Sub Code:EME102/NME102

Paper Id: 140106 Roll No:

B TECH
(SEM-I) THEORY EXAMINATION 2019-20
ENGINEERING MECHANICS

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If required any missing data, then choose suitably.

SECTION A

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

a.	Explain coplanar concurrent forces.
b.	Explain Polygon law of forces.
c.	Explain coulomb's law of friction.
d.	Define types of beam with neat sketch.
e.	State and explain parallel axis theorem.
f.	Differentiate between centroid and centre of gravity.
g.	Where does the position of centre of gravity of cone and hemisphere lie?
h.	What is the difference between stress and strain?
i.	Define coefficient of friction.
j.	Differentiate between shear force and bending moment.

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.

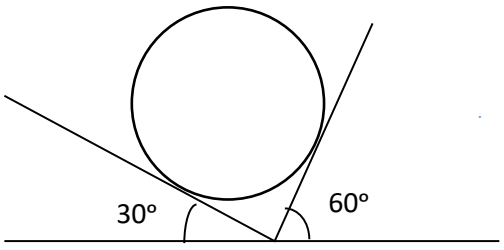
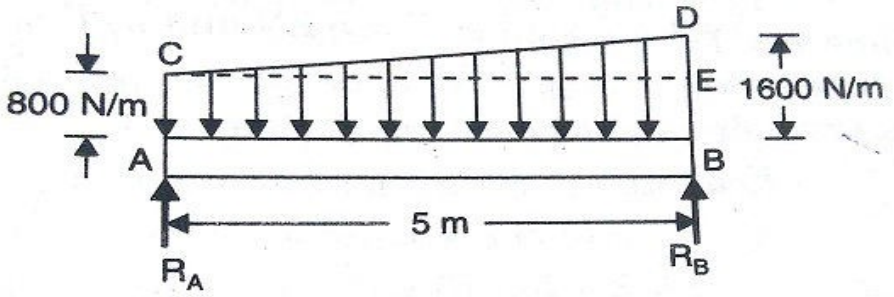


Fig.1

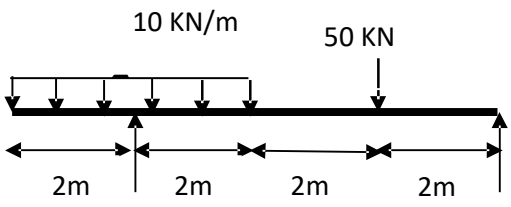
b.	A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m at one end to 1600 N/m at the other end as shown in figure 2. Calculate the reaction at both the ends.  **Fig. 2.**
c.	Define moment of inertia. State and prove parallel axis theorem.
d.	A particle moves along a staight 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

3. Attempt any *one* part of the following: 10x1=10

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.	Define friction and its types also describe limiting friction, coefficient of friction and angle of repose.

4. Attempt any *one* part of the following: 10x1=10

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

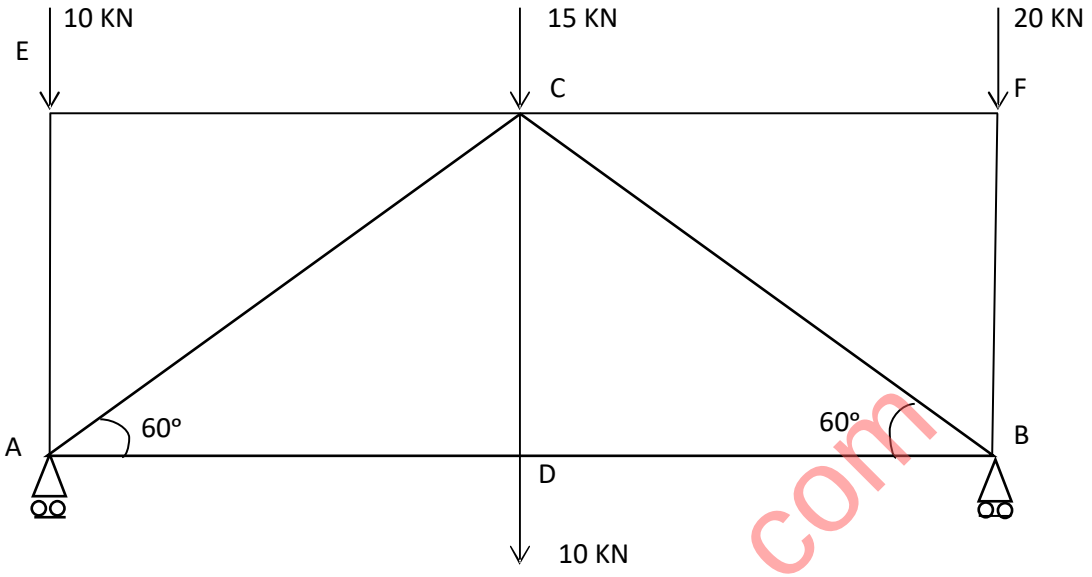


Fig.5

5. Attempt any *one* part of the following: 10x1=10

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

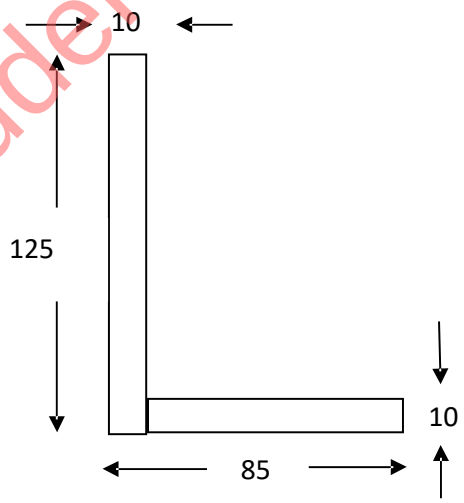


Fig.6

b.	Locate the coordinate X_c and Y_c of the center of a 100 mm diameter circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area as shown in **fig.7**.

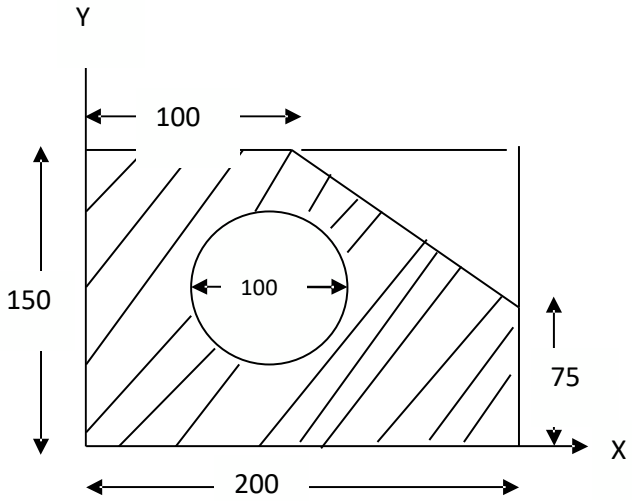


Fig.7

6. Attempt any *one* part of the following: 10x1=10

a.	State and prove work energy principle.
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: 10x1=10

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.