Mansoura University

Faculty of Engineering
Dept. of production & Mechanical Design

First Semester Jan 2010
Date: 3-2-2010
Time: 3 hours
Full mark: (75 mark)

Exam of strength of materials
For Textile Engineering Dept. Grad 1 students

Question One: ***(5 Marks)***

a) Briefly define the following:

Stiffness - Toughness – Resilience- Ductility - Elasticity.

Question Two: ***(15 Marks)***

A beam composed of two channels is shown in Fig. 1. It is supported at the left end by a 2–cm round eye bar. A 2–cm pin is used at each eye. The beam is supported at C by a steel bearing plate measuring 10 cm × 15 cm, which rests on a concrete wall. Determine the maximum load 'W' which can be applied. The allowable stresses are as shown below. Assume the beam to be strong enough to carry the load.

Shear stress in pin = 6 ½ KN/cm^2; concrete bearing stress = 0.325 KN/cm^2;
Tensile stress in rod = 12 KN/cm^2; And steel bearing stress = 30 KN/cm^2.

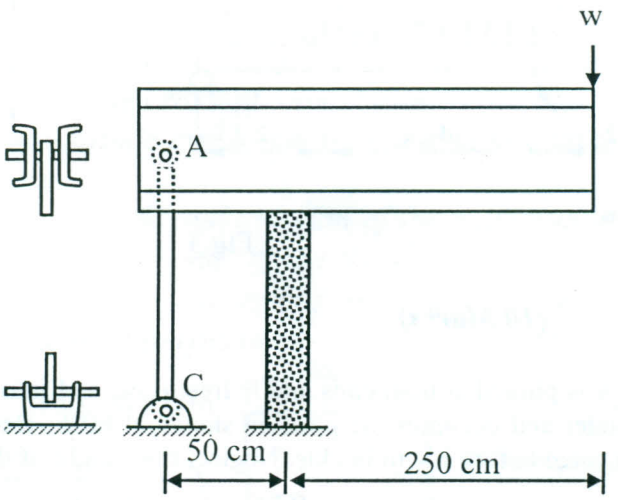


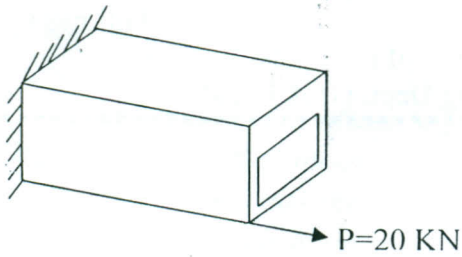
Fig. 1

Question Three: ***(15 Marks)***

A solid circular steel shaft is subjected to a twisting moment T = 1.50π KN.cm and a tensile force P of an unknown magnitude. If the outer diameter of the shaft is 2 cm and for steel the working normal stress and shear stress are 120 N/mm^2 and 50 N/mm^2 respectively, use Mohr's stress circle to find the maximum value of force P.

Question Four: ***(20 Marks)***

Calculate the maximum normal stress for part shown in Fig. 2. **Note: all dimension in mm.**



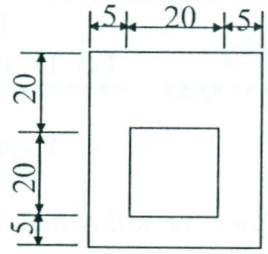


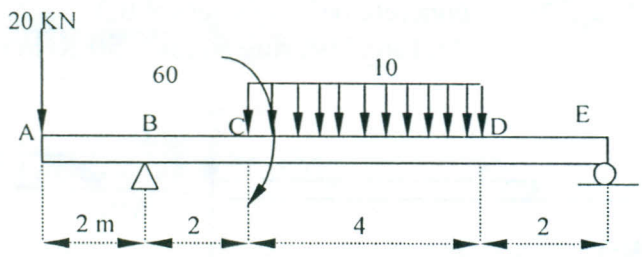
Fig. 2

Question Five: ***(10 Marks)***

The uniform beam ABCDE is supported and loaded as shown in Fig.3

(a) Plot to scale the shear force and bending moment diagrams.

(b) If the beam has a constant T- section (as shown), calculate the maximum bending stress in the beam.



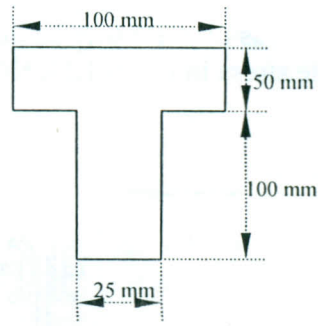


Fig.3

Question Five: ***(10 Marks)***

The column shown in Fig. 4 is pinned at both ends and is free to expand into the opening of the upper end. The bar is steel 2.5 cm in diameter and occupies the position shown at 60°F. Determine the highest temperature to which the column may be heated before it will buckle. Neglect the weight of the column. $\alpha = 12 \times 10^{-6} (K^0)^{-1}$

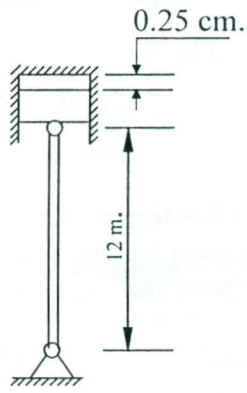


Fig. 4

Best Wishes
Dr. Noha Fouda