Seat No.: _____   *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E Sem-I/II Examination June-July 2011

Subject code: 110010   **Subject Name: MECHANICS OF SOLIDS**
Date: 11/7/2011   **Total Marks: 70**   **Time: 10:30 am to 1:00pm**

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

Q.1 **(a)** Answer in one Line: **07**
   i) What should be the efficiency of Self Locking Machines?
   ii) Resultant of two forces can be found using which Law?
   iii) The Elastic Range is defined by which Law?
   iv) Force is defined by its magnitude and 2 other parameters. Name them.
   v) Name the machine used for conducting the Tension test.
   vi) What will be the shape of Bending Moment diagram of a uniformly loaded cantilever beam?
   vii) Name the various elastic constants and give their relationship
  (b) 3 wires exert forces on a hook as shown in Fig.1. Find out the force that will be exerted by a single wire that can replace all the 3 wires.   **07**

Q.2 **(a)** Find the total deformation of a steel rod subjected to a force of 250kN, as shown in Fig.2. Length of rod is 1000mm and Modulus of Elasticity of steel is 200GPa   **07**
  (b) Determine the centroid of the plane area in which a circular part of 40 mm radius, has been removed as shown in Fig.3.   **07**

OR

  (b) Replace the couple and force by a single force-couple applied at A for the lever shown in Fig.4. Also find the distance of a point C from A where only a single force can replace the force-couple system   **07**

Q.3 **(a)** A block of mass 100 kg is placed on an incline as shown in Fig.5. If μ_s =0.35 and μ_r =0.25, determine the magnitude of horizontal force P, required to start the block to move up the plane.   **07**
  (b) Find the Moment of Inertia of a rectangular area about its centroidal x and y axis using the Parallel axis theorem.   **07**

OR

Q.3 **(a)** Determine forces in member Ab and BC of a truss shown in Fig.6 using Method of Joints and in member AC using Method of Sections.   **07**
  (b) An effort of 10 N is applied to lift a load of 125 N by a lifting machine having Velocity Ratio of 40. If the effort is removed, will there be a reversal in the machine? Determine the frictional effort of this machine.   **07**

Q.4 **(a)** Draw the Shear Force and Bending Moment Diagrams for the beam loaded as shown in Fig.7   **07**
  (b) Determine the Stress, Strain, Modulus of Elasticity and Poisson's Ratio from the following results for a bar tested on UTM: Diameter= 20mm; Gauge length = 150 mm; Increase in Gauge length = 14mm; Decrease in diameter = 0.85 mm; Tensile load = 6 kN   **07**

OR

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Q.4 **(a)** Find the reactions at the fixed support for a beam loaded as shown in Fig.8 **07**

(b) A beam of T shaped cross section shown in Fig.9 is subjected to bending about x-x axis due to a moment of 20 kNm. Find the bending stress at the top of the beam. **07**

Q.5 **(a)** Find the shear stress at the junction of the flange and web of an I section shown in Fig.10, if it is subjected to a Shear Force of 20 kN. **07**

(b) Enumerate the various tests required to be carried out to find the mechanical properties of materials. Also describe the salient points on the stress-strain curve obtained from Tension test on Mild Steel **07**

OR

Q.5 **(a)** Fill in the blanks: **07**

 i) Forces acting transverse to the axis of the member will produce_____ stress

 ii) The _____ is found from the stress vs strain relation of a material.

 iii) Ductility is the ability of a material to be drawn in the form of a _____

 iv) Statically determinate structures can be analysed using the 3 equations of _____

 v) The constant of proportionality for a member under shear stress and strain is given by the Modulus of _____

 vi) The Bending or Flexural equation is given by:
 _____ = _____ = _____

 vii) The relationship between Shear force (V) and Bending moment (M) is given by the differential _____

(b) The shear and normal stresses on a cross section of a beam are shown in the Fig. 11. Find the Principal stresses and direction of Principal planes. **07**
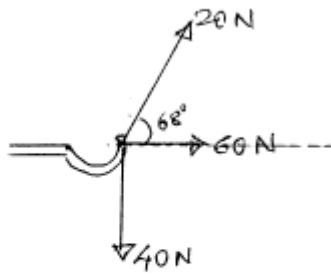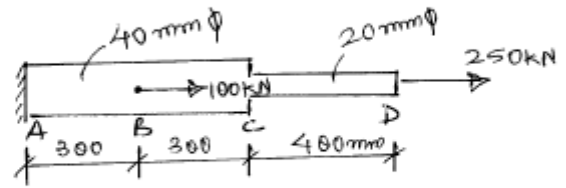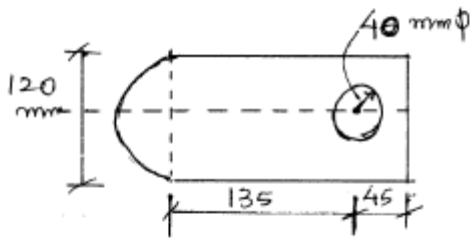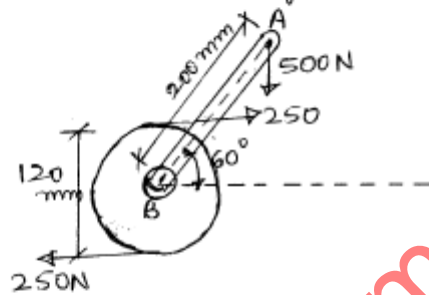
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Fig. 1. Q.1.(b)
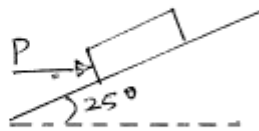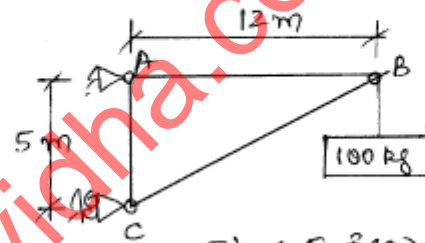
Fig. 2. Q. 2(a)

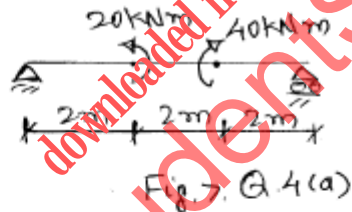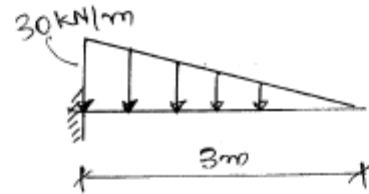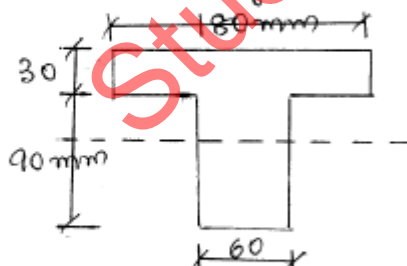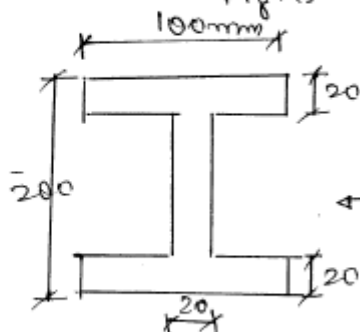Fig. 3. Q. 2(b)

Fig. 4. 2(b)

Fig. 5. Q. 3(a)
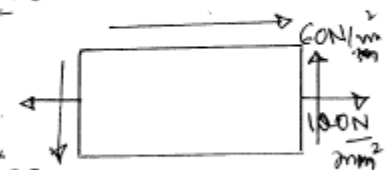
Fig. 6 Q.3(a)

Fig. 7. Q.4(a)

Fig. 8 Q.4(a)

Fig. 9 Q.4(b)

Fig. 10 Q.5(a)

Fig. 11 Q.5(b)

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