COMPETETIVE ENTRANCE EXAMINATION INTO H. T. T. T. C.

BAMBILI BAMENDA 2013 SESSION

Paper 1 (Major), for Mechanical Design, Mechanical Manufacturing and Automobile mechanics

APPLIED MECHANICS F1 DURATION: 3hrs. Coefficient 4

ANSWER ALL QUESTIONS

1. A. beam AB (fig. 1) is hinged at A and supported at B by a vertical cord, which passes over two frictionless pulleys C and D. If pulley D carries a vertical load Q, find the position x of the load P if the beam is to remain in equilibrium in the horizontal position.

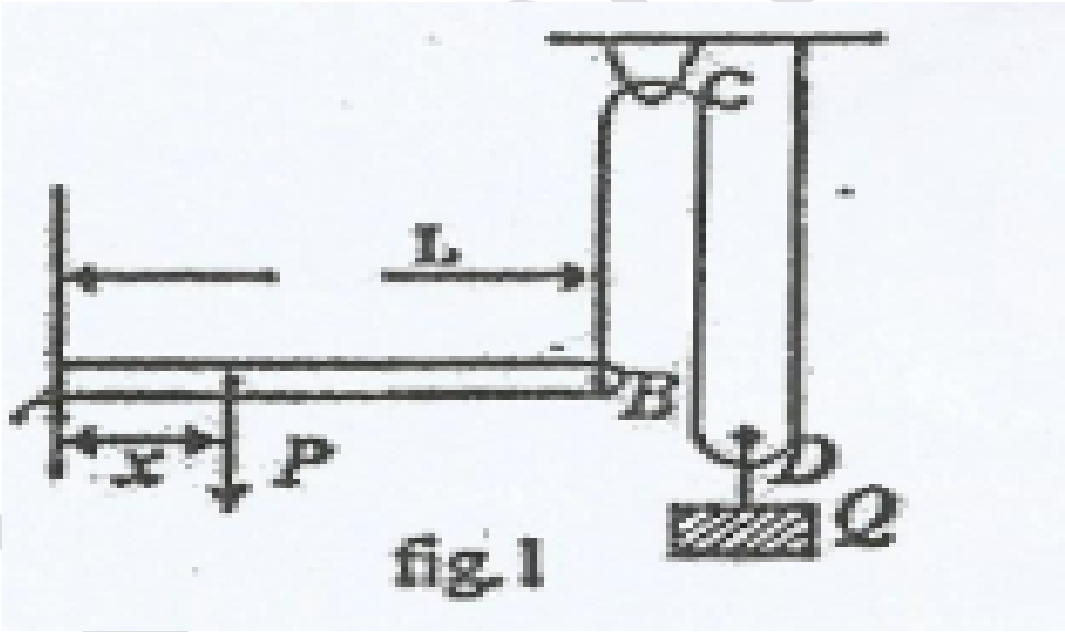


fig. 1

A. Q/2 B. QL/2P C. 2QL D. 2T/P

2. A uniform wheel of 600mm diameter weighing 5KN rests against a rigid rectangular block of 150mm height as shown in fig. 2. Find the reaction of the block. Take the entire surface to be smooth.

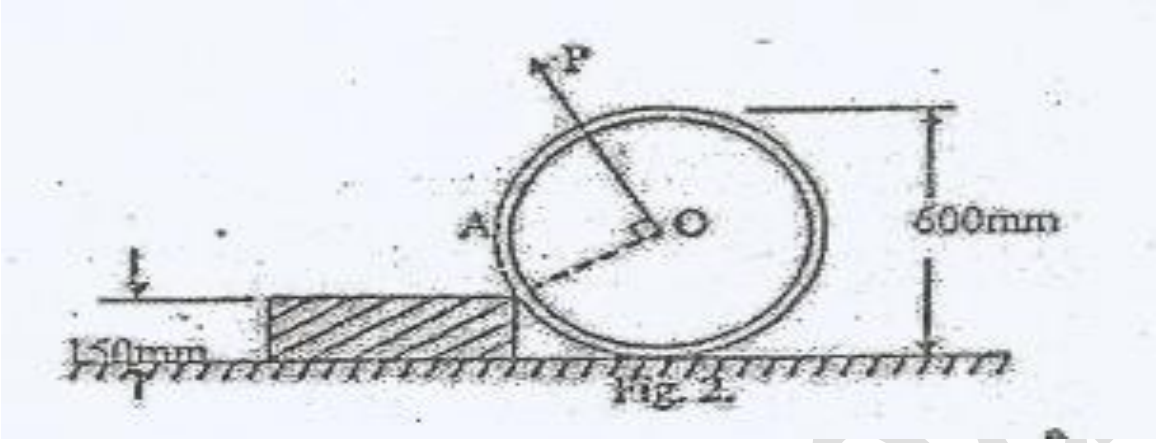


Fig. 2.

A. 2.5KN B. 4.33KN C. 1.5KN D. 4.5KN

3. In designing the lifting hook, the forces acting on a horizontal section through B may be determined by replacing F by an equivalent force at B and a couple. If the couple is 3000N – mm, determine.

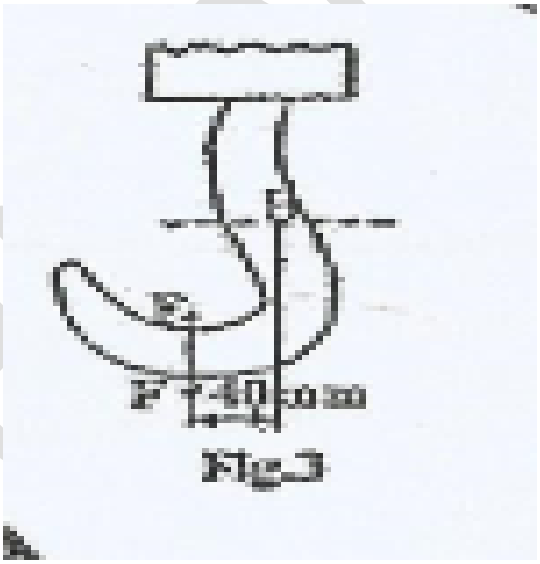


Fig.3

A. 150N B. 86.6 C. 200N D. 75N

In fig. 4, two forces are to be replaced by an equivalent force R applied at the point P.

4. Calculate P by finding its distance X from AB.

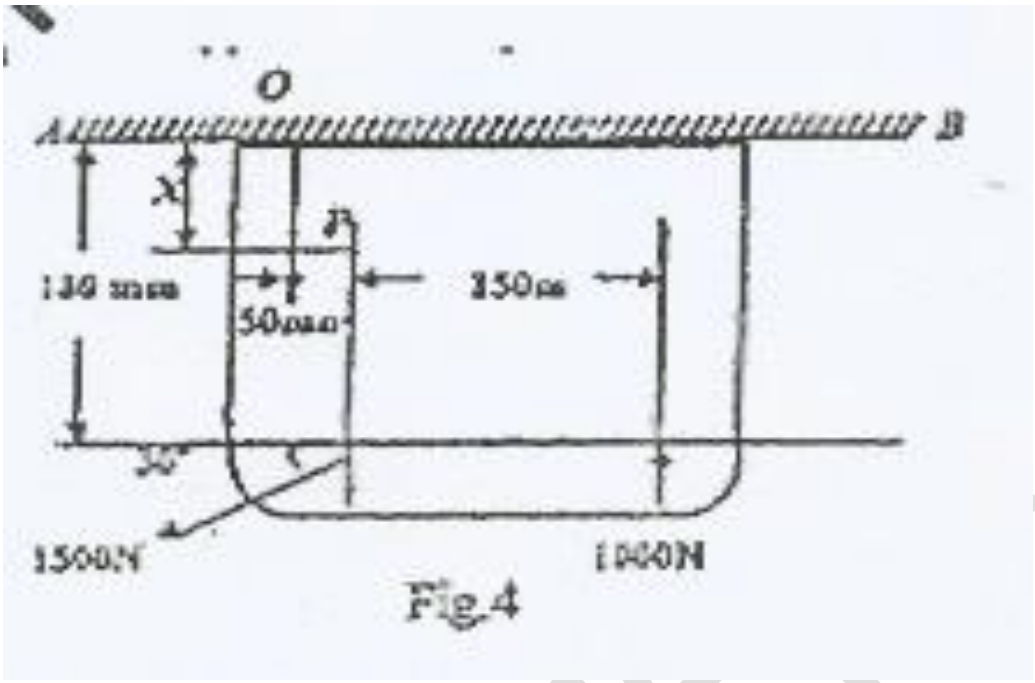


Fig.4

A. 53.35mm B. 53.95mm C. 45.85mm D. 44.5mm

5. Calculate the magnitude of R

A. 1200N B. 1300N C. 1322.87N D. 1431.32N

6. Calculate the angle θ it makes with the horizontal.

A. 23.3^0 B. 10.89^0 C. 30.25^0 D. 46.35^0

7. Calculate the moment transmitted to the supporting wall at A (from fig. 5).

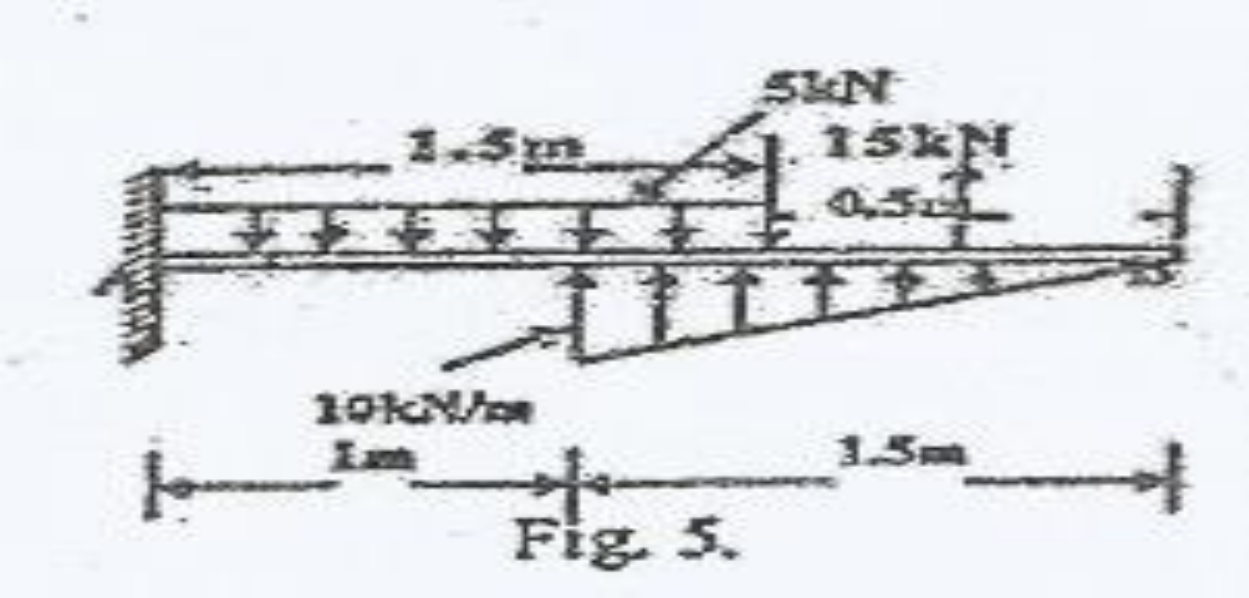


Fig. 5.

8. A fixed crane of 1000Kg mass is to lift 2400Kg crates. It is held in place by a pin at A and a rocket at B. CG is located at G. Determine the components of reaction at B.

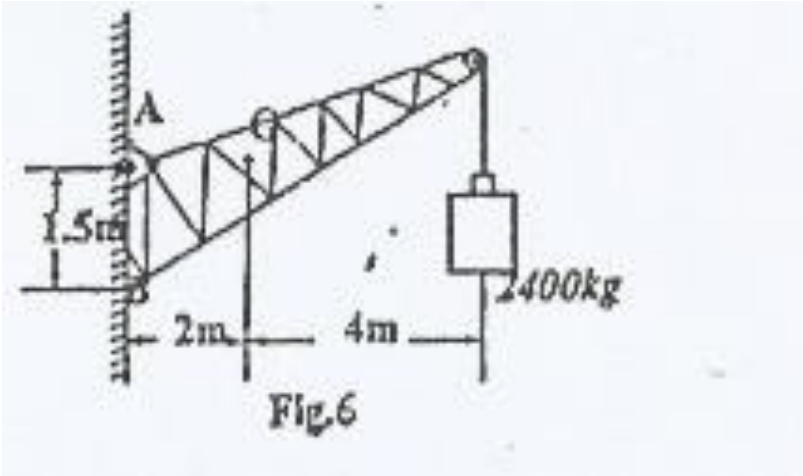
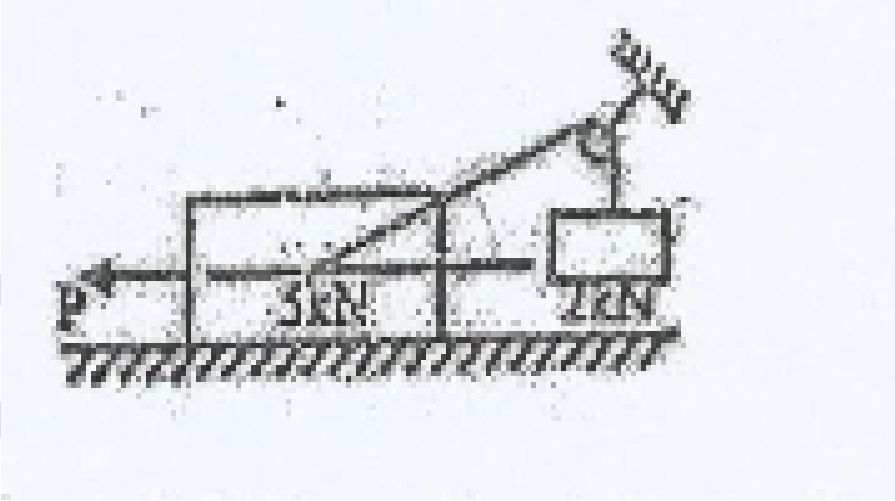


Fig.6

A. - 35.625KNm B. 15KNm C. 30.243KNm D. 20KNm

A block weighing 5Kn is attached to a chord which passes over a frictionless pulley and supports a weight of 2KN. The coefficient of friction between the block and the floor is 0.35.



9. Determine the value of force P if the motion is impending to the right.

A.4KN B. 0.35KN C. 0.332KN D. 1.732KN

10. Determine the value of force P if the motion is impending to the left.

A. – 1.26KN B. 4KN C. 1.5KN D. 3.132KN

11. Blocks A and B connected by a rigid horizontally bar planed at each end are placed on inclined planes as shown below. The weight of the block B is 300N. Find the limiting values of the weight of the block A to just start motion of the system.

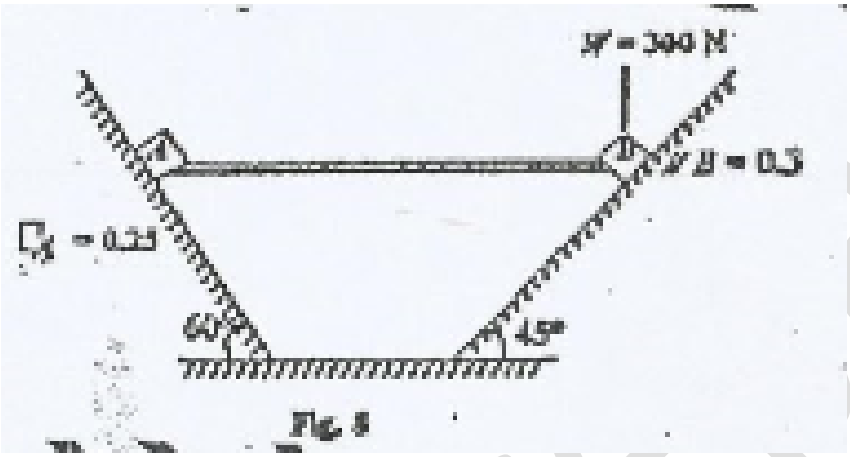


Fig. 8

A. 538.7N B. 751.85N C. 606.09N D. 557.14

12. A force wheel drive can as shown in fig. 9 has mass of 2000Kg with passengers. The roadway is inclined at an angle with the horizontal. If the coefficient of friction between the tyres and the road is 0.3, what is the maximum inclination that it can climb?

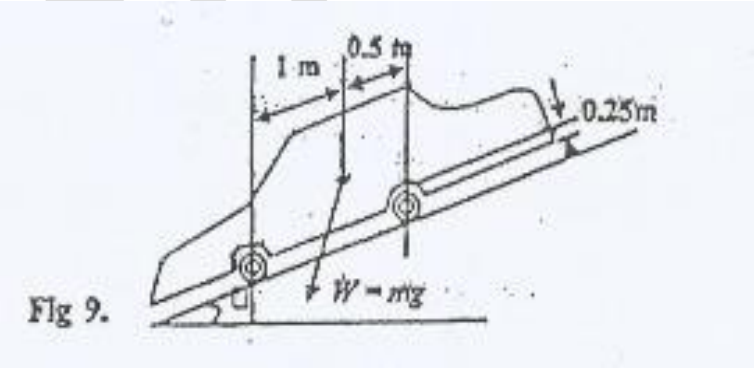


Fig 9.

A.30.6^0 B. 45^0 C. 16.69^0 D. 23.5^0

13. Find the length of belt necessary to drive a pulley of 500mm diameter running parallel at a distance of 12m from the driving pulley of diameter 1600m.

A. 27.39m B. 27.32m C. 33.12m D. 29.31m

14. Determine the time required to stop the automobile on ice for which ⊡= 0.08

A. 0.08s B. 0.784s C. 24.77s D. 19.44s

15. Determine the time required to stop the automobile on concrete road for which ⊡= 0.75.

A. 7.35s B. 0.75s C. 9.8s D. 2.64s

A circular rod of diameter 20m and 500m long is subjected to a tensile force of 45KN. The modulus of elasticity for steel may be taken as 200KN/m^2

16. Calculate stress of the rod.

A. 143.24N/m^2 B. 142.23N/m^2 C. 123.11N/m^2 D. 148.41N/m^2

17. Calculate the strain of the rod.

A. 0.000534 B. 0,000716 C. 0.000321 D. 0.000824

18. Calculate the extension of bar due to applied load.

A. 0.25mm B. 0.38mm C. 0.36mm D. 0.24mm

A hollow cast – iron cylinder 4m long and 300mm outer diameter and thickness of metal 50mm is subjected to a central load on the top when standing straight. The stress produced is 75000KN/m^2. Assume Young's modulus for cast iron as 1.5 x 10^8KN/m^2 (fig10)

19. Calculate the magnitude of the load.

A. 126.4KN B. 294.2KN C. 112.5KN D. 240KN

20. Calculate the longitudinal strain produced

A. 0.0002 B. 0.0005 C. 0.0025 D. 0.0009

21. Calculate the total decrease in length

A. 1.5mm B. 3mm C. 2.5mm D. 2mm

22. A load of 100Kg is supported upon the rods A and C each of 100mm diameter and another rod B of 15mm diameter. Find the stresses in rod B.

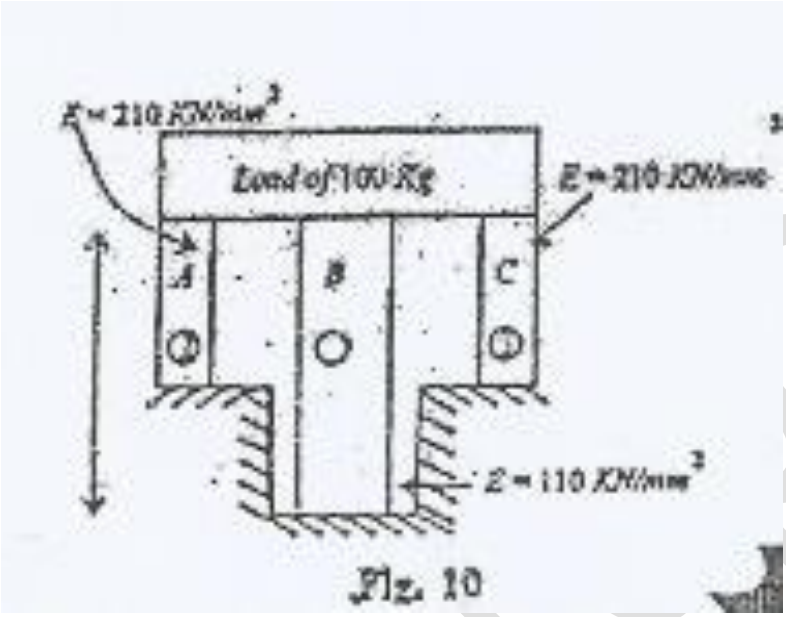


Fig. 10

A.4.67N/mm^2 B. 3.34N/mm^2 C. 1.34N/mm^2 D. 2.45N/mm^2

23. A steel rod 20mm diameter passes centrally through a steel tube 25mm internal diameter and 40mm external diameter. The tube is 750mm long and is closed by rigid washers of negligible thickness which are fastened by nuts threaded on the rod. The nuts are tightened until the compressive load on the tube is 20KN (fig. 11). Calculate the stress on the rod. There are o.4 threads per mm length Take E = 200CN/m^2.

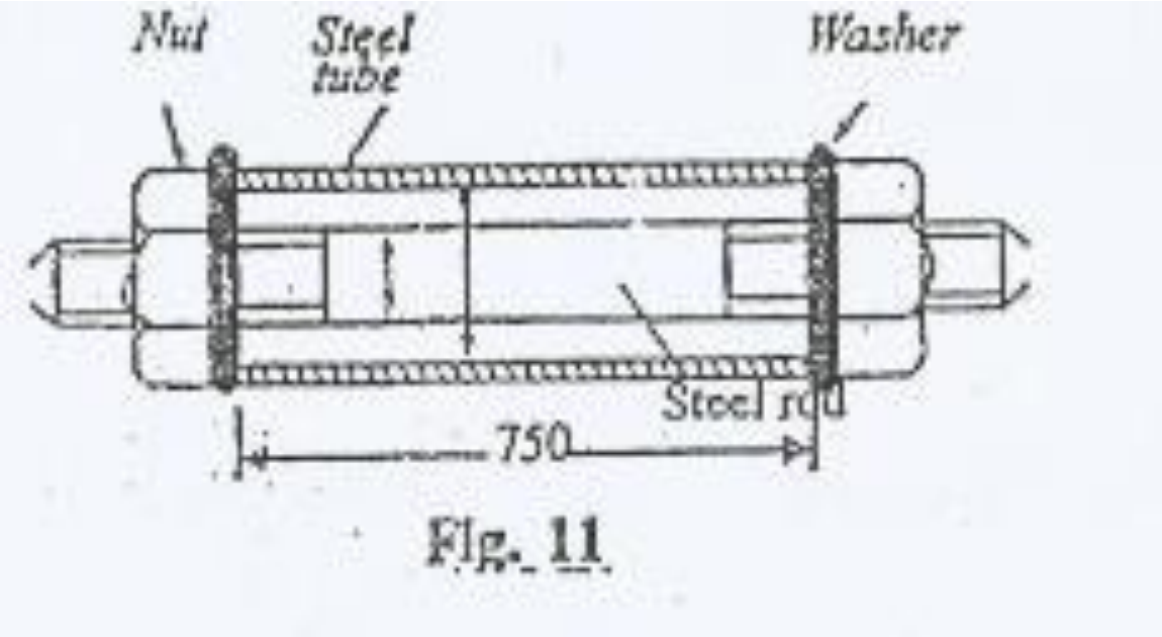


Fig. 11

A. 63.6MN/m^2 B. 26.1MN/m^2 C. 48.48MN/m^2 D. 118.9MN/m^2

24. A steel rod 40mm in diameter is enclosed by a copper tube of external diameter 50mm and external diameter 40mm. A pin 25mm in diameter is fittedtransversely to the assembly at each end so as to secure the rod and the tube. If the temperature of the assembly is raised by 60^0C, find the shear in the pin.

Take $E_s = 2 \times 10^5$N/mm^2, $E_c = 10^5$, $\boxdot_s = 1.2 \times 10^{-5}$per ^{0}C and $A_c = -1.6 \times 10^{-5}$per^{0}C.

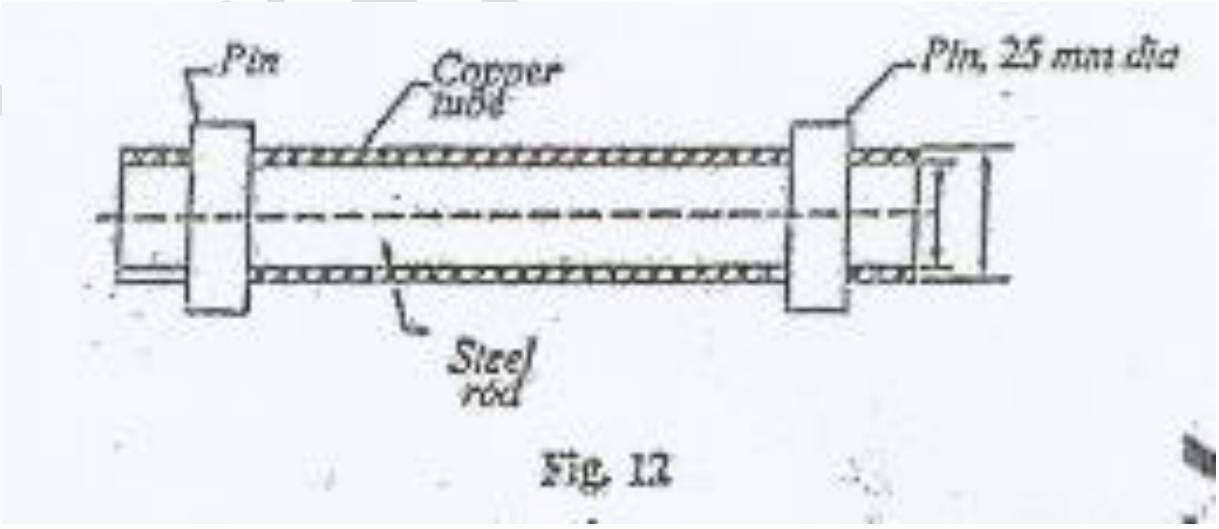


Fig. 12

A. 10.28N/m^2 B. 18.286N/m^2 C. 9.16N/m^2 D. 12.5N/m^2

25. A beam made of C. I and having a section of 50mm external diameter and 25mm internal diameter is supported at two points 4m apart. The beam carries a concentrated load of 100N at its centers. Find the maximum bending stress induced in the beam.

A. $25N/m^2$ B. $8.69N/m^2$ C. $28.7N/m^2$ D. $16.2N/m^2$