Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) Examination December 2025 (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	Describe the concept of bond energy	(3)
2	Illustrate the concept of plastic deformation by twinning	(3)
3	Illustrate Frenkel defect	(3)
4	State Fick's second law of diffusion	(3)
5	State Hume-Rothery's rule	(3)
6	Describe the process nitriding	(3)
7	What are CMCs among composite materials?	(3)
8	What is a composite biomaterial? Give two examples.	(3)
9	What is Ohm's law?	(3)
10	Define thermal conductivity	(3)

PART B

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

Module 1

11	a) Sketch within a cubic unit cell the following planes (1 1 $\bar{1}$), (1 $\bar{1}$ 0), (0 0 1) and directions [1 1 1], [1 0 1]	(8)
	b) Describe the mechanism of slip in single crystals and explain the terms (i) resolved shear stress and (ii) critical resolved shear stress	(6)
12	a) Describe homogeneous and heterogeneous nucleation process	(8)
	b) Write notes on (i) under cooling (ii) dendritic growth (iii) grain boundary irregularity	(6)

Module 2

13	Discuss crystal imperfections in detail	(14)
14	Explain the following (i) Fick's laws of diffusion in solids	(14)

(ii) Diffusion mechanisms in solids

(iii) Applications of diffusion in mechanical engineering

Module 3

15 a) Illustrate Iron-Carbon equilibrium diagram and explain the following (i)Eutectic reaction (ii) Eutectoid reaction (8)

b) How ferrous alloys are classified? Explain (6)

16 a) What is hardenability? Illustrate Jominy end quench test (8)

b) Illustrate flame hardening and induction hardening processes (6)

Module 4

17 a) Differentiate between Polymer-Matrix Composites (PMCs) and Metal-Matrix Composites (MMCs) (10)

b) Explain the concept of sandwich composites (4)

18 a) Describe the application of composites in marine industry and sporting goods industry (10)

b) Explain the factors that influence the mechanical properties of semicrystalline polymers (4)

Module 5

19 a) In terms of electron energy band structure, discuss reasons for the difference in electrical conductivity between metals, semiconductors, and insulators (7)

b) Explain about thermal stresses in materials (7)

20 a) Distinguish between antiferromagnetism and ferrimagnetism (5)

b) Writes notes on (9)

(i) Refraction (ii) Reflection (iii) Absorption

***