

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEMESTER 1st / 2nd (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 **08**
and check the answer by law of Polygon.
- 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 **07**
bucket *A* is 100 N , if the system is in equilibrium, find the weight of bucket *B*
and force in each part of the rope.
- Q.3** (a) Determine the resultant of a force system shown in *Fig.3* and locate the **07**
resultant with respect to point *A*.
- (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 **07**
Fig.5 and determine the maximum bending moment.
- (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*. **07**
Find stress in each part and total change in length of the bar.
- (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 mm diameter and 3 m in length is subjected to rise of **04**
 50° 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 $\alpha = 12 \times 10^{-6}/^\circ\text{C}$.
- (b) Draw shear stress distribution diagram of a T- Section beam shown in *Fig.8*, if **07**
it is subjected to shear force of 120 kN .
- Q.7** (a) A uniform ladder of weight 300 N and length 6 m is placed against a vertical **07**
wall such that it makes an inclination of 60° 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 N/mm^2 and 80 N/mm^2 and shear stress 20 N/mm^2 are acting as shown in Fig.9. Find the values of principal stresses and position of principal planes. **07**

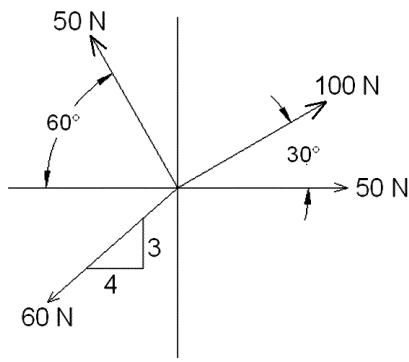


Fig.1 [Q-1(b)]

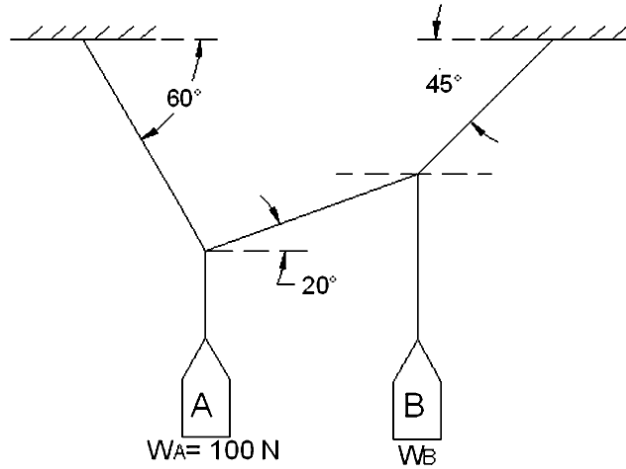


Fig.2 [Q-2(b)]

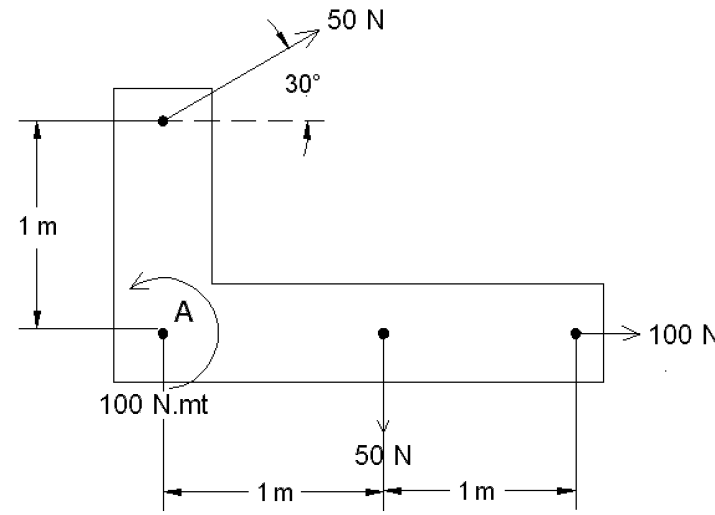


Fig.3 [Q-3(a)]

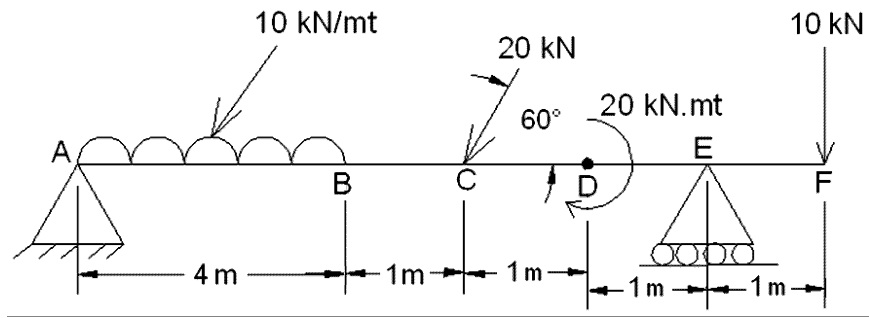


Fig.4 [Q-3(b)]

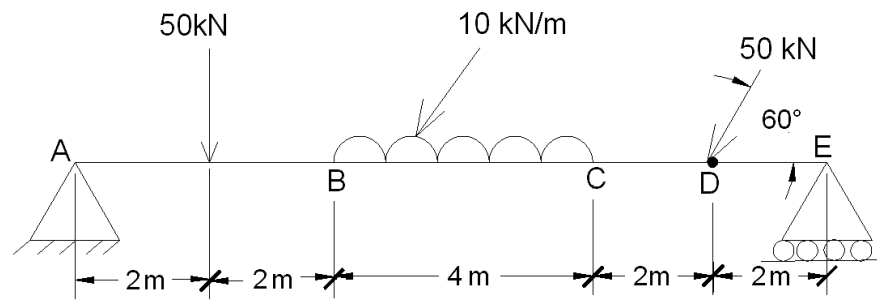


Fig.5 [Q-4(a)]

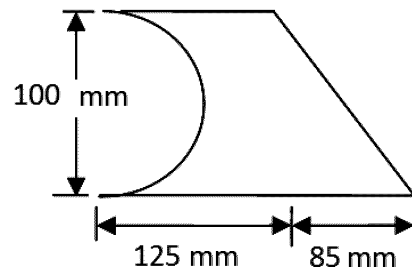


Fig.6 [Q-4(b) and Q-5(b)]

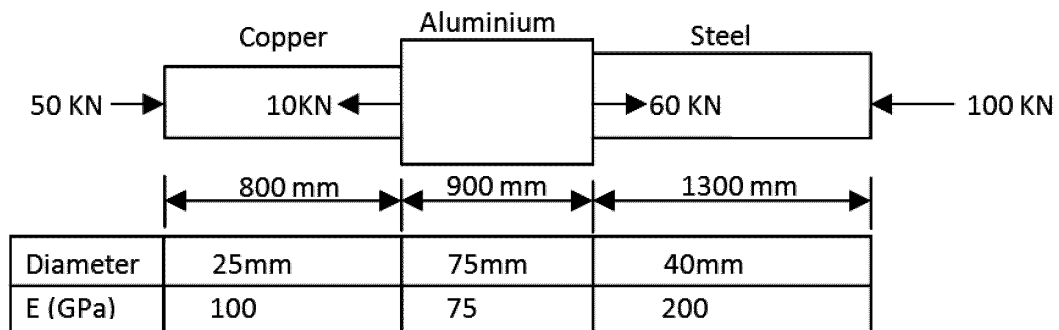


Fig.7 [Q-5(a)]

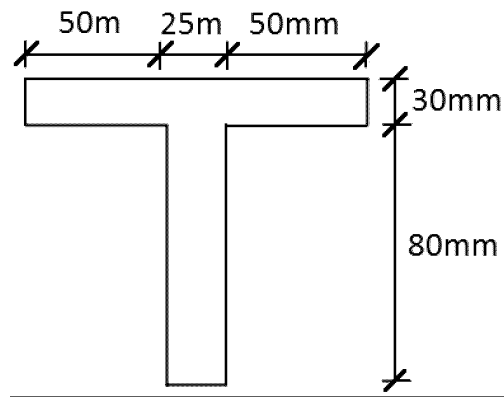


Fig.8 [Q-6(b)]

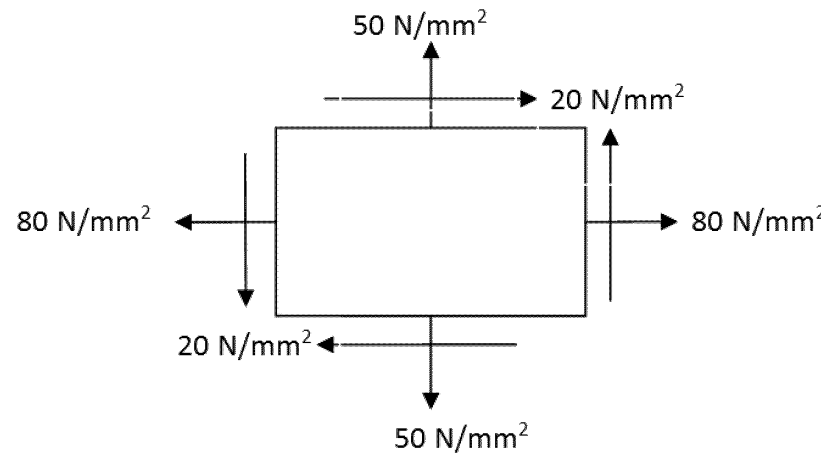


Fig.9 [Q-7(b)]