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320314(20)

APR-MAY

B. E. (Third Semester) Examination, 2020

(Old Scheme)

(Civil Engg. Branch)

MECHANICS of SOLIDS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each question is compuslory and carries 2 marks. Attempt any two parts from (b), (c) and (d) and carries 7 marks each.*

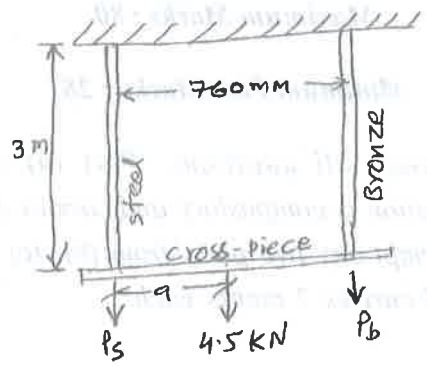
Unit-I

1. (a) Define bulk modulus. 2

(b) Derive the relation between E and K. 7

(c) Derive the expression for stress and elongation produced in a bar due to its self weight. 7

(d) Two vertical rods one of steel and other bronze are rigidity fastened at upper ends at a horizontal distance of 760 mm apart. Each rod is 3 m long and 25 mm in diameter. A horizontal cross-piece connects the lower ends of the bar where should a load of 4·5 kN be placed on the cross-piece so that it remains horizontal after being loaded? 7



Unit-II

2. (a) Define major and minor principle stress. 2

(b) Write the procedure with graphical demonstration of Mohr's circle for two unlike stresses σ_1 and σ_2. 7

(c) A point is subjected to prependicular stresses of 50 MN/m^2 and 30 MN/m^2 both tensile. Calclate the normal, tangential and resultant stress and its obliquity on a plane making at an angle of 30 with the axis of second stress. 7

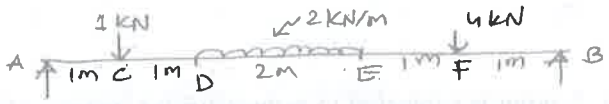
(d) A block of material is subjected to a tensile strain of 12×10^{-6} and compressive strain of 15×10^{-6} on planes at right angles to each other. There is also a shear strain of 12×10^{-6} and there is no strain on planes at right angles to the above plane. Calculate the principal strain in the magnitude and deviation. 7

Unit-III

3. (a) Write relations between bending moment, shear force and loading. 2

(b) Draw the shear force and bending moment diagrams

for the beam shown in figure. Find max BM and its position also. 7



(c) Calculate section modulus for a rectangular section having width (b) and depth (d). 7

(d) Prove that for a rectangular section having width (b) and depth (d) max shear stress q_{max} is 1.5 times of average shear stress q_{avg}. 7

Unit-IV

4. (a) Explain short, medium and long column. 2

(b) A hollow C.I. column whose outside diameter is 200 mm has a thickness of 20 mm. It is 4·5 m long and is fixed at both ends. Calculate the safe load by Rankine-Gordon formula using a factor of safety of 4. 7

(c) Discuss the modes of failure and stability criteria of a retaining wall briefly. 7

(d) A masonary retaining wall 6 m high and retains earth of unit weight 18 kN/m^3. The top width of retaining wall is 0·5 m and bottom width 2 m . The angle of repose is 30 unit weight of masonary is 24 kN/m^3. Determine the maximum and minimum presure on the wall. 7

Unit-V

5. (a) What is shear centre? 2

(b) Derive the relation :

$$\frac{fs}{R} = \frac{q}{r} = \frac{N\theta}{L}$$ 7

(c) A solid steel shaft has to transmit 75 kw at 200 r.p.m. Taking allowable shear stress as 70 MN/m^2. Find the suitable diameter for the shaft the maximum torque transmitted on each reduction exceeds the mean by 30%. 7

(d) A closed coiled helical spring made of wire 5 mm in diameter and having an inside diameter of 40 mm joins two shafts. The effective number of coils between the

shafts is 15 and 0·735 kW is transmitted through the spring at 1000 r.p.m.. Calculate the relative axial twist in degrees between the ends of spring and also the intersity of bearing stress in the material $E = 200\ G^N/m^2$. 7