

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE SEMESTER 1<sup>st</sup> / 2<sup>nd</sup> (OLD) EXAMINATION WINTER 2016**

**Subject Code: 110010**

**Date: 02/02/2017**

**Subject Name: Mechanics of Solids**

**Time: 10:30 AM TO 1:00 PM**

**Total Marks: 70**

**Instructions:**

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

- Q.1** (a) Explain in brief: **06**  
(i) Equilibrant, (ii) Resolution of force, (iii) Law of Parallelogram
- (b) Determine the resultant of a force system shown in *Fig.1* by analytical method and check the answer by law of Polygon. **08**
- Q.2** (a) i) State Varignon's theorem and give the application of theorem. **03**  
ii) Explain the conditions of equilibrium for different types of force systems. **04**
- (b) Two buckets are suspended by a flexible rope as shown in *Fig.2*. The weight of bucket *A* is  $100\text{ N}$ , if the system is in equilibrium, find the weight of bucket *B* and force in each part of the rope. **07**
- Q.3** (a) Determine the resultant of a force system shown in *Fig.3* and locate the resultant with respect to point *A*. **07**
- (b) Find the reactions at supports for beam the shown in *Fig.4*. **07**
- Q.4** (a) Draw the shear force and bending moment diagram for the beam shown in *Fig.5* and determine the maximum bending moment. **07**
- (b) Find out centroid of the Lamina shown in *Fig.6*. **07**
- Q.5** (a) A stepped bar made of Copper, Aluminum and steel part as shown in *Fig.7*. Find stress in each part and total change in length of the bar. **07**
- (b) Determine moment of inertia of section shown in *Fig.6* about base. **07**
- Q.6** (a) i) State Pappu's – Guildinu's theorems. **03**  
ii) A steel rod of  $50\text{ mm}$  diameter and  $3\text{ m}$  in length is subjected to rise of  $50^\circ\text{ C}$  temperature. Determine the free expansion of rod. If the free expansion is prevented, find the stress in the rod. Take  $E_s = 2 \times 10^5\text{ MPa}$  and  $\alpha = 12 \times 10^{-6}/^\circ\text{C}$ . **04**
- (b) Draw shear stress distribution diagram of a T- Section beam shown in *Fig.8*, if it is subjected to shear force of  $120\text{ kN}$ . **07**
- Q.7** (a) A uniform ladder of weight  $300\text{ N}$  and length  $6\text{ m}$  is placed against a vertical wall such that it makes an inclination of  $60^\circ$  with floor. A person of weight  $800$

$N$  climbs the ladder. At what position of the person the ladder will start to slip. Take coefficient of friction is  $0.2$  for wall and ladder and  $0.25$  for floor and ladder.

- (b) At a point in a strained material two mutually perpendicular tensile stress of  $50 \text{ N/mm}^2$  and  $80 \text{ N/mm}^2$  and shear stress  $20 \text{ N/mm}^2$  are acting as shown in Fig.9. Find the values of principal stresses and position of principal planes. 07

\*\*\*\*\*

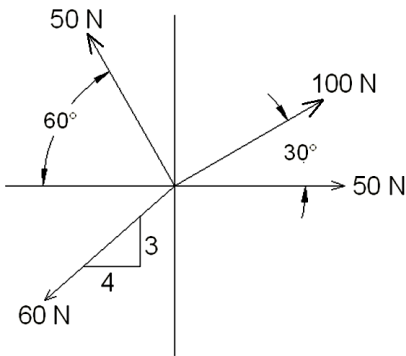


Fig.1 [ Q-1(b) ]

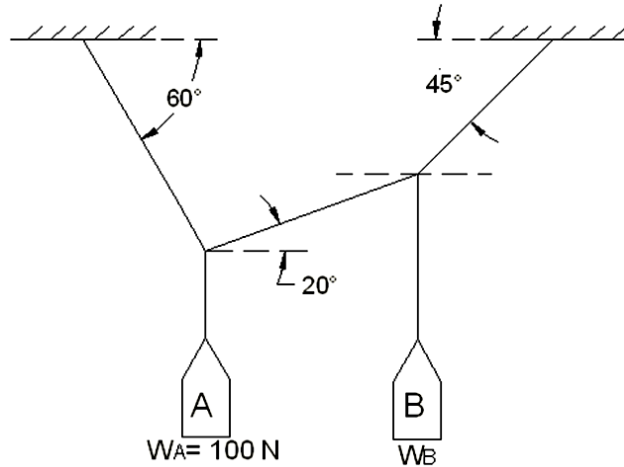


Fig.2 [ Q-2(b) ]

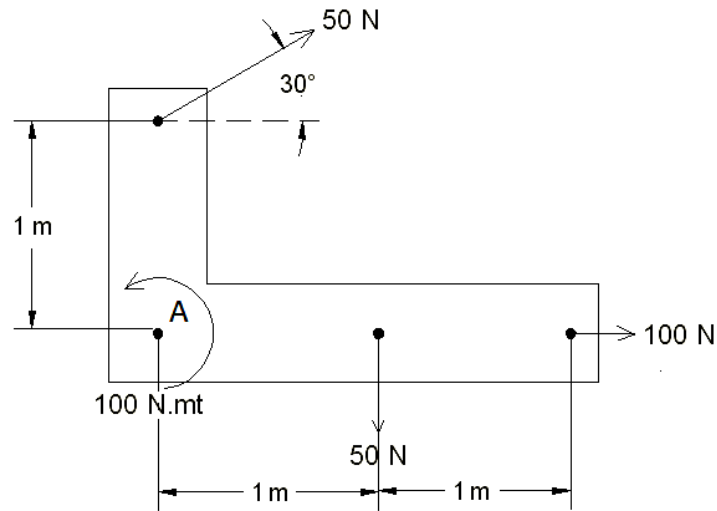
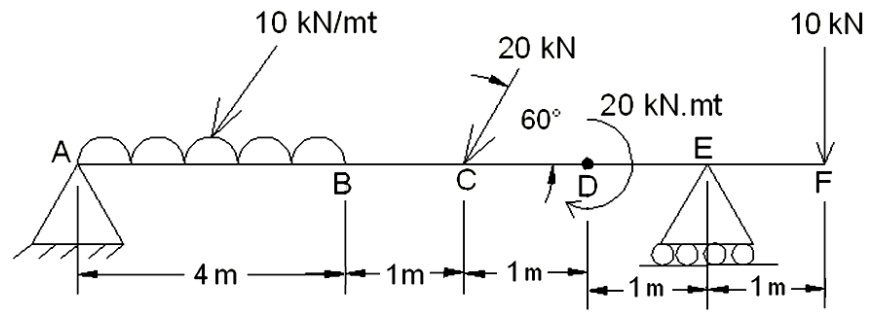
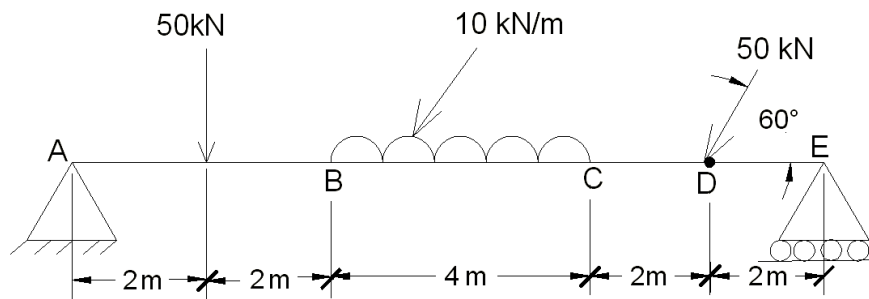


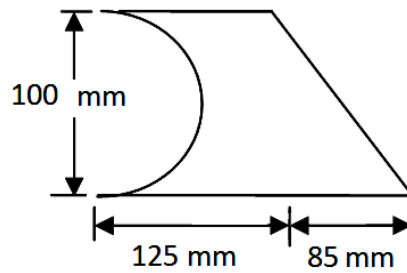
Fig.3 [ Q-3(a) ]



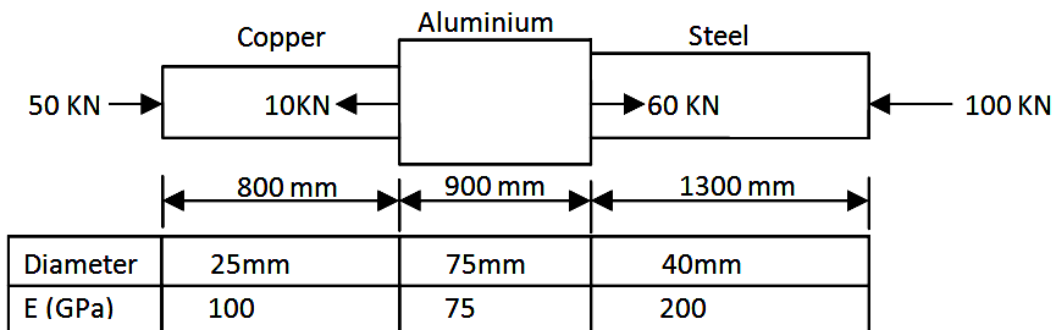
**Fig.4 [ Q-3(b) ]**



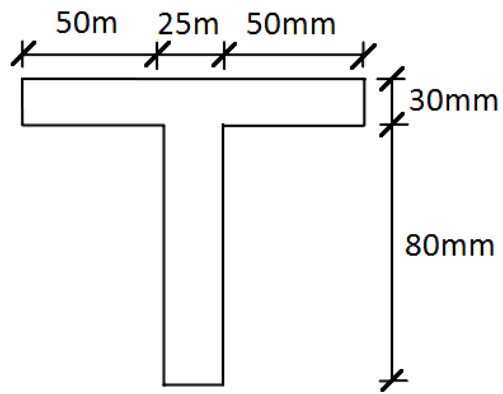
**Fig.5 [ Q-4(a) ]**



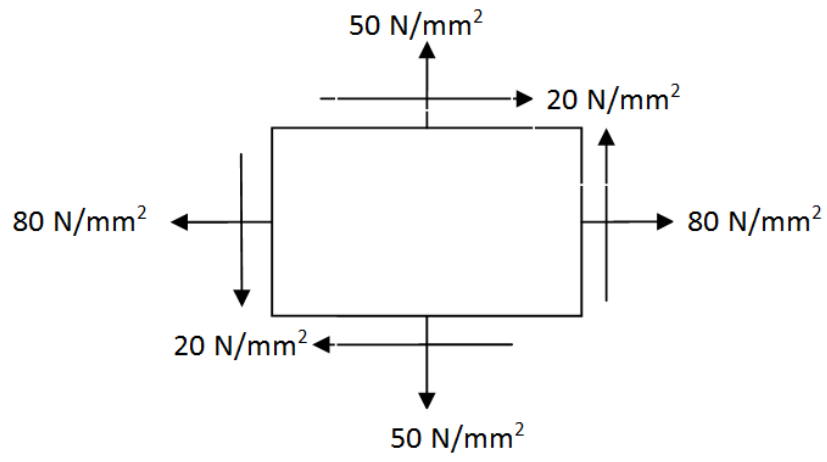
**Fig.6 [ Q-4(b) and Q-5(b) ]**



**Fig.7 [ Q-5(a) ]**



**Fig.8 [ Q-6(b) ]**



**Fig.9 [ Q-7(b) ]**