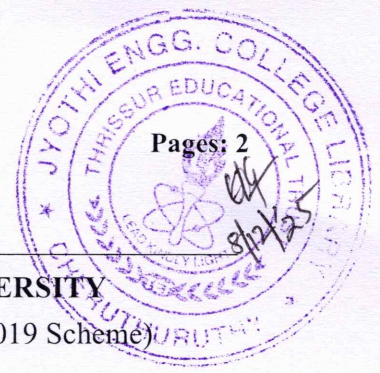


Reg No.: \_\_\_\_\_

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 $[1\ 1\ 1]$ , $[\bar{1}\ 0\ 1]$ | (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<br>(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 (8)
  - (i) Eutectic reaction (ii) Eutectoid reaction
- 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

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