

**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  $\mu_s = 0.35$  and  $\mu_k = 0.25$ , 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**

- 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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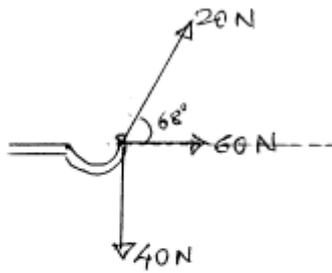


Fig. 1. Q.1.(b)

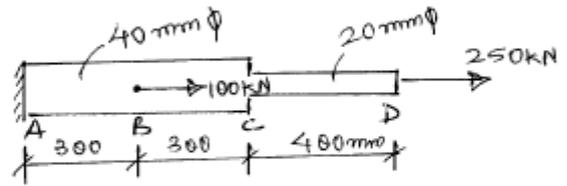


Fig. 2. Q.2(a)

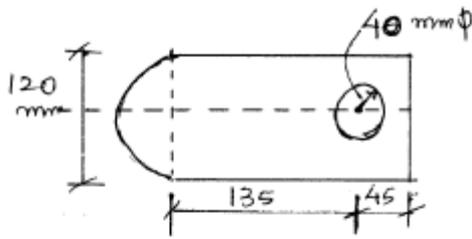


Fig. 3. Q.2(b)

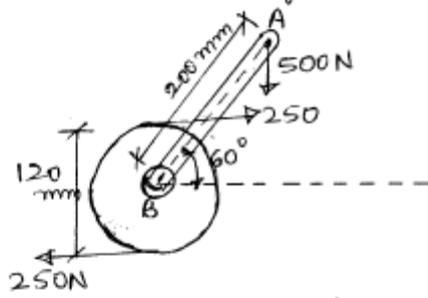


Fig. 4. 2(b)

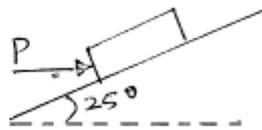


Fig. 5. Q.3(a)

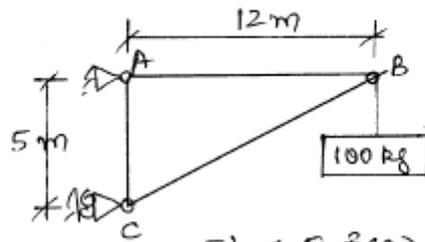


Fig. 6 Q.3(a)

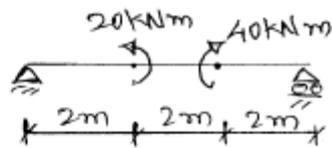


Fig. 7. Q.4(a)

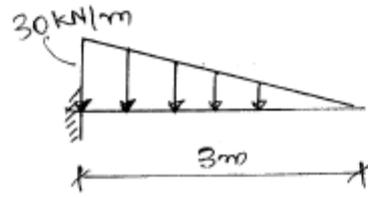


Fig. 8 Q.4(a)

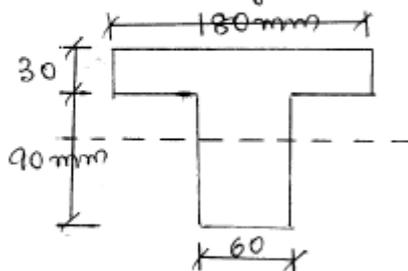


Fig. 9 Q.4(b)

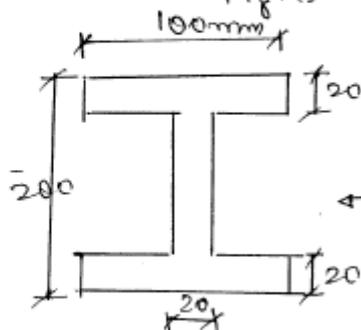


Fig. 10 Q.5(a)

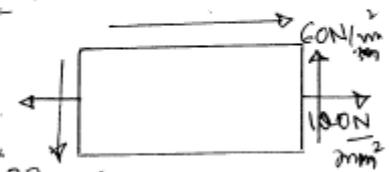


Fig. 11 Q.5(b)