Printed Pages:05 **Sub Code: EME 202/NME 202**

Paper Id: 140209 **Roll No.** | | | | | | | | | | |

B TECH
(SEM-II) THEORY EXAMINATION 2018-19
ENGINEERING MECHANICS

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. State and prove parallelogram law of forces.
b. List the characteristics of force. Give the necessary and sufficient conditions for equilibrium of 'non-concurrent' force system.
c. Define coefficient of friction and angle of friction.
d. Define types of beam with neat sketch.
e. Explain the terms: Perfect frame, imperfect frame, deficient frame and redundant frame.
f. Differentiate between centroid and centre of gravity.
g. Write D'Alembert's principle.
h. What is the difference between stress and strain?
i. Define Principle of virtual work and its application.
j. State the law of conservation of momentum.

SECTION B

2. Attempt any *three* of the following: **10x3=30**

a. A ball of weight 120 N rests in a right angled groove, as shown in fig. 1. The sides of the groove are inclined to an angle of 30º and 60º to the horizontal. If all the surfaces are smooth, then determine the reactions at the point of contact.

30° 60°

Fig.1

b. A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m at one end to 1600 N/m at the other end as shown in figure 2. Calculate the reaction at both the ends.

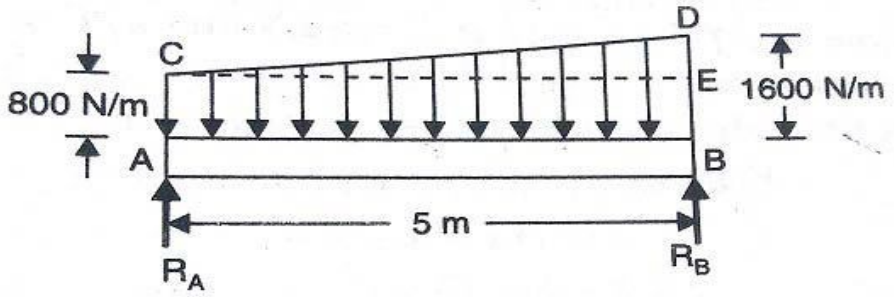

Fig. 2.

c. Define moment of inertia. State and prove parallel axis theorem.

d. A particle moves along a staight line and its motion is represented by the equation

$$s = 16\,t + 4\,t^2 - 3t^3$$

where s is in meter and t is in seconds. Determine:

(i) Displacement, velocity and acceleration 2 seconds after start
(ii) Displacement and acceleration when velocity is zero
(iii) Displacement and velocity when acceleration is zero

e. Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and length 1.5 m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take E = 1 x 10^5 N/mm^2.

SECTION C

Note: Attempt all the questions of this section. Each question is of 10 marks. 10x5=10

3. Attempt any *one* part of the following:

a. A uniform ladder of weight 30 N and length 13 m is placed against a smooth vertical wall with its lower end 10 m from the wall. In this position the ladder is just to slip. Determine the coefficient of friction between the ladder and the floor and frictional force acting on the ladder at the point of contact between the ladder and floor.

b. The frictionless pulley A shown in fig. 3 is supported by a two bars AB and AC which are hinged at B and C to a vertical wall. The flexible cable DG hinged at D goes over the pulley and support a load of 20 KN at G. The angles between various members are shown in figure. Determine the forces in AB and AC. Neglect the size of the pulley.

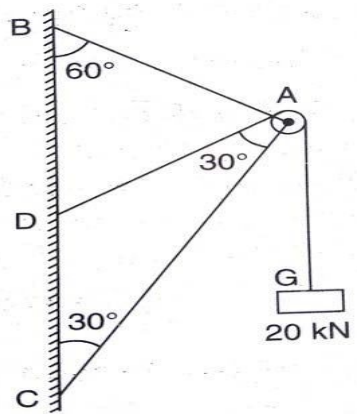

Fig.3

4. Attempt any *one* part of the following:

a. Draw shear force and bending moment diagram for given overhanging beam as shown in fig.4

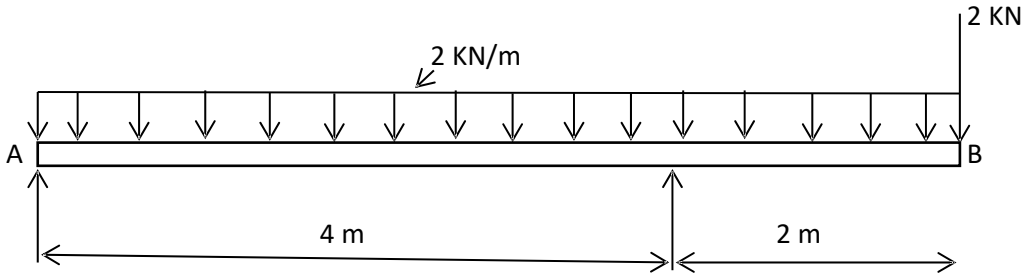

Fig.4

b. A truss of span AB= 6 m and loaded as shown in fig.5. Find reactions and forces in the members of the truss

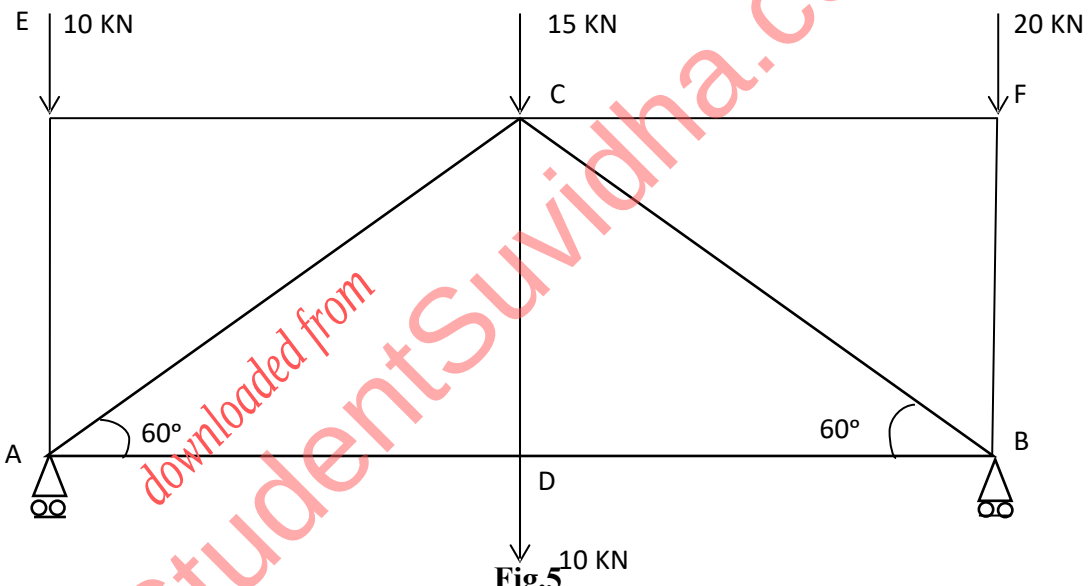

Fig.5

5. Attempt any *one* part of the following:

a. Determine the moment of inertia of the L-section as shown in figure 6 about its centroidal axis parallel to the legs. Also find the polar moment of inertia. All dimensions are in mm.

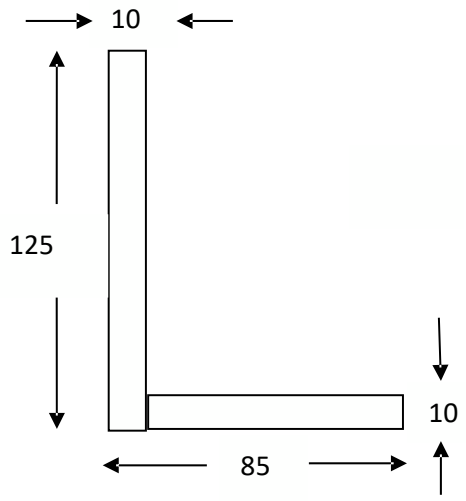

Fig.6

b. Determine the center of gravity of the plane uniform lamina shown in fig.7.

5 cm

5 cm

Fig.7

6. Attempt any *one* part of the following:

a. Determine the tension in the string and accelerations of blocks A and B weighing 200 N and 50 N connected by an inextensible string as shown in **fig.8**. Assume pulleys as frictionless and weightless.

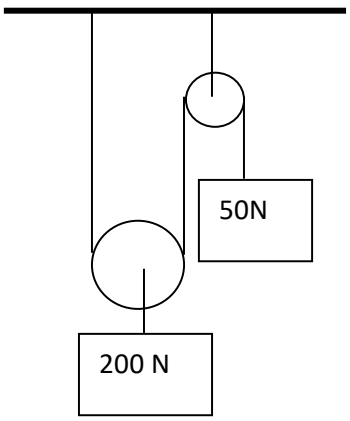

Fig. 8

b. A passenger sitting in a train moving at 54 km/hr is hit by a stone thrown at right angles to it with a velocity of 18 km/hr. calculate the velocity and direction with which the stone appears to hit the passenger.

7. Attempt any *one* part of the following:

a. Discuss stress strain diagram for ductile and brittle materials in detail with suitable diagram.

b. List the assumptions made in simple bending theory. Derive the simple bending equation.