



Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Third Semester B.Tech Degree Examination December 2021 (2019 scheme)

Course Code: RAT201

Course Name: PROCESSING AND PROPERTIES OF MATERIALS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks

		Marks
1	With suitable examples describe about polymorphism.	(3)
2	Define unit cell, lattice and basis.	(3)
3	Describe about vacancy defects.	(3)
4	Why do we use PET plastic to make carbonated beverage bottles?	(3)
5	Write down the important reactions in an Iron-Carbon equilibrium diagram	(3)
6	Explain eutectic reaction	(3)
7	What are composites? Classify them.	(3)
8	What are biomaterials	(3)
9	Describe about ferromagnetism. Give two examples for ferromagnetic materials	(3)
10	Define thermal conductivity. What are factors influencing conductivity.	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

- | | | |
|-------|---|-----|
| 11(a) | Obtain the atomic packing factor of FCC crystal system | (4) |
| (b) | The density of potassium, which has the BCC structure and one atom per lattice point, is 0.855 g/cm^3 . The atomic weight of potassium is 39.09 g/mol . | (5) |
| (c) | Calculate (a) the lattice parameter; and (b) the atomic radius of potassium. | |
| | Represent the following planes and directions in a cubic crystal | (5) |
| | $(013)[01\bar{1}], [\bar{1}21], (020), [1\bar{2}3]$ | |
| 12(a) | A single crystal of an FCC metal is oriented so that the $[001]$ direction is parallel to an applied stress of 5000 MPa . Calculate the resolved shear stress acting on the (111) slip plane in the $[\bar{1}10]$ direction | (6) |
| (b) | Explain about heterogeneous nucleation. | (4) |
| (c) | Differentiate between slip and twinning. | (4) |

Module 2

- 13(a) Differentiate between Schottky and Frenkel defect. (4)
(b) With suitable figures explain about any two surface defects. (8)
(c) Explain the significance of Frank Reed Source. (4)
- 14(a) What is diffusion? Discuss about major diffusion mechanisms. Explain Fick's second law of diffusion. (10)
(b) Describe the role of temperature on diffusion process. (4)

Module 3

- 15(a) What are solid solutions? Describe Hume Rothery's rule for the formation of substitutional solid solution. (5)
(b) Draw Fe-Fe₃C equilibrium diagram and mark all salient points. With neat figures, describe the microstructural evolution of a hypoeutectoid steel. (9)
- 16(a) Draw the TTT diagram of a eutectoid iron-carbon alloy. (5)
(b) Explain about normalizing. (3)
(c) Describe about Jominy end quench test. (6)

Module 4

- 17(a) What are polymer matrix composites (PMC)? Mention the characteristics of polymer matrix composites. (5)
(b) List five applications of composites in the aircraft and aerospace field. (5)
(c) Describe two mechanical properties of semicrystalline polymers. (4)
- 18(a) Differentiate between thermoplastics and thermosetting plastics. (6)
(b) Mention the composition, properties and applications of any two aluminum alloys. (6)
(c) What is meant by polymerisation? (2)

Module 5

- 19(a) what is meant by the drift velocity and mobility of a free electron. (4)
What is electrical conductivity? In terms of electron energy band structure,
(b) discuss reasons for the difference in electrical conductivity between metals, semiconductors, and insulators. (10)
- 20(a) Distinguish between materials that are opaque, translucent, and transparent in terms of their appearance and light transmittance. (9)
(b) Define reflection. Briefly explain what determines the characteristic colour of (a) a metal and (b) a transparent nonmetal. (5)
