

Ref. No.: Ex/Met/PC/B/TS/222/2022(S)

**B.E. METALLURGICAL AND MATERIAL ENGINEERING SECOND  
YEAR SECOND SEMESTER SUPPLEMENTARY EXAM - 2022**

**Subject: TESTING OF MATERIALS**

**Time: 3 hours**

**Full Marks = 100**

**(Answer question no 1 and 7 and any four from the rest)**

**1. Answer any ten questions: (10 × 2 = 20)**

a. Complete the table:

Test	Indenter	Load	Application
Brinell	10 mm (dia. Steel ball)	_____	Nonferrous metals and alloys
Vickers	_____	15 Kg	All materials

- b. What effect will be observed on hardness value of a material when the indentation is made at too close to an existing indentation?
- c. Concrete has exceptional strength in compression but it fails rather early in tension, why?
- d. The slope of the stress-strain curve in the plastic range is called \_\_\_\_\_?
- e. With an increase in strain rate, ductility \_\_\_\_\_ and tensile strength \_\_\_\_\_.
- f. The standard specimen geometry for impact testing is \_\_\_\_\_?
- g. Three basic factors contribute to brittle-cleavage type fracture are \_\_\_\_\_
- h. what type of fracture surface will you expect if the impact test carried out at below the nil ductility temperature?
- i. Match with mechanical tests in Group 1 to the output parameters in Group 2:

Group 1		Group 2	
1.	Tensile test	I.	Ductile to brittle transition temperature
2.	Impact test	II.	Equicohesive temperature
3.	Fatigue test	III.	Yield point phenomenon
4.	Creep test	IV.	Endurance limit

- j. Define "fatigue ratio".
- k. Arrange in increasing order of creep resistance of a material: (i) Single crystal, (ii) Polycrystal, (iii) Directionally solidified crystal.
- l. Which nondestructive testing will you prefer to detect the crack present inside the material?

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2.

5 + 5 + 5 = 15

- a. State the purposes for conducting micro indentation at low load over macro indentation.
- b. What are the precautionary steps we need to follow for measuring the hardness using the Vickers hardness testing machine?
- c. The following data is obtained from a Brinell hardness test.

Dia. Of indentation(mm)	Dia. Of indenter(mm)	Load (kg)
4.75	10	3000
3.33	7	1470
2.35	5	750

Determine the B.H.N. and explain the basic principle from the above data.

3.

6 + (3 + 6) = 15

- a. Draw schematic load elongation, engineering stress strain and true stress strain curves on the same diagram for a low carbon steel tested under uniaxial tension. Compare the nature of these curves assigning reasons for differences.
- b. Find the relation between True stress and Engineering stress. If a true stress-true strain curve is given by  $\sigma = 1250\epsilon^{0.27}$ , where, stress is in MPa. What is the ultimate tensile stress of the material?

4.

6 + 6 + 3 = 15

- a. Design an experiment to know the transition temperature curve for a plain carbon steel tested in notched impact.
- b. Sketch the curve and state the important metallurgical factors that affect the transition temperature.
- c. What is meant by the term notch sensitivity?

5.

3 + 6 + 6 = 15

- a. Define range of stress, stress ratio and amplitude ratio in connection with cyclic loading.
- b. Discuss the effect of stress ratio on S-N curve of a material.
- c. Explain the effect of mean stress on fatigue of materials.

6.

8 + 7 = 15

- a. Draw typical constant load and constant stress creep curves delineating the different stages. Indicate the phenomenological processes in each stage. What is minimum creep rate?
- b. Define equicohesive temperature of a material. Copper (Cu) does not creep at room temperature but lead (Pb): why?

7. Compare to contrast (Any four): (4 × 5 = 20)

- a. Failure Vs Fracture of materials
- b. Brinell Vs Vickers hardness test.
- c. Izod vs Charpy impact test
- d. Creep vs stress rupture test.
- e. Liquid dye penetration test vs Magnetic particle test