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**BTECH**  
**(SEM III) THEORY EXAMINATION 2025-26**  
**MATERIALS ENGINEERING**

TIME: 3 HRS

M.MARKS: 70

**Note:** Attempt all Sections. In case of any missing data; choose suitably.

**SECTION A**

**1. Attempt all questions in brief.**

**02 x 7 = 14**

Q no.	Question	CO	Level
a.	Define Hooke's law in its generalized form? What is the difference between engineering stress and true stress?	1	K2
b.	What is a dislocation? Differentiate between line and interfacial defects.	1	K2
c.	Define and explain the eutectic reaction with an example.	2	K2
d.	What is the purpose of alloying in steel? What are the two common alloying elements in steel and their effects.	3	K2
e.	How does a TTT diagram help in predicting microstructure?	3	K2
f.	Differentiate between normalizing and annealing. When these processes are required.	4	K2
g.	Define creep? What are the different factors influence creep rate?	5	K2

**SECTION B**

**2. Attempt any three of the following:**

**07 x 3 = 21**

Q no.	Question	CO	Level
a.	Define toughness and resilience? How is toughness measured from a stress-strain curve?	1	K2
b.	What is High Speed Steel (HSS) and where is it used?	2	K3
c.	What is carbon fiber and why is it used in composites? What makes carbon fiber-based composites most suitable for different applications.	3	K3
d.	Explain the process principles of flame and induction hardening. Name some applications.	4	K4
e.	What is the difference between X-ray diffraction and radiography? Explain the process principle of X-ray diffraction used in NDT.	5	K4

**SECTION C**

**3. Attempt any one part of the following:**

**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Define Young's modulus. Differentiate between engineering stress-strain and true stress-strain curves. Derive the relation between stress-strain.	1	K3
b.	Describe the common metallic crystal structures (FCC, BCC, HCP). Compare their packing efficiency, coordination number, and examples of metals exhibiting these structures.	1	K4



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**MATERIALS ENGINEERING**

**TIME: 3 HRS****M.MARKS: 70****4. Attempt any one part of the following:****07 x 1 = 07**

Q no.	Question	CO	Level
a.	Draw and explain the Fe-Fe <sub>3</sub> C phase diagram. Highlight important phase transformations and critical temperatures.	2	K5
b.	What is High Speed Steel (HSS)? Discuss its composition, properties, and applications in cutting tools.	2	K4

**5. Attempt any one part of the following:****07 x 1 = 07**

Q no.	Question	CO	Level
a.	Explain the characteristics of tool steels. How do alloying elements improve hardness, wear resistance, and toughness?	3	K4
b.	Explain the properties of titanium alloys. Why are they preferred in aerospace and biomedical applications?	3	K3

**6. Attempt any one part of the following:****07 x 1 = 07**

Q no.	Question	CO	Level
a.	Draw and explain the isothermal transformation (TTT) diagram for Fe-C alloys. Discuss the microstructures obtained at different cooling rates.	4	K5
b.	Describe cyaniding and carbo-nitriding. How do they differ in terms of diffusion elements and applications?	4	K4

**7. Attempt any one part of the following:****07 x 1 = 07**

Q no.	Question	CO	Level
a.	Discuss the working principle and applications of Magnetic Particle Inspection (MPI) and Ultrasonic Testing (UT) with suitable diagram. Enlist their advantages and disadvantages?	5	K4
b.	How do metals behave at very low temperatures? Explain the effect of cryogenic temperatures on material properties. Discuss ductile-to-brittle transition temperature with examples.	5	K4