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Total Number of Pages: 02

B.Tech
PCMT4302

5th Semester Regular / BackExamination 2016-17
DEFORMATION BEHAVIOUR OF MATERIALS

BRANCH:METTA,MME

Time: 3 Hours

Max Marks: 70

Q.CODE: Y176

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

- Determine the cohesive strength of a silica fiber, if $E=95 \text{ GPa}$, $\gamma_s=1 \text{ Jm}^{-2}$ and $a_0=0.16 \text{ nm}$.
- What is the difference between creep test and stress rupture test?
- What are the different factors that contribute to a brittle-cleavage type fracture?
- What is stress intensity factor?
- With the help of suitable diagrams explain the different fatigue stress cycles.
- Explain why modulus of elasticity is one of the most structure-insensitive of the mechanical properties?
- Explain Superplasticity.
- Draw the creep curve and show the various regions of the curve.
- Draw the load – time curve for an instrumented charpy test.
- What is dislocation width? Explain its effect on the dislocation motion.

Q2 Explain the difference between True stress-true strain curve and engineering stress-strain curve. The following data were obtained during the true stress-true strain test of a nickel specimen. (2+8)

Load, kN	Diameter, mm	Load, kN	Diameter, mm
0	6.40	15.88	5.11
15.30	6.35	15.57	5.08
15.92	6.22	14.90	4.83
16.32	6.10	14.01	4.57
16.50	5.97	13.12	4.32
16.55	5.84	12.45	3.78

- Plot the true stress-true strain curve.(use graph paper)
- Determine the following: a) True stress at maximum load, b) True fracture stress, c) True fracture strain, d) True uniform strain, e) True necking strain, f) Ultimate tensile strength, g) Strain hardening exponent.

Q3 a) Explain the Mohr's Circle of stress in two dimensions with suitable diagrams. **(5)**

b) What is precipitation hardening? Discuss the mechanisms of precipitation hardening of Al-Cu alloys. **(5)**

Q4 a) Explain the Mohr's Circle of strain with suitable diagrams. **(5)**

b) Find the principal stresses and the orientation of the axes of principal stress with the x, y axes for following situations. **(5)**

(i) $\sigma_x = +340 \text{ MPa}$, $\sigma_y = +34 \text{ MPa}$, $\tau_{xy} = -55 \text{ MPa}$

(ii) $\sigma_x = -410 \text{ MPa}$, $\sigma_y = +34 \text{ MPa}$, $\tau_{xy} = +170 \text{ MPa}$

Construct a Mohr's circle of stress for each of the plane-stress conditions

Q5 a) Derive the theoretical shear strength of metal from required assumptions? How is the presence of dislocations responsible for the variations of theoretical shear strength to observed shear strength? **(5)**

b) Describe the yield point phenomenon for mild steel. **(5)**

Q6 a) Derive the relation between True stress- True strain and Engineering stress-strain. Explain the different parameters determined from the True stress-strain curve **(5)**

b) The displacement field in micro units for a body is given by $U = (x^2 + y) \mathbf{i} + (3 + z) \mathbf{j} + (x^2 + 2y) \mathbf{k}$. Determine the principal strains at (3, 1, -2) and the direction of the minimum principal strain. **(5)**

Q7 a) A 4340 steel bar is subjected to a fluctuating axial load that varies from a maximum of 330kN tension to a minimum of 110kN compression. The mechanical properties of the steel are: $\sigma_u = 1090 \text{ MPa}$, $\sigma_o = 1010 \text{ MPa}$, $\sigma_e = 510 \text{ MPa}$. Determine the bar diameter to give infinite fatigue life based on a safety factor of 2.5 **(5)**

b) Draw the deformation mechanism map and explain the various regions of the map. **(5)**

Q8 Write short answer on any TWO: (5 x 2)

a) Dispersion and Grain boundary strengthening

b) Critical Resolved Shear Stress

c) Mohr's Circle in 3D

d) Mechanisms of creep failure