Q. Code:851918

Reg. No. | | | | | | | | | | | | | |

B.E./ B. TECH DEGREE EXAMINATIONS, MAY 2024

Second Semester

MR22202 – MATERIAL SCIENCE AND ENGINEERING

(Marine Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Understand the Fundamentals of Metallurgy, Properties of metals and crystallography.	**2**
CO 2	Understand the various heat treatment processes.	**2**
CO 3	Understand the various mechanical property testing methods.	**2**
CO 4	Understand how different materials are selected for different uses on board ships, welding and corrosion metallurgy, bonding, and Non-destructive testing.	**2**
CO 5	Appreciate the various properties of the latest materials, including non-metals.	**2**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Define the term Crystallography.	**1**	**2**
2.	What is the difference between mild steel and cast iron?	**1**	**2**
3.	Explain the term wrought iron.	**1**	**2**
4.	What is the grain boundary within a polycrystalline solid?	**1**	**2**
5.	Compare normalizing and annealing as heat treatment processes for steel.	**2**	**2**
6.	What are the drawbacks of the hardening process in heat treatment of steel?	**2**	**2**
7.	Differentiate between nitriding and carburizing as hardening processes?	**2**	**2**
8.	Explain the importance of the Jominy end quench test.	**2**	**2**
9.	Compare inter-granular fracture and trans-granular fracture in crystalline materials?	**3**	**2**
10.	How can the fatigue life of a component be increased?	**3**	**2**

11.	What is the importance of the fracture toughness test in mechanical testing?	**3**	**2**	
12.	Briefly explain the term DBTT and its significance in the marine field.	**3**	**2**	
13.	What is the HAZ in welding of metals?	**4**	**2**	
14.	What are the disadvantages of Visual Inspection as a method for non-destructive testing of materials?	**4**	**2**	
15.	Classify the different types of loads applied during testing of materials.	**4**	**2**	
16.	What is the distinguishing feature of thermosetting adhesives?	**4**	**2**	
17.	What is a polymer?	**5**	**2**	
18.	Compare bottom-up and top-down approaches in preparation of nanomaterials.	**5**	**2**	
19.	Why are ceramics very useful as materials?	**5**	**2**	
20.	What are the main features of carbon nanotubes that make it a very useful nanomaterial?	**5**	**2**	

PART- B (5 x 10 = 50 Marks)

			Marks	CO	RBT LEVEL
21. (a)	**(i)**	Explain the properties of copper and Aluminium as metals.	**(4)**	**1**	**2**
	(ii)	What alloys of copper and Aluminium are used in the marine and other fields.	**(6)**	**1**	**2**
		(OR)			
(b)	**(i)**	What is the purpose of the iron carbon equilibrium diagram for a material science student.	**(2)**	**1**	**2**
	(ii)	Explain the different phases in the diagram and their properties.	**(8)**	**1**	**2**
22. (a)		Explain the Jominy End quench test for measuring hardenability of materials with appropriate drawings.	**(10)**	**2**	**2**
		(OR)			
(b)	**(i)**	Explain the flame hardening process with a neat sketch.	**(5)**	**2**	**2**
	(ii)	Compare normal annealing and stress relieve annealing using visuals.	**(5)**	**2**	**2**
23. (a)	**(i)**	Briefly compare ductile and brittle fracture in materials.	**(6)**	**3**	**2**
	(ii)	Explain Failure due to creep and its importance in the marine field.	**(4)**	**3**	**2**

(OR)

			Marks	CO	RBT LEVEL
(b)		Explain Any one hardness testing method in detail for testing of materials with appropriate sketches.	**(10)**	**3**	**2**
24. (a)		Explain magnetic particle testing as a Non-destructive testing method for material - Give its advantages and disadvantages.	**(10)**	**4**	**2**

(OR)

(b)		Explain fatigue testing in detail with appropriate sketches.	**(10)**	**4**	**2**
25. (a)	**(i)**	What are plastics? How are they made?	**(4)**	**5**	**2**
	(ii)	Explain how plastics are used in the Marine Industry with examples.	**(6)**	**5**	**2**

(OR)

(b)	**(i)**	How are carbon nanotubes made in a lab? Explain with a sketch.	**(6)**	**5**	**2**
	(ii)	What is a composite material? Give an example and an application in the marine industry?	**(4)**	**5**	**2**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	What is the name of the material used to make (tool) steels for machining materials? What are the elements you will add to it to give it the necessary properties?	**(10)**	**1**	**3**

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