

Material Properties Evaluation (MT- 604)

Time: 3 hrs

Full Marks: 70

Use **single** answer script.  
Answer any **FIVE** questions.  
Use your own words as far as practicable.

1. (a) What is creep? Draw a conventional creep curve indicating different stages of creep behaviour and explain the nature of the curve.  
(b) What are the fundamental differences between stress-rupture test and creep test?  
(c) Explain the effect of test temperature on creep curve for a low alloy steel at a constant load.  

7+4+3
2. (a) What is fatigue? Draw the S-N (Stress vs. Number of cycles) curve of fatigue failure for medium carbon steel and aluminium, indicating their endurance limits.  
(b) What do you mean by residual stress? Briefly discuss the influence of residual stress on fatigue property.  
(c) How do you increase the fatigue life of a component?  

7+4+3
3. (a) How does completely pearlitic microstructure contribute to impact properties in steel?  
(b) How do you define the DBTT criterion for low strength ship steel?  
(c) Explain the principle of measurement of sub-zero impact toughness? Why is it practically important?  
(d) Mention the specification of cantilever specimen used for Izod test.  

3+3+6+2
4. State true or false and justify your comments: 3.5×4
  - (a) Superplastic behaviour occurs at  $T < 0.5T_m$ .
  - (b) Cold deformation introduces a significant anisotropy in the mechanical properties.
  - (c) Usually more than one creep mechanism operates at the same time.
  - (d) Fatigue deformation of age hardened alloy results in over ageing

5. Distinguish between each of the following pairs: 3.5×4
- (a) Diffuse necking and localised necking
  - (b) Orowan's theory and Wood's concept
  - (c) Strain hardening exponent and strain rate sensitivity
  - (d) Corrosion fatigue and thermal fatigue
6. (a) How does H/D ratio influence the compressive strength?  
(b) How does grain size affect super plastic behaviour of Ti-6Al-4V alloy?  
(c) Why brittle materials are usually tested under compression?  
(d) How does Vickers micro-hardness receive wide acceptance over Knoop micro-hardness for metallurgical research work?
- 4+3+3+4
7. (a) Explain the principle and methods of ultrasonic non-destructive testing of metallic components. Give two examples of the sources leading to the misinterpretation of results in ultrasonic testing.  
(b) Explain the difference in the principle and scope of magnetic particle inspection and eddy current testing.
- 8+6
8. Write technical notes on: 3.5×4
- (a) Creep resistant materials
  - (b) Fatigue stress cycles
  - (c) Notch tensile test
  - (d) Instability in tension