THE OPEN UNIVERSITY OF SRI LANKA
Department Of Civil Engineering
Diploma in Technology (Civil) - Level 3
CEX3234 – Strength of Materials

Final Examination - 2012/2013

Time Allowed : three (03) hours

Date : 29 - 07-2013 (Monday) Time : 0930 - 1230 hrs.

Answer five (05) questions including the question Q1.

Q1.

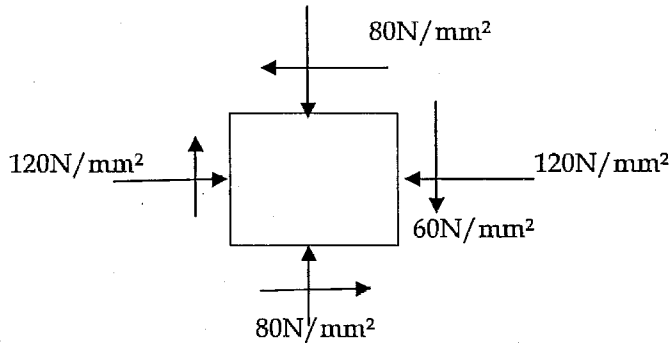
(a) Explain the terms :
- i) Poission ratio
- ii) Modulus of Elasticity

(b) Young's modulus of steel is 210 GN/m² and Poission ratio is 0.3. The steel is subjected to a shear stress of 24MN/m². Calculate the shear strain of the material.

(c) A simply supported beam of span 4m has a circular cross section of 150 mm diameter. The permissible stress is 10N/mm².

(i) Determine the second moment area of the cross section.
(ii) Evaluate the maximum permissible uniformly distributed load that it can carry by using the simple bending formula.

(d) The state of stress in a two dimentional body is as given bellow.



(i) Draw the Mohr's circle for the stress state.
(ii) Determine the principal stresses
(iii) Determine the maximum shear stress.

(e) The figure Q1.e shows and overhanging beam AC, 12m long and supported at end A and point B. Length AB is 9m. Along the entire length of the beam it carries a uniformly distributed load of 6 kN/m.

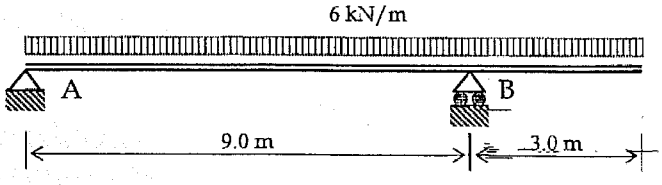


Fig. Q1.e

1. Draw the free body diagram and find the support reactions.
2. Draw the shear force diagram and bending moment diagram.

(30 marks)

Q2. Consider the over hanging beam carrying uniformly distributed load of 2kN/m and a point load of 2kN as shown in Fig.Q2.

(a) Determine the reactions.
(b) Draw the shearforce diagram.
(c) Draw the Bending Moment diagram.
(d) Locate the point of contraflexure.

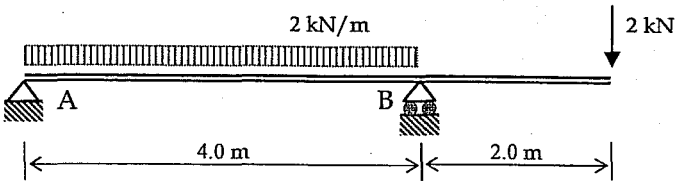


Fig. Q2

(17.5 marks)

Q3. (a) Torsion formula for a circular section can be written as $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{r}$.

Write clearly meaning of each term.

(b) A solid circular shaft transmits 75 kw power at 200 r.p.m. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length of shaft and shear stress is limited to 50N/mm². Take modulus of rigidity as 1 x 10^5N/mm².

(17.5 Marks)

Q4. A reinforced concrete column, 4m high, has the cross section shown in Fig. Q4. The four reinforcing bars are each 20mm in diameter. If the column is subjected to 1000kN compressive force, find the stresses in steel bars and concrete and shortening of the column. Young's modulus of steel and concrete are 200 kN/mm² and 15kN/mm² respectively.

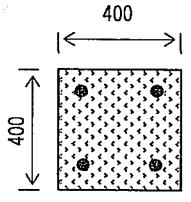


Fig. Q4

(17.5 Marks)

Q5. (a) Write down the simple bending formula and define all the terms.
(b) Determine the position and magnitude of maximum deflection in the simply supported beam shown in Fig Q5.

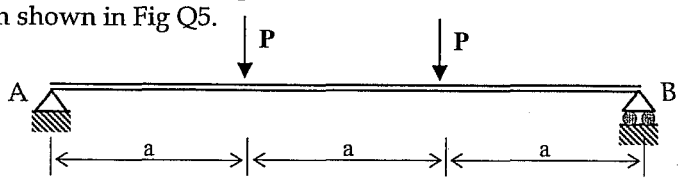


Fig. Q5

(17.5 Marks)

Q6. A column of timber section 15cm x 20cm is 6m long both ends being fixed. If the Young's modulus for timber = 17.5 kN/mm², Determine;

(a) Bukling load and
(b) Safe load of the column if factor of safety = 3.

(When both ends are fixed, the buckling load $P_e = 4\pi^2EI/L^2$)

(17.5 Marks)

Q7. An elemental cube is subjected to tensile stresses of 30N/mm² and 10N/mm² acting on two mutually perpendicular planes and a shear stress of 10 N/mm² on these planes.

Draw the Mohr's circle of stresses and hence or otherwise determine the magnitudes and directions of principal stresses and also the greatest shear stress.

(17.5 Marks)