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***B.Tech. Degree IV Semester Regular/ Supplementary Examination in  
Marine Engineering June 2022***

**19-208-0403 METALLURGY AND MATERIAL SCIENCE**

*(2019 Scheme)*

Time: 3 Hours

Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

CO1: Understand the crystal structure of metal, defects occurring in crystals of metals and the process of solidification of metals under slow and fast cooling.

CO2: Understand the phase rule, phase diagrams, solid solutions, examples of binary solid solutions and to understand the mechanism of corrosion and its prevention methods.

CO3: Understand about different heat treatment methods and different metals and alloys.

CO4: Gain knowledge about the phenomena of failures occurring in metals.

CO5: Learn about the different destructive and non-destructive tests and the different metals used onboard and in marine applications.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

PO – Programme Outcomes

**PART A**

(Answer *ALL* questions)

(5 × 15 = 75)

		Marks	BL	CO	PO
I.	(a) Explain the types of Bravais lattices with suitable examples and sketch of the unit cell.	10	L2	1	1.3.1
	(b) Differentiate between allotropy and polymorphism with examples.	5	L2	1	1.3.1
<b>OR</b>					
II.	With the help of suitable sketches explain point, line and surface imperfections found in solid crystal.	15	L2	1	1.3.1
III.	Draw a neat sketch of the iron-carbon equilibrium diagram. Label all significant features and explain the three important reactions.	15	L3	2	1.3.1
<b>OR</b>					
IV.	(a) Discuss on Gibb's phase rule and obtain the degrees of freedom for non variant and mono variant systems.	5	L1	2	1.3.1
	(b) Explain any -four types of corrosion with suitable sketch and mechanism.	10	L2	2	1.4.1
V.	(a) Explain various types of strengthening mechanisms in metals.	10	L2	3	1.3.1
	(b) Discuss different types of carburizing techniques used in surface treatments.	5	L2	3	1.3.1
<b>OR</b>					
VI.	(a) Explain the functions of various alloying elements of steels.	7	L2	3	1.3.1
	(b) Discuss the composition, properties and applications of gray and spheroidal graphite cast irons.	8	L2	3	1.3.1

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VII.	Explain the following:	15	L2	4	1.3.1
	(i) Creep curve				
	(ii) Mechanism of creep				
	(iii) Factors affecting creep.				
	<b>OR</b>				
VIII.	(a) Explain the characteristics and stages of different fractures with neat sketches.	10	L2	4	1.3.1
	(b) Differentiate between slip and twinning in metals.	5	L3	4	1.3.1
IX.	(a) Explain any three destructive test with suitable sketches.	10	L2	5	1.3.1
	(b) What are the materials used for propellers and rudders? Discuss their properties.	5	L3	5	1.4.1
	<b>OR</b>				
X.	Explain any three non destructive test with suitable sketches.	15	L2	5	1.3.1

Blooms's Taxonomy Levels

L1 – 10%, L2 – 55%, L3 – 35%.

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