40+40+40+37+32

200

— SE Mech. III CBSGS

SOM

09.12.16

Q. P. Code : 555001

Time: 3 Hrs **Marks: 80**

N. B.
1) Question No. 1 is compulsory.
2) Assume suitable data if necessary.
3) Attempt any Three questions from remaining Five questions.
4) Figures in bracket indicate marks.

Q. 1 **Solve any four** **5x4=20**

a) Draw stress strain curve for ductile and brittle material also Explain factor of safety with the help of stress-strain diagram of both.

b) Define Hoop stress and Longitudinal stress in thin cylinder. Derive their formula.

c) For a rectangular cross section of beam, show that the maximum shear stress is 1.5 times the average shear stress. Also draw shear stress distribution diagram.

d) State Torsion Formula and explain the terms involved in it. Give assumptions in the analysis of pure torsion.

e) Establish the relationship between shear force, bending moment and rate of loading in beam.

Q. 2 A) A stepped bar ABCD has the following dimensions: **(10)**

Portion AB: Length 1200 mm and diameter 40 mm.

Portion BC: length 800 mm, diameter 20 mm.

Portion CD: Length 1000 mm, diameter 30 mm.

It is subjected to four point loads as shown in Figure 1. Find the Value of 'P' for equilibrium and then find the change in length of the bar. Assume E = 200 Gpa.

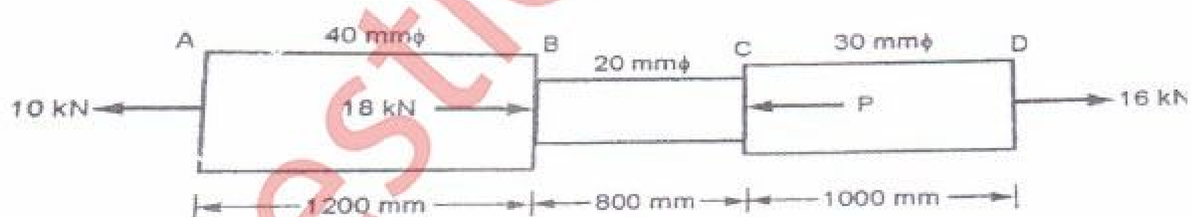

Figure 1

[TURN OVER]

B) A steel block 360 mm X 80 mm X 160 mm is subjected to the following forces **(10)**

i) A tensile force of 1280 KN on the 160 mm X 80 mm faces (take as a X-direction)

ii) A tensile force of 3456 KN on the 360 mm X 80 mm faces (take as a Y-direction) and

iii) A compressive force of 5184 KN on the 160 mm X 360 mm faces (take as a Z-direction)

Find the changes in the dimensions of the block and also the change in volume. Take $E = 2 \times 10^5$ N/mm^2 and $1/m = 0.25$

Q. 3 A) A beam 8.5 m long rests on the supports 5 m apart, the beam carries load as shown in Figure 2. Draw SFD and BMD showing all the important points. **(10)**

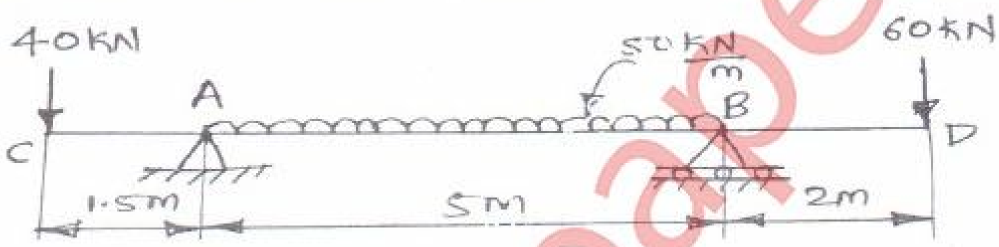

Figure 2

B) A steel bar consists of two equal portions each 1 meter long, the respective diameters of each portion being 30 mm and 50 mm. Find the total strain energy of the bar when it is subjected to an axial pull of 150 KN. **(10)**
Take $E = 200 \times 10^3$ N/mm^2 for steel.

Q. 4 A) A symmetrical I-section with flanges 250mm x 20 mm has a web 160 mm X 10 mm. If the shear force acting on the section is 80 KN, find maximum shear stress developed in the section and draw shear stress distribution diagram. **(10)**

B) A cylindrical shell 3 meter long closed at the ends having 1 meter internal diameter is subjected to an internal pressure of 1.5 MPa. If the thickness of the shell wall is 15 mm, find the circumferential, longitudinal stresses and Maximum shear stress. Find also the change in diameter, Length and volume of the shell. **(10)**
$E = 2 \times 10^5$ N/mm^2, $1/m = 0.3$

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Q. 5 A) Determine the diameter of a solid shaft, which will transmit 300 KW at 250 rpm and the working conditions to be satisfied are: **(10)**

The twist should not be more than 1^0 in a shaft of length 2 meter and

The maximum shear stress should not exceed 30 N/mm^2

Take, Modulus of rigidity = $1x10^5$ N/mm^2

B) Find Euler's crippling load for hollow cylindrical column of 50 mm external diameter and 5 mm thick. Both ends of column are hinged and length of column is 2.5 meter. Take $E=2x10^5$ N/mm^2. Also determine Rankine's crippling load for the same column. Take fc = 350 MPa and $\alpha = 1/7500$. **(10)**

Q. 6 A) A 4 m long steel bar of square cross section of 40 mm side, is heated through 75^0C with its ends clamped before heating. Calculate the thrust exerted by the bar on clamps: **(10)**

i) if the clamps do not yield

ii) if the clamps yield by 0.6 mm.

Take, E = 210 GPa and $\alpha = 11.5 \times 10^{-6}$ /^0C.

B) Find slope and deflection equation for the beam as shown in figure given below. Determine the deflection at a point where couple 50KNm is acting (Figure 3) **(10)**

Take, EI= 2 X 10^4 KN/m^2.

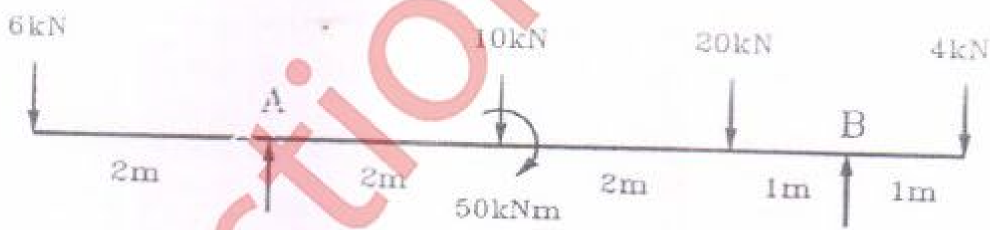

Figure 3
