Roll No ....

MMPD - 103

M.E./M.Tech., I Semester

Examination, December 2015

Material Technology And Failure Analysis

Time : Three Hours

Maximum Marks : 70

Note : i)   Attempt Any Five Questions out of eight questions given.
   ii) Draw neat diagrams in support of your answers.
   iii) Assume suitable data, if any missing.

1. a) Classify the defects in crystals. Explain them in detail.

   b) Explain recovery, recrystallization and grain growth.

2. a) Discuss types of bonds in crystals and their effects on the properties of metals.

   b) How measurement of damping capacity is done? Explain in detail?

3. a) Compare hot and cold working of metals.

   b) State and explain various theories of failure.

4. a) Define these terms: strain hardening, strain aging, strain rate.

   b) Compare elastic deformation of metals with plastic deformation of metals.

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5. Define the following: (any five)

   • Endurance Limit.

   • Steady state creep rate.

   • Reversed and repeated cycles in fatigue.

   • Transient creep.

   • Viscous creep.

   • S-N diagram.

   • Stress concentration and controlling factors.

6. A solid round bar, 25 mm in diameter, has a groove 2.5 mm deep with a 2.5 mm radius machined into it. The bar is made of AISI 1018 CD steel and is subjected to a purely reversing torque of 200Nm. For the S-N curve of this material, let $f = 0.9$.

   a) Estimate the number of cycles to failure.

   b) If the bar is also placed in an environment with a temperature of 450^0C, estimate the number of cycles to failure.

7. A plate of steel has a yield stress of 1000 MPa. The plate fractured when the tensile stress reached 800 MPa and it was therefore hypothesized that a surface crack was present. If the fracture toughness for this steel is 60 MPa-m$^{\frac{1}{2}}$, approximately what crack size is suggested?

8. Write short note on following (any two) :

   a) Stress intensity factor in finite bodies.

   b) Goodman Gerber relations for fatigue.

   c) Modes of crack displacement.

   d) Fatigue Toughness.

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