SE/MTRX/Sem-IV/CBSGS/SOM 12/12/2017

QP CODE : 27757

Duration: - 03 Hours **Total marks assigned to the paper: 80**

N.B.: (1) Question No. 1 is **compulsory**.

(2) Attempt any **THREE** questions from remaining **Five** questions.

(3) Clearly mention the **assumption** made if any.

(4) Draw **neat** sketches wherever **applicable**.

Q1. Attempt **ANY FOUR** from the following:

(a) Draw shear force and bending moment diagram for a simply supported beam having length l carrying UDL w per unit length over whole span. **05**

(b) Derive an expression for total elongation of uniform circular bar due to self-weight if Υ is its specific weight and E is Young's modulus. **05**

(c) Explain the theory of simple bending. **05**

(d) Derive relation between Young's modulus, modulus of rigidity and bulk modulus. **05**

(e) Explain various types of stresses. **05**

Q2. **(a)** Figure2a shows a simply supported beam of uniform section whose moment of inertia is $4.3\times10^8 mm^4$. For the loading shown, find position and magnitude of maximum deflection. Take E= $200kN/mm^2$. **10**

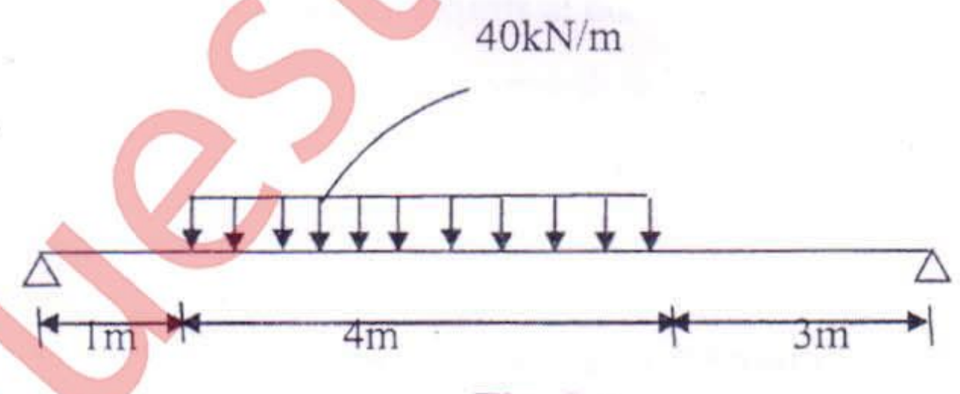

Fig. 2 a

(b) A solid circular shaft is to transmit 300kW at 100rpm. If the shear stress is not to exceed $80N/mm^2$find diameter of shaft. What % saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of external diameter, the length, material and max.shear stress being the same? **10**

Q3. **(a)** A beam AB 10m long has supports at its ends A and B. It carries a point load of 5kN at **10**

3m from A and a point load of 5kN at 7m from A and a UDL of 1kN/m between point loads. Draw shear force and bending moment diagrams for the beam.

(b) A shaft has to transmit a torque a torque of 30kNm. The maximum shear stress is not to exceed 100MPa and angle of twist is not to exceed 1°/m length. Calculate the dimensions of shaft to the given specifications if it is a **10**

i) Solid circular shaft

ii) Hollow circular shaft of internal diameter 90% of external diameter.

Consider G= 80GPa.

Q4. **(a)** A 12mm diameter steel rod passes centrally through a copper tube 48mm external and 36mm internal diameter and 2.5m long. The tube is closed at each end by 24mm thick steel plates which are secured by nuts. The nuts are tightened until the copper tube is reduced in length by 0.508mm. The whole assembly is then raised in temperature by 60°C. Calculate stresses in copper and steel before and after rise of temperature assuming that thickness of plates remain unchanged. Take $E_s = 2.1\times10^5 N/mm^2$, $E_c = 1.05\times10^5 N/mm^2$, $\alpha_s = 1.2\times10^{-5}/°C$, $\alpha_c = 1.75\times10^{-5}/°C$. **10**

(b) The principal tensile stresses at a point across 2 perpendicular planes are 80N/mm^{2}and 40 N/mm^2. Find normal and tangential stresses and the resultant stress and its obliquity on a plane at 20° with major principal plane. Also find the intensity of stress which acting alone can produce same maximum strain. Take Poisson's ratio= ¼. **10**

Q5. **(a)** A beam of uniform section is 10m long and is simply supported at the ends. It carries concentrated loads of 100kN and 60kN at distances of 2m and 5m resp.from left end. Calculate the deflection under each load. Also find maximum deflection. Take I= $18\times10^8 mm^4$ and E= 200kN/mm^2. **10**

(b) A hollow shaft with diameter ratio 3/5 is required to transmit 450kW at 120rpm with a uniform twisting moment. The shearing stress in shaft must not exceed 60 N/mm^{2}and twist in a length of 2.5m must not exceed 1°. Calculate minimum external diameter of shaft satisfying these conditions. Take $C=8\times10^4$ N/mm^2. **10**

Q6. **(a)**

(i) Define and explain principal planes and principal stresses. **05**

[TURN OVER

(ii) Draw SFD and BMD for simply supported beam carrying UVL of w/unit run over whole span of length l. **05**

(b)

(i) Write a short note on thermal stresses. **05**

(ii) Define shear force and bending moment diagram. Also explain the sign conventions of SFD and BMD. **05**
