Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–I EXAMINATION – WINTER 2015

Subject Code: X11901 **Date:28/12/2015**

Subject Name: STRENGTH OF MATERIALS

Time: 10:30am to 01:00pm **Total Marks: 70**

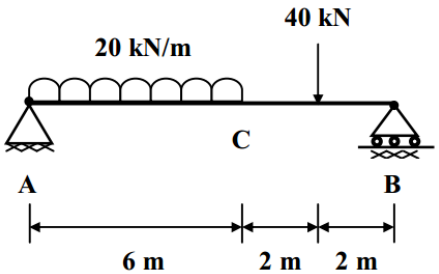
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

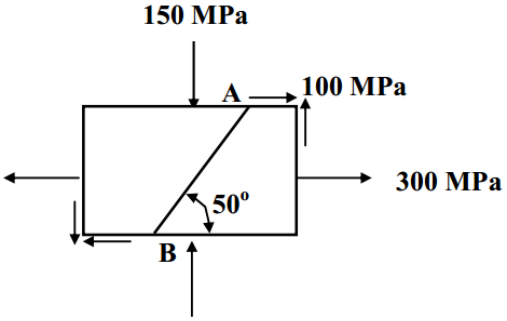
Q.1 **(a)** Define the terms, Shear force, Bending moment, Point of contra-flexure. **07**

(b) Define the terms Complementary shear stress, Resultant stress, Angle of obliquity. **07**

Q.2 **(a)** Draw shear force diagram (SFD) and bending moment diagram (BMD) neatly for the beam as shown in the following figure showing the values at salient points. **07**



(b) For the element shown in the following figure, find the normal stress, tangential stress and resultant stress on the plane AB. Also, find principal stresses and principal planes. Use any method. **07**



OR

(b) For torsion of a circular shaft, derive the equation $T/IP = \tau/R = C\theta/L$ with usual notations **07**

Q.3 **(a)** A hollow circular shaft transmits 800 kW at 150 RPM. Its maximum torque is 25% more than the average torque. The ratio of internal to external radius is 0.8. If the maximum shear stress and angle of twist in 3 m length are not to exceed 80 MPa and 3° then find the required sectional dimension of the shaft. Take modulus of rigidity: C = 85 GPa. **09**

(b) Write the equation for instantaneous stress for impact loading. Using the same show that the stress induced due to sudden loading is twice that of the stress due to gradual loading. **05**

OR

Q.3 **(a)** A tie beam of a roof truss consists of an angle 90 x 90 x 8 mm is subjected to a load of 120 kN. The tie is connected to a gusset plate by welding. Design the joint, if the size of the weld is 6 mm. Take maximum allowable shear stress in the weld as 100 MPa. The distance between the neutral axis and the edges of the angle section are 28.7 mm and 61.3 mm respectively. **09**

(b) Plot Shear stress distribution diagram for I-section, T-section, H-section, Rectangular section, Circular section **05**

Q.4 **(a)** Find the minimum diameter of steel wire if the permissible stress is limited to 90×10^6 N/m^2 and the 2.5 m wire is required to lift a load of 20 kN Also determine the elongation of steel wire when stressed to it's permissible limit. (Take E= 210 Gpa.) **07**

(b) Prove that the relation $M = EI * d^2y/dx^2$ **07**
Where: M = Bending moment, E = Young modulus, I = M.O.I.

OR

Q.4 **(a)** Two solid shafts AB and BC of aluminum and steel respectively are rigidly fastened together at B and attached to two rigid supports at A and C. Shaft AB is 7.0 cm in diameter and 2m in length. Shaft BC is 5.0 cm in diameter and 1m in length. A torque of 20 kN.cm is applied at the junction B. Compute the maximum shearing stresses in each material. What is the angle of twist at the junction? Take the modulus of rigidity of the materials as 0.3×10^5 N/mm^2 for aluminum and 0.9×10^5 N/mm^2 for steel. **07**

(b) A fixed beam AB, 6 m long is carrying a point load of 50 kN at its centre. The moment of inertia of the beam is 78×10^6 mm^4 and value of E for beam material is 2×10^5 N/mm^2. **07**
Determine (1) Fixed end moments at A & B. (2) Deflection under the load

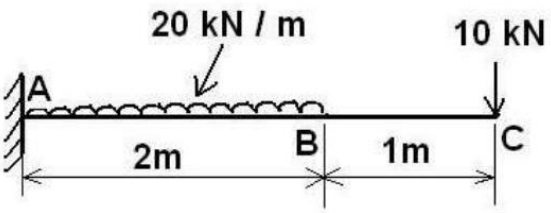
Q.5 **(a)** State advantages and disadvantages of the welded joints. With neat sketches explain different types of the welded joints. **07**

(b) Design a solid circular shaft to transmit 250 kw power at 70 rpm. The shear stress must not exceed 80 MPa and the angle of twist must not exceed 1.5º in a length of 2.0 m. Take $G = 8 \times 10^4$MPa. **07**

OR

Q.5 **(a)** Define "Eccentricity" and explain different types of failure of a riveted joint with sketch. **07**

(b) Determine Slope and deflection at point C for the cantilever beam as shown in following figure using any method. Take EI = 32000 kNm^2. **07**



****