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Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Science and Technology Degree Programme
3rd Year 2nd Semester Examination – August/September 2014

SCT 342-2 Structural Properties of Materials

Uva Wellassa University

Number of questions: Four (04)
Answer all questions
Mark allocation: 100
Time allocation: Two (02) hours

1. a. Define engineering stress and engineering strain. (04 marks)

b. Draw a schematic representation of the apparatus used to conduct the tensile test. (08 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? (05 marks)

d. What are the main characteristic features of elastic and plastic regions in stress-strain diagram of a metal? (08 marks)

2. a. Give stress-strain plot for low carbon steel. You should clearly label the important regions and points of the plot. (07 marks)

b. What is the atomic scale picture of the elastic deformation? How does this change under plastic deformation? (06 marks)

c. How does modulus of elasticity (E) of Tungsten, Copper, and Aluminium change with temperature (T)? Explain your answer using E vs T plot for the temperature range from -200 °C to 800 °C. (04 marks)

d. In an alloy, the stress at which plastic deformation begins is 275 MPa and its modulus of elasticity is 115 GPa.

(i) Calculate the maximum load that can be applied to a sample of this alloy with a cross-sectional area of 325 mm^2 without plastic deformation. (04 marks)

(ii) If the original sample length is 115 mm, what will be the maximum length to which it may be stretched without causing plastic deformation? (04 marks)

3. a. Briefly describe the following terms. (12 marks)

   i. Ductility
   ii. Resilience
   iii. Toughness

   b. Derive the expressions for the true stress and strain using engineering stress and strain. (06 marks)

   c. What is meant by "elastic strain recovery"? (04 marks)

   d. Name three (03) hardness tests that are performed in mechanical testing of materials. (03 marks)

4. a. Explain how failure of engineering materials influences the human lives. (05 marks)

   b. Give rough sketches for highly and moderately ductile fracture surfaces. What is the most common type of fracture found in metals? (03 marks)

   c. What is "cleavage"? (02 marks)

   d. Briefly describe the following terms. (15 marks)

   i. Stress concentration
   ii. Fatigue
   iii. Creep