Paper Code: ETA1203 [illegible] JAN.2015

Time : 3 Hours | Subject: Strength of Materials

Maximum Marks :75

Note: Attempt all five questions. Internal choice is indicated. Use of scientific calculator is allowed.

Q1 Attempt all the questions:- (2.5x10=25)

(a) Draw stress-strain curve for Mild steel.

(b) An aluminium rod of 20mm diameter is elongated by 3.5mm along its longitudinal direction by a load of 25kN. Determine the original length of the bar. Take E=70GPa.

(c) Define poisson's ratio. Also, state its range in normal conditions.

(d) Draw a BM diagram for a simply supported beam having point load and a moment acting at its center.

(e) Explain Castigliano's theorem for finding deflection of beams.

(f) Explain principle of superposition.

(g) Find principle stress with the help of a Mohr's circle for two perpendicular linear stresses 100N/mm² (tensile) and 50N/mm² (compressive).

(h) A cylindrical tank of 1m internal diameter has wall thickness of 25mm and is 20m high. Calculate the maximum stress when the tank is full of water.

(i) What is the difference between open coiled and close coiled helical springs?

(j) Explain Lame's theorem and its application.

Q2 A steel rod of 20mm diameter passes through a brass tube of 20mm internal diameter and 30mm external diameter. The nut on the rod is tightened until a stress of 12MPa is developed in the rod. The temperature of the tube is then raised by 80°C. What are the final stresses on the rod and the tube? Assume E_s=200GPa and α_s=0.0000117/°C, E_b=80GPa and α_b=0.00019/°C. (12.5)

Q3 In a two dimensional problem, two mutually perpendicular stresses at a point are 120MPa (tensile) and 80MPa (compressive). If the principle stress is limited to 150MPa, find the value of shear stress. Also, find the inclination of principle plane and magnitude of the maximum shear. (12.5)

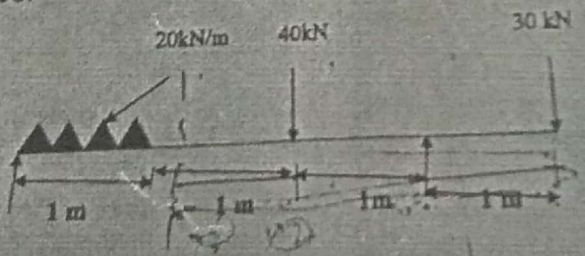
OR

A solid shaft is required to transmit 90kW of power at 200rpm. Find the diameter of the shaft, if permissible stress for the material is 60N/mm² and permissible twist is 0.30°/m. Assume C=80GN/m². (12.5)

Q4 A uniform T-section beam is 80mm wide by 120mm deep with a 25mm thick flange and a 12mm thick web. If the limiting bending stress for the beam are 80MN/m² in compression and 160MN/m² in tension. Find the maximum u.d.l. that the beam can carry over a simply supported span of 4m and having a point load of 10kN at center of the beam length. (12.5)

OR

Draw a SF and BM diagram for the overhanging beam shown in figure. Indicate the point of contraflexure. (12.5)



Q5 A cylindrical shell is 3m long, 1m in diameter and thickness of metal is 10mm. It is subjected to an internal pressure of 150N/mm². Calculate the change in dimension of the shell and the maximum stress induced. Assume E=200GPa and Poison's ratio=0.3. (12.5)

OR

A closed coiled helical spring is to be made out of 5mm diameter wire that is 2m long so that it deflects by 20mm under an axial load of 50N. Determine the diameter of the coil. Assume C=81GN/m². (12.5)

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