Seat No

Paper / Subject Code: 51603 / Strength of Materials

SE/MECH/SEM-III/CBCS

(3 Hours) **[Total Marks: 80]**

20 NOV 2019

N.B.
1. Question No.1 is compulsory.
2. Answer any three questions from remaining questions.
3. Assume suitable data if required.
4. Figure to the right indicates full marks.

Q.1 Answer any four of the following. 20

a. Derive an expression for the strain energy due to suddenly applied load.

b. Derive the relation between load, shear force and bending moment.

c. Write the assumptions made in theory of pure torsion and derive torsional formula.

d. Draw shear stress distribution diagram for symmetry I section, T section and rectangular section.

e. Write the assumption for simple bending and derive the flexural formula.

f. Find the maximum power that can be transmitted through 50 mm diameter shaft at 150 rpm, if the maximum permissible shear stress is 80 N/ mm^2.

Q.2 a. A bar of brass 20 mm is enclosed in a steel tube of 40 mm external diameter and 20 mm internal diameter. The bar and the tubes are initially 1.2 m long and are rigidly fastened at both ends. If the temperature is raised by 60°C, find the stresses induced in the bar and tube. 10

Given: $E_s = 2 \times 10^5$ N/mm^2

$E_b = 1 \times 10^5$ N/mm^2

$\alpha_s = 11.6 \times 10^{-6}$/°C

$\alpha_b = 18.7 \times 10^{-6}$/°C.

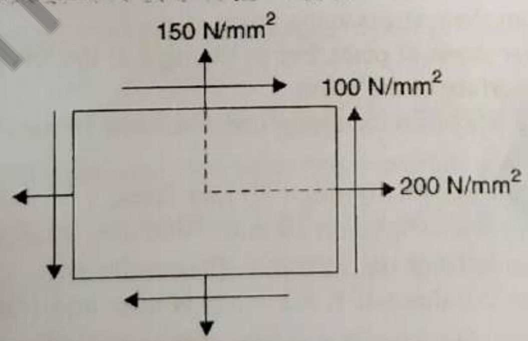
b. The state of stress at a point in a strained material is as shown in Fig. Determine 10

(i) the direction of principal planes

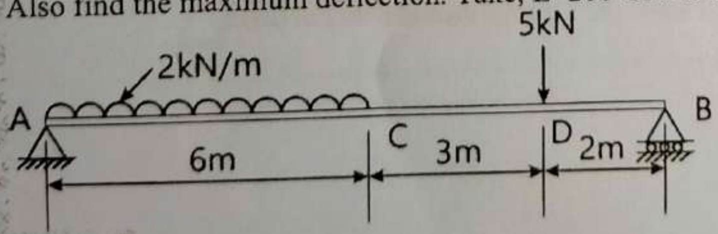
(ii) the magnitude of principal stresses and

(iii) the magnitude of maximum shear stress.

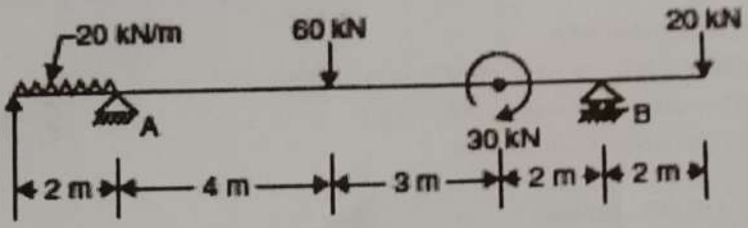
Indicate the direction of all the above by a sketch.



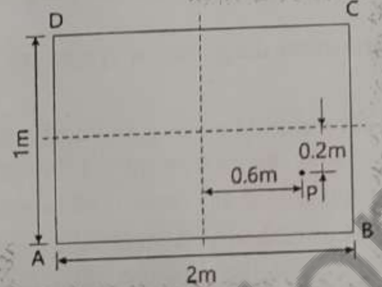
Q.3 a. Find slope at point A & B deflections at points C & D for a beam as shown in fig. Also find the maximum deflection. Take, E=200 GPa & I=10^8 mm^4 10



b. Draw SF and BM diagrams for the beam shown in figure. 10



Q.4 a. A vertical column of rectangular section is subjected to a compressive load of P=800 KN as shown in fig. Find the stress intensities at the four comers of the column. 10



b. A propeller shaft is required to transmit 50 kW power at 500 rpm. It is a hollow shaft, having an inside diameter 0.6 times of outside diameter and permissible shear stress for shaft material is 90 N / mm^2. Calculate the inside and outside diameters of the shaft. 10

Q.5 a. A cylindrical shell is 3m long and 1.2m in diameter and 12mm thick is subjected to internal pressure of 1.8 N/mm^2 calculate change in dimensions and volume of shell. Take E=210 kN/mm^2 1/m=0.3 10

b. A simply supported beam of length 3 m and a cross section of 100 mm×200 mm carrying a UDL of 4 kN/m. find 10

1. Maximum bending stress in the beam.
2. Maximum shear stress in the beam.
3. The shear stress at point 1 m to the right of the left support and 25 mm below the top surface of the beam.

Q.6 a. A 400 mm long bar has rectangular cross-section 10 mm × 30 mm. This bar is subjected to 10

(i) 15 kN tensile force on 10 mm × 30 mm faces,
(ii) 80 kN compressive force on 10 mm × 400 mm faces, and
(iii) 180 kN tensile force on 30 mm × 400 mm faces.
Find the change in volume if E = 2 × 105 N/mm^2 and 1/m= 0.3.

b. A hallow cylindrical CI column is 4 m long with both end fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 250 KN with a FOS of 5. Take internal diameter as 0.8 times the external diameter E=200 GN/m^2. 10
