Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 level 2nd Semester Examination – Sept. / Oct. 2015
SCT 342-2 Structural Properties of Materials

Uva Wellassa University

Instructions to candidates
Duration: 02 hours
Number of questions: 04
Mark allocation: 100
Answer all questions

1.

a. Why we study mechanical properties of materials? (3 marks)

b. Define the term, engineering stress and engineering strain. (4 marks)

c. Describe briefly tensile test that we used to determine the mechanical properties of materials. Use appropriate diagrams for your answer. (10 marks)

d. Discuss briefly characteristic features of elastic and plastic regions in stress-strain diagram of a metal? (8 marks)

2.

a. Give stress-strain plots for mild steel and aluminium. Lable clearly the important regions and points of your plots. (8 marks)

b. What is the atomic scale picture of the elastic deformation? How does this change under plastic deformation? (5 marks)

c. If the tensile stress on a rectangular bar is 150 MPa, what will be the magnitude of the shear stress on planes oriented 45° to the axis of the bar? (6 marks)

d. A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, what will be the resultant elongation? (6 marks)
[The magnitude of modulus of elasticity of copper is 110 GPa]

3.

a. Define the term Poisson's ratio. (3 marks)

b. A tensile stress is to be applied along the long axis of a cylindrical brass rod that has a diameter of 10 mm. Determine the magnitude of the load required to produce a 2.5 X 10^{-3} mm change in diameter if the deformation is entirely elastic. The value for Poisson's ratio for brass is 0.34 and the modulus of elasticity of brass is 97 GPa. (7 marks)

c. What is meant by "elastic strain recovery"? (5 marks)

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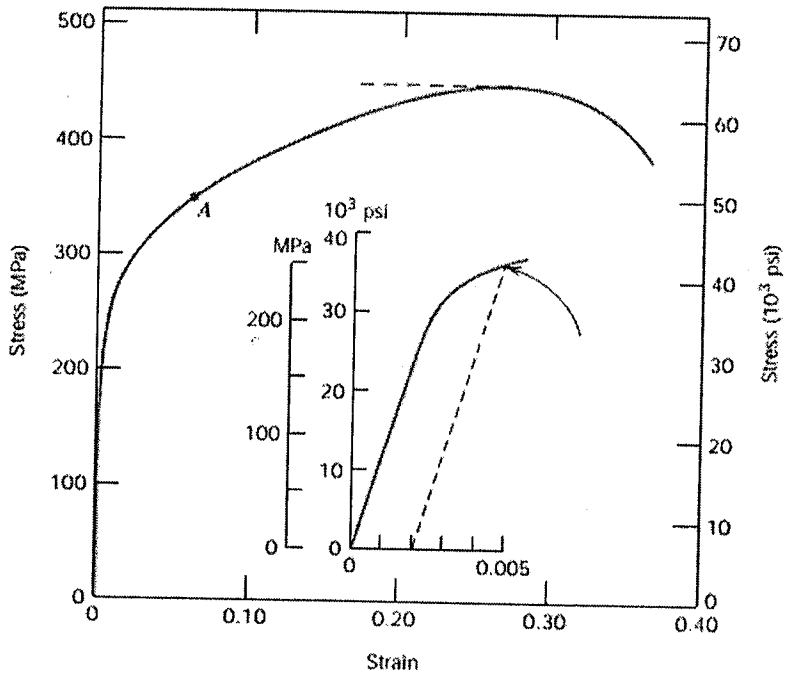
d. The following figure shows tensile stress-strain behavior of a brass specimen. Using this figure determin the following:

i. The modulus of elasticity. (3 marks)

ii. The yield strength at a strain offset of 0.002. (3 marks)

iii. The maximum load that can be sustained by a cylindrical specimen having an original diameter of 12.8 mm. (4 marks)



4.

a. Obtain the expressions for the true stress and strain using engineering stress and strain. (6 marks)

b. Give brief description for following terms.

i. Ductility
ii. Resilience
iii. Toughness

(12 marks)

c. A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile tested to fracture and found to have an engineering fracture strength σ(f) of 460 MPa. If its cross-sectional diameter at fracture is 10.7 mm, determine:

i. The ductility in terms of percent reduction in area. (3 marks)
ii. The true stress at fracture. (4 marks)