Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Regular and Supplementary Examination December 2022 (2019 Scheme)

Course Code: MET205
Course Name: METALLURGY AND MATERIAL SCIENCE

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions. Each question carries 3 marks   Marks

1	Describe the importance of long range and short range order of atomic arrangement on mechanical strength in solids.	(3)
2	Write three differences between slip & twinning.	(3)
3	What is Frank-Read source?	(3)
4	What are the distinct features of Scanning Electronic Microscope (SEM)?	(3)
5	What do you mean by critical cooling rate in CCT diagram?	(3)
6	How phase amounts can be determined using phase diagram?	(3)
7	Describe precipitation hardening mechanism in materials.	(3)
8	List the composition, properties, and use of Gun metal.	(3)
9	What are composites? Give one example and its application.	(3)
10	Differentiate Creep & Fatigue.	(3)

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

Module 1

11	a)	Prove that the resolved shear stress on the slip plane in the slip direction is zero, when the slip plane is normal to the stress axis	(7)
	b)	Explain atomic packing factor and its importance.	(4)
	c)	Compare primary bond with secondary bond.	(3)
12	a)	Explain the phenomenon recovery, recrystallization and grain growth.	(9)
	b)	State and explain Schmid's law.	(5)

Module 2

13	a)	How X-Ray diffraction technique is utilized for the determination of crystal structures?	(4)

b) A hardening process is performed at 1000°C on an iron–carbon alloy. The initial concentration of carbon in the alloy is 0.20 wt% C. The surface concentration is to be maintained at 1.30 wt% C. Determine the carburizing time needed to achieve a carbon concentration of 0.45 wt% at a position 2 mm. Assume the error function value 'z' as 0.85. The temperature-independent preexponential of diffusion is $2.3*10^{-5}$ m^2/sec and the activation energy is 148 kJ/mol. (10)

14 a) Write a short note on different types of Line defects occur in crystals. (7)

b) Explain unsteady state diffusion. Derive the equation for Fick's second law. (7)

Module 3

15 a) Write the procedure for constructing TTT diagram. Mark all regions in a TTT diagram for Fe-C alloy system (10)

b) Differentiate Normalising & Annealing. (4)

16 a) Why surface hardening processes are done on steels? Explain any two surface hardening methods. (10)

b) What is invariant reaction? Compare eutectoid and peritectoid reaction. (4)

Module 4

17 a) How various alloying elements influence the property of steel? (7)

b) Give the composition and applications of i) high speed steel ii) white iron (4)

c) How cold working increases the strength of a material? (3)

18 a) Explain the following strengthening mechanism in metals.

i) Strengthening by grain size reduction (5)

ii) Solid solution strengthening (5)

b) What are non-ferrous alloys? Give two examples and their applications. (4)

Module 5

19 a) With the aid of S-N curve explain the mechanism of Creep. (10)

b) What are super alloys? List its advantages and applications (4)

20 a) What is fatigue failure? Explain various factors that affect the fatigue life of a material. (10)

b) What is maraging steel? Write any two engineering applications (4)