B. TECH. SEM - III (PRODUCTION ENGG.) (2014 COURSE) (CBCS)
: WINTER - 2017
SUBJECT: STRENGTH OF MACHINE ELEMENTS

Day: Friday **Time:** 10.00 AM TO 01.00 PM
Date: 19/01/2018 **Max. Marks: 60**

W-2017-2054

N.B:

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if **NECESSARY.**

Q.1 Find the elongation in mm of a straight bar of steel 12 metres long due to its own weight if hung. The value of the modulus of elasticity of the material is unknown. However, it is known that the modulus of the rigidity of the material is 0.88 x 10^5 N/mm^2 and Poisson's ratio is 0.25. Take specific weight of steel equal to 8.3 x 10^{-5} N/mm^3. **(10)**

OR

Q.1 A solid vertical prismatic steel bar of equilateral triangular section of side 25 mm is firmly fixed at top. A rigid collar is attached at the lower end at a distance of 600 mm from top. Compute the strain energy in each of the following cases: **(10)**

i) When a pull of 10 kN is applied gradually.
ii) When a force of 8 kN is suddenly applied
iii) When a weight of 4 kN falls through 120 mm. Assume E= 210 GPa.

Q.2 The principal stresses at a point across two perpendicular planes are 75 MN/m^2 (tensile) and 35 MN/m^2 (tensile). Find the normal, tangential stresses and the resultant stress and its obliquity on a plane at 20^0 with the major principal plane. **(10)**

OR

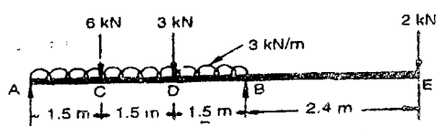
Q.2 A solid circular shaft is subjected to a bending moment of 40 KN-m and a torque of 10 KN-m. Design a diameter of shaft according to: **(10)**

i) Maximum principle stress theory
ii) Maximum shear stress theory
iii) Maximum strain energy theory

Take μ = 0.25, stress at elastic limit = 200 N/mm^2 and factor of safety = 2

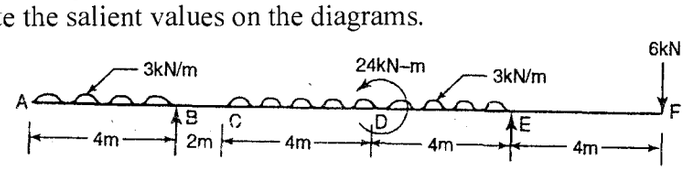
Q.3 Fig. show a loaded beam **(10)**

i) Sketch the B.M and S.F diagrams giving the important numerical values
ii) Calculate the maximum bending moment and the point at which it occurs.



OR

Q.3 Draw the bending moment and shear force diagrams for the beam shown in Fig. Indicate the salient values on the diagrams. **(10)**



P.T.O.

Q.4 A hollow circular shaft having internal diameter 50% of its external diameter, transmits 600 kW at 150 rpm. Determine the external diameter of the shaft if the shear stress is not to exceed 65 N/mm^2 and a twist in a length of 3 m should not exceed 1.4^0. Assume T_{max} = 1.2 times T_{mean}, G =100 GPa. **(10)**

OR

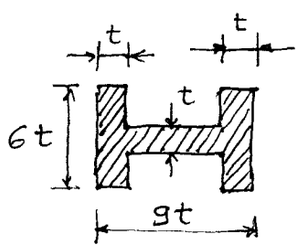
Q.4 A 3 m cantilever beam is loaded with a point load of 10 kN at its free end. Find the cross section of the beam. The maximum bending stress is not to exceed 5 N/mm^2 and the maximum deflection is restricted to 8 mm. Take E = 2 x 10^4 N/mm^2. **(10)**

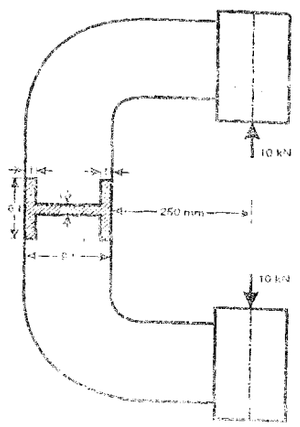
Q.5 A symmetrical I- section has flanges of size 180 mm x 10 mm and its overall depth is 500 mm. The thickness of web is 8 mm. It is strengthened with a plate of size 240 mm x 12 mm on compression side. Find the moment of resistance of the section, A = 10320 mm^2 if the permissible stress is 150 N/mm^2. How much uniformly distributed load it can carry, if it used as a cantilever of span 3 m? **(10)**

OR

Q.5 An I- section beam 340 mm x 200 mm has a web thickness 10 mm and flange thickness of 20 mm. It carries a shearing force of 100 kN. Sketch the shear stress distribution across the beam. **(10)**

Q.6 A 'C' frame subjected to a force of 10 kN is shown in Figure. It is made of grey cast iron, FG 300 and factor of safety is 5. Determine the dimensions of the cross-section of the frame. **(10)**





OR

Q.6 A bell crank lever is to be designed for a load of 5 kN, at the short arm end. The arm length are 100 mm and 450 mm. Permissible shear and tensile stresses for pin and lever are 70 MPa and 80 MPa. Bearing pressure is 10 MPa. Assuming lever cross sections as t x 3t and fulcrum pin length 1.25 times pin diameter. Design the lever. **(10)**