Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech (Hons.) Degree Examination June 2024 (2022 Admission)

Course Code: MET296

Course Name: MATERIALS IN MANUFACTURING

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		List and brief on the structural parameters in high temperature deformed metals.	3
2		With the help of figures, show the representation of directions and planes of a hexagonal crystal structure using miller indices.	3
3		Why remelting is essential in the production of superalloys?	3
4		Explain the requirement of superalloys in gas turbine engines.	3
5		List the brittle phases in superalloys. Which are the elements causing the formation of brittle phases?	3
6		Why are cast superalloys preferred over wrought alloys in turbine blades?	3
7		Explain shear banding in Ti.	3
8		Write a note on heat treatment of Titanium.	3
9		What are maraging steels?	3
10		Explain about TZC?	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Explain the different mechanisms of creep deformation.	6
	b)	What are the different primary and secondary bonds? Give properties associated with each bond.	8
12	a)	Explain different strengthening mechanisms of crystalline solids.	10
	b)	Explain the formation and characteristics associated with sub-grains in creep deformation.	4

Module -2

13		With a detailed diagram, explain elaborately the procedure, metallurgy, process specifications of VIM.	14

14		Explain the process of ESR with neat diagrams. Give the advantages and challenges of ESR of superalloys.	14

Module -3

15	a)	Write a brief note on Iron-Nickel base superalloys.	7
	b)	Write a brief note on nickel-based superalloys.	7
16	a)	Explain the different phases in superalloys.	10
	b)	Differentiate wrought and cast alloys.	4

Module -4

17		Elaborate the behaviour of single crystal superalloys under creep and under fatigue.	14
18	a)	Explain different techniques of manufacturing single crystal superalloys.	8
	b)	Discuss the different steps in investment casting.	6

Module -5

19	a)	Write a note on heat treatment of maraging steel.	6
	b)	Write a note on TZM	4
	c)	Write note on Hume-Rothery phases	4
20	a)	Explain the production of Mo metal.	8
	b)	Explain the effects of Mo alloying.	6