii) Metallic bonds.	08	2	1
	b	Explain the following crystallographic features of a Solid material. i) FCC crystal structure with example ii) Energy bands in insulator iii) Edge dislocation in a metal.	08	2	1
3	a	Define and explain the following thermal properties of a material. i) Thermo-electric effect ii) Linear thermal expansion coefficient iii) Thermal shock.	08	2	2
	b	Explain the principle of working of following materials. i) Piezoelectric materials and ii) Thermocouples.	08	3	2
		<b>OR</b>			
4	a	With a stress-strain curve, explain the following properties of a material. i) Young's Modulus ii) Ultimate Tensile Strength and iii) Toughness.	08	3	2
	b	Define the following mechanical properties of a solid material. i) Fracture toughness ii) Hardness iii) Fatigue limit.	08	2	2
5	a	Explain the properties and applications of stainless steel.	06	2	2
	b	Mention the dopant used for p-type and n-type semiconductors.	04	2	2
	c	Explain the properties and applications of ceramics.	06	2	2
		<b>OR</b>			
6	a	Explain the properties and applications of fiber reinforced composites.	08	2	2
	b	Classify forming processes of structural materials and explain any two forming processes.	08	2	2
7	a	Explain the steps involved in thermal oxidation method of semiconductor devices.	08	3	3
	b	Describe the cause, effect and prevention methods of any two defects of heat treatment process of metals.	08	2	3
		<b>OR</b>			
8	a	Differentiate between annealing and normalizing process of ferrous materials.	08	3	3
	b	Describe hardening of steel with the help of TTT diagram.	08	2	3
9	a	Define nanomaterials and describe the applications of nanomaterials with example.	08	2	4
	b	Describe the effect of particle size and surface area of nanomaterials on the mechanical and optical properties of it.	08	2	4
		<b>OR</b>			
10	a	Describe the significant properties and applications of carbon nanotubes.	08	2	4
	b	Describe the principle of working of X-Ray Diffraction (XRD) techniques for the characterization of solid materials.	08	3	4