Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-II Examination June 2010

Subject code: 110010 Subject Name: Mechanics of Solids

Date: 24 /06 /2010 **Time: 02.30 pm- 05.00 pm**

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) Resultant force of a system of two forces is directed vertically downwards. The magnitude of resultant force R is 50 N One of the force of the system has magnitude of 30 N and is inclined at an angle of 60º with horizontal as shown in **Fig (1).** Determine the magnitude P and direction θ of the second force. **07**

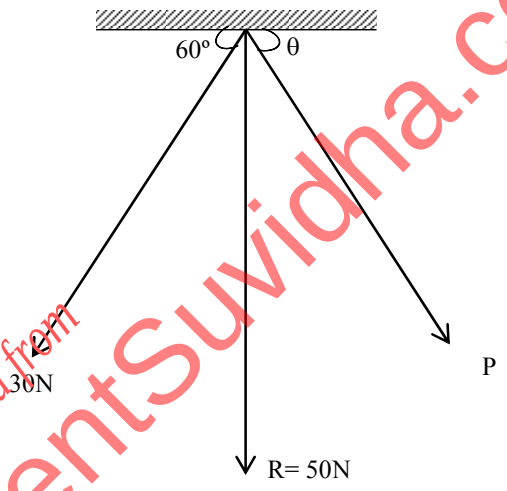

fig. (1)

(b) State Lami's Theorem. Determine the force P required to keep the system as shown in **Fig (2),** in equilibrium. **05**

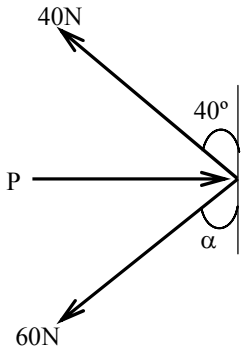

fig. (2)

(c) Explain the law of machine. **02**

Q.2

(a) A lamina of uniform thickness is hung through a weightless hook at point B such that side AB remains horizontal; as shown in **Fig(3).** Determine the length AB of the lamina. **07**

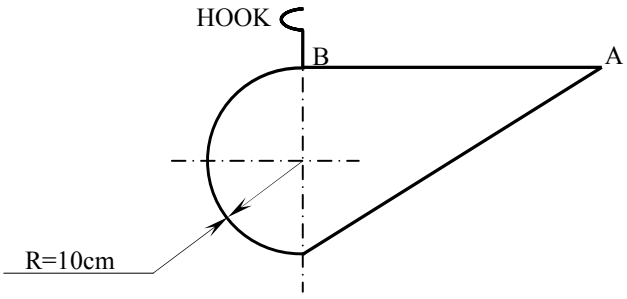

fig. (3)

(b) Three forces are acting on a weightless equilateral triangular plate as shown in **Fig. (4).** Determine the magnitude, direction and position of the resultant force. **05**

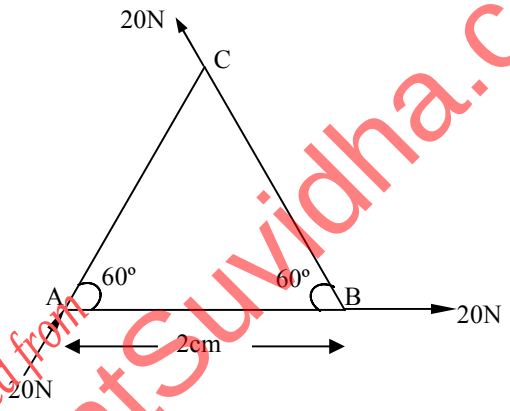

fig. (4)

(c) Differentiate between ideal machine and actual machine. Draw the relationship between efficiency of machine and the load lifted by the machine for both, the ideal and the actual machine on the same plot. **02**

OR

(b) A cantilever beam is loaded as shown in **Fig (5).** Determine the reactions at support of beam. **05**

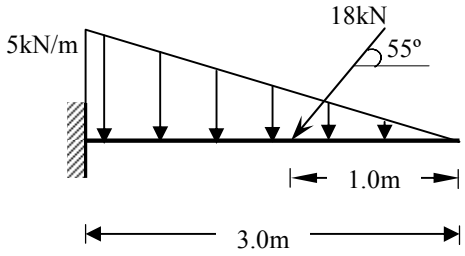

fig. (5)

(c) Explain the behaviour of mild steel when tested under tension till failure occurs. **02**

Q.3

(a) A square block with 1.0m side has a height of 2.0m and is resting on the floor as shown in **Fig.(6).** The weight of the block is 0.5kN. A pulling force P just sufficient to move the block is applied at a point, 1.5m above the floor. Check, whether the block may slide or topple due to the pulling force P. Coefficient of friction between block and floor is 0.3. **07**

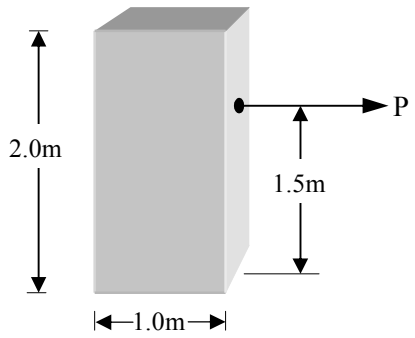

fig. (6)

(b) Determine the forces in the members of truss loaded as shown in **Fig(7).** **05**

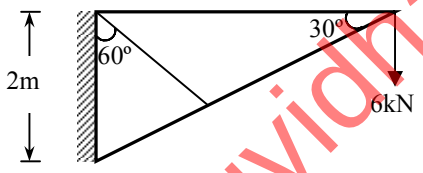

fig. (7)

(c) A steel rod is rigidly fitted in a copper tube. The assembly is rigidly fitted at both the ends. If the temperature of assembly is dropped, what kind of stresses will setup in both the materials? Coefficient of thermal expansion for steel is less than that of copper. **02**

OR

Q.3

(a) A ladder is supported by a horizontal floor and a vertical wall. The weight of ladder is 200N. The coefficient of friction at the wall is 0.2 and at the floor is 0.4. A man of weight of 600N is to climb on it. Determine the minimum inclination of the ladder with horizontal floor so that the man can climb the full height of ladder without slipping. **07**

(b) A steel rod with yield stress 250MPa has 1.0m length and 20mm diameter. Determine the changed dimensions of the rod if it is stressed upto yield stress. The modulus of elasticity is 2×10^5 MPa and the Poisson's ratio is 0.25. **05**

(c) Determine the polar moment of inertia about the axes passing through the centroid of quarter circle shaped lamina with radius equal to 10cm. **02**

Q.4 Draw shear force and bending moment diagrams of the beam loaded as shown in **Fig.(8).** **14**

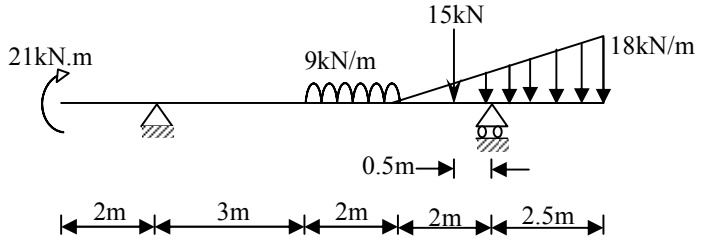

fig. (8)

OR

Q.4 Draw shear force and bending moment diagrams of the beams loaded as shown in **Fig.(9)** and **Fig.(10).** **14**

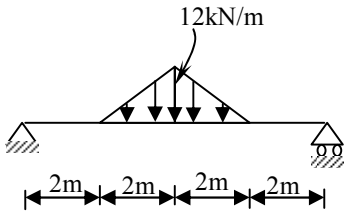

fig. (9)

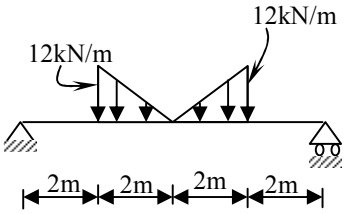

fig. (10)

Q.5

(a) Determine the maximum bending stress and draw bending stress distribution in a section as shown in **Fig.(11)**, if it is subjected to a bending moment of 20kN-m. **07**

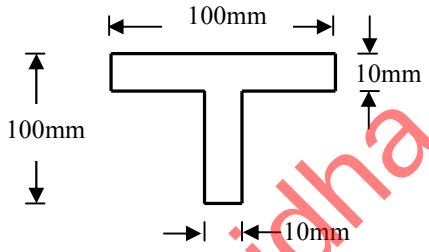

fig. (11)

(b) Determine the minimum diameter of shaft required to transmit 10 kN-m torque. The permissible twist is 1° per meter length and the permissible shear stress of the shaft material is 100MPa. Take modulus of rigidity as 1×10^5 MPa. **07**

OR

Q.5

(a) Determine the maximum shear stress and draw shear stress distribution across the section as shown in fig. (11),if the section is subjected to a shear force of 40kN. **07**

(b) At a point in a strained material, stress conditions on two planes; making an angle of 60° between two, are as shown in **Fig. (12).** Determine the principal planes and principal stresses through the point. **07**

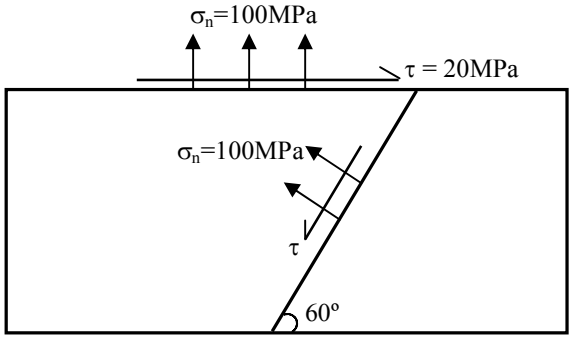

fig. (12)