Total No. of Questions – [8] Total No. of Printed Pages 06

G.R. No.	

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May 2019/ENDSEM

S. Y. B. TECH. (Civil Engineering) (SEMESTER - I)

COURSE NAME:Strength of Materials

COURSE CODE: CVUA21174

(PATTERN 2017)

Time: [2Hours] **[Max. Marks: 50]**

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data whereever required**

Q1 a) A beam *ABCD* with an overhang at one end supports a 60 KN and 30 KN point load at B & D respectively as shown in fig.1.Draw the shear-force and bending-moment diagrams for this beam. [6]

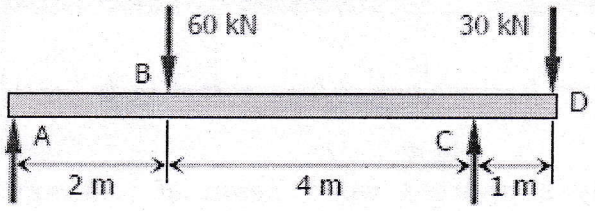

fig.1

OR

b) Draw the shear force and bending moment diagrams for a cantilever beam AB shown in fig.2, carrying udl of intensity q over one-half of its length. [6]

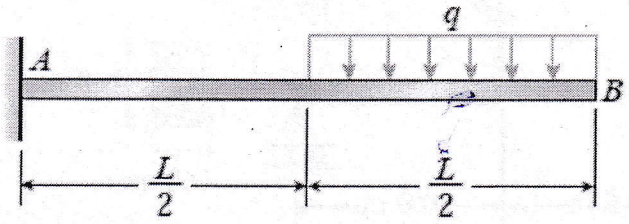

fig.2

Q2 a) A short hollow circular tube of aluminium supports a compressive load of 26 KN as shown in fig.3. The inner and outer diameters of the tube are 50 mm and 60 mm respectively and its length 300 mm. The shortening of the tube due to load is measured as 9 mm. Determine the compressive stress and strain in the tube. [6]

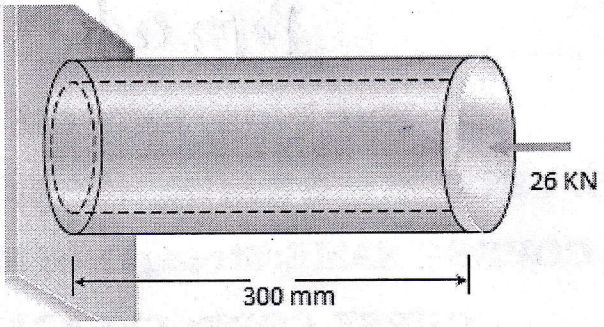

fig.3

OR

b) A horizontal bar AB, pinned at A and supported by wire CD and EF of dia 4mm and 3 mm with length 0.40m and 0.30m respectively. The permissible stresses in wire CD and EF are 200 MPa, 175 MPa respectively. Use modulus of elasticity as 45 GPa for both wires. Calculate the allowable load P that can be applied at the end B. [6]

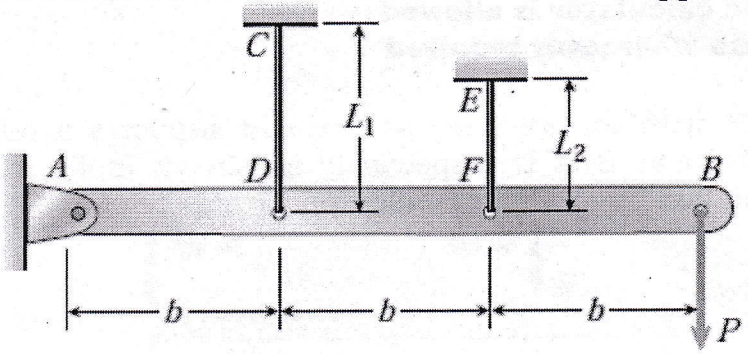

Fig.4

Q3 a) A simply supported wood beam of rectangular section and of span 1.2m carries a concentrated load P at its mid span in addition to its own weight. The crsoo section has width 140mm and height 240mm. The weight density of the wood is 5.4 KN/m^3 .
Calculate the maximum permissible value of the load P,if the allowing bending stress is 8.5 MPa. [6]

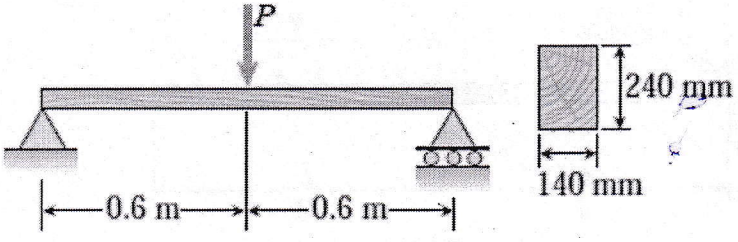

Fig.5

OR

b) For the problem in Q3 a), Calculate the maximum permissible value of the load P,if the allowing shear stress is 0.8 MPa. [6]

Q4 a) Describe through figure actual length and effective length of long column that depends on end conditions. [4]

OR

b) An aluminum pole for a street light weighs 4600N and supports an arm that weighs 660N as shown in fig 6. The center of gravity of the arm is at 1.2m from the axis of the pole. The outside dia of pole at its base is 225mm and thickness of 18mm. [4]
Determine the maximum and minimum stresses developed at base.

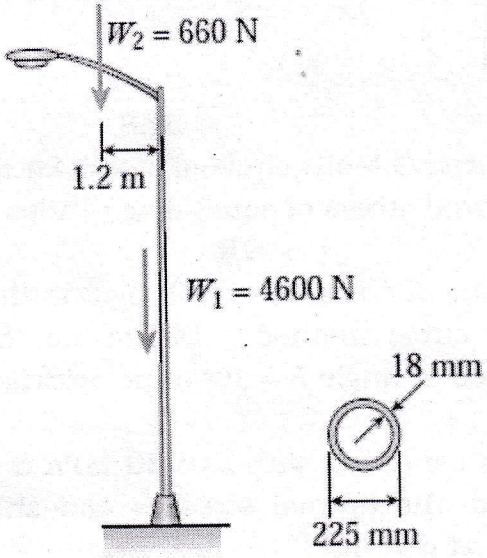

fig.6

Q5 a) For the plane state of stress $\sigma x = 50\ MPa$, $\sigma y = 10\ MPa$, τ=15 MPa as shown in fig.7, determine [6]
i) principalstresses and location of principal planes
ii) Maximum shear stress and its location

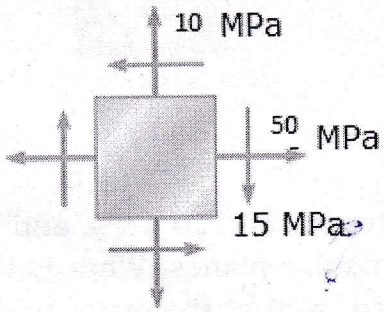

fig.7

b) At a point on the surface of a pressurized cylinder, the material is subjected to biaxial stresses $\sigma x = 90\ MPa$, $\sigma y = 20\ MPa$, as shown in fig.8. Determine the stresses acting on an element inclined at angle $\theta = 30^0$ anticlockwise with vertical surface. [4]

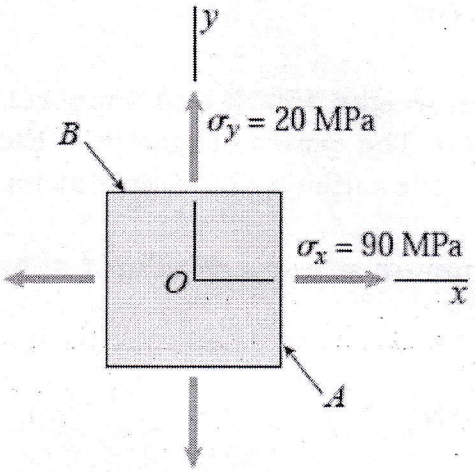

fig.8

c) Draw representative Mohr circle of stress for i) State of pure shear ii) Bi-axial normal stress of equal magnitudes [4]

OR

Q6 a) Refer Plane state of stress shown in fig.8 in the Q.5b. Using Mohr's circle method , Determine the stresses acting on an element inclined at angle $\theta = 30^0$ anticlockwise with vertical surface. [6]

b) A plane-stress condition with σx= 80 MPa & σy= 40 MPa is shown in fig.9 Determine the normal stresses and shearing stresses acting on inclined plane at $\alpha = 60^0$ [4]

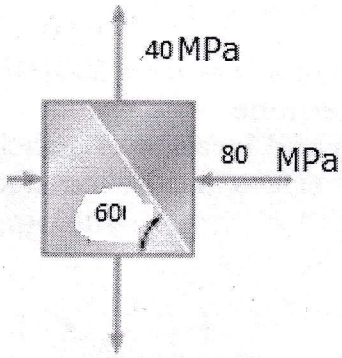

fig.9

c) Direct tensile stresses of 120 MPa and 70 MPa acts on a body on mutually perpendicular planes. What is the magnitude of shear stress that can be applied, so that the major principal stress at the point does not exceed 135 MPa. [4]

Q7 a) For a beam shown in fig 10 AB=5 m and BC = 2.5m ,carries a point load of 500N at C. Using Macaulay's method determine the equation of the elastic curve and calculate a) Slope at B (*b*) Deflection at C. E = 210GPa & I = 5 x 10^7 mm^4. [6]

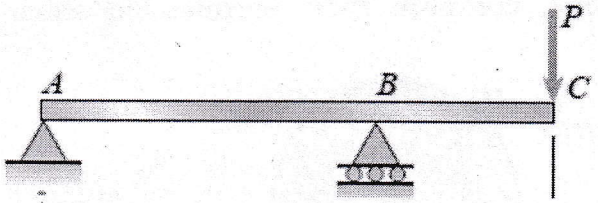

fig 10

b) A motor driving a solid steel shaft transmits 30KW power to a gear at B. The allowable shear stress in the steel is 40 MPa. What could be the required diameter d of the shaft shown in fig 11, if it is operated at 500 rpm?. [4]

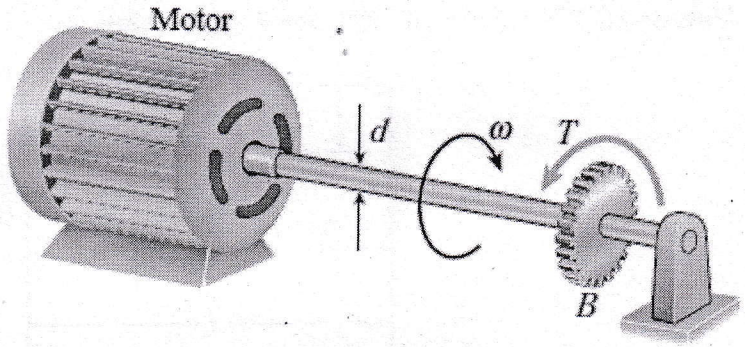

fig.11

c) A simply supported beam AB of span 1.2 m is subjected to point load P = 20 KN at C as shown in fig.12 The portion CB has double MI as that of remaining.Draw M /EI diagram with all values and slope under load P and determine slope at A. [4]

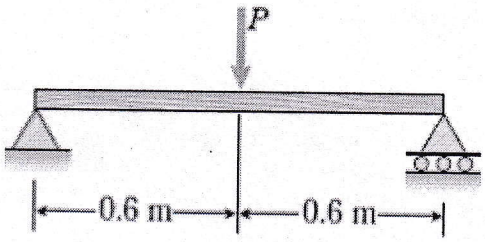

fig.12

OR

Q8 a) A hollow shaft and a solid shaft constructed of the same materials have the same length and the same outer radius R as shown in fig 12 . The inner radius of the hollow shaft is 0.6R .Assuming that both shafts are subjected to same torque, compare their permissible shear stresses and angle of twist. [6]

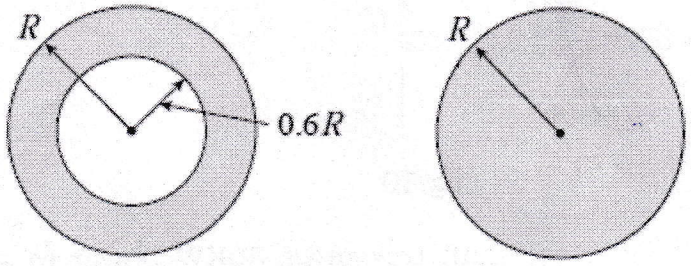

fig.12

b) Using Macaulay's method determine general equation for slope and deflection along with constants for the beam shown in fig.13. [4]
Use q=10 KN/m,P= 50 KN, a= 4 m, b= 2m

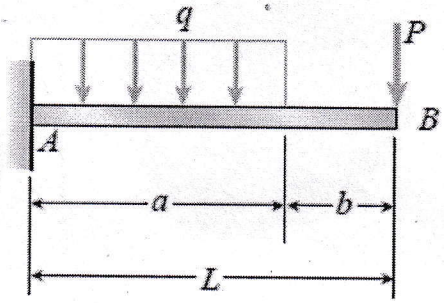

fig.13

c) What diameter is required to achieve torsional stiffness of 645 Nm for solid circular rod of 1.2 m length, having shear modulus of 120GPa. [4]

END