

Sub: Material Properties Evaluation

(Code: MT 604)

Time: 3 hrs

Full Marks: 70

Use **Single** answer script

Answer any **Seven** questions

Use your own words as far as practicable

1. (a) What is impact toughness? How can it be determined from the impact test?
(b) Why hardened steel specimens are usually tested in Izod impact tester?
(c) How do composition and microstructure influence the impact properties in steel?
4+2+4
2. State true or false and justify your comments: 10
(a) Grain size has a strong effect on impact transition temperature.
(b) Hardness of copper increases with increasing test temperature.
(c) Reduction in area in the longitudinal direction is usually lower than that of the transverse direction of a plate.
3. Distinguish between each of the following pairs: 10
(a) Proportional limit and elastic limit
(b) Izod and Charpy impact test
(c) Notch tensile and unnotch tensile behaviour of a ductile metal
4. (a) What is compressive strength?
(b) Explain the load-deformation curves for compression test with different values of L/D ratio.
(c) In a compression test (friction is absent), under the compressive force of 10 metric tonnes, a cylinder of diameter 10 mm and initial height 20 mm has been reduced in height to 15 mm and spread out in diameter. Calculate the true compressive stress and strain.
2+4+4
5. (a) State and explain Barba's law.
(b) Explain why necking occurs in the tension test of a ductile material.
(c) True stress-strain curve of a material can be expressed as $\sigma = 1000\epsilon^{0.3}$, stress is in MPa. Find YS, UTS and true stress at maximum load of the material.
3+3+4

6. (a) What is fatigue?
(b) Explain different types of stress cycles that can be observed during fatigue test.
(c) What do you understand by steady stress, variable stress and range of stress?
2+5+3
7. Briefly explain the following:
(a) 'Safety factor' in engineering design
(b) The important mechanical property of the material used in a ropeway
(c) The property of the sheet metal used in the boiler of a steam turbine
(d) Effect of surface condition on fatigue life.
2½ × 4
8. (a) What is creep? Explain the mechanism of different stages of creep with a suitable diagram.
(b) What is equicohesive temperature? State its significance?
7+3
9. (a) Which type of defects can be identified by dye penetrant test? Briefly explain the principle of this test.
(b) Briefly explain the principle of ultrasonic testing method. Which type of defects can be identified by this technique?
5+5
10. Write technical notes on the following.
(a) Corrosion fatigue
(b) Visual testing as an NDT method
(c) Eddy current testing as an NDT technique
10
11. (a) Compare the advantages of non-destructive testing over destructive tests.
(b) Between ultrasonic and radiographic testing methods which one (i) is more economical, (ii) has higher portability of the equipment and (iii) requires more skilled operator? Justify your answers.
4+6
