Printed Pages:04 **Sub Code: ME 201**

Paper Id: 140201 **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. List the characteristics of force. Give the necessary and sufficient conditions for equilibrium of 'non-concurrent' force system.
b. State and Derive Lami's theorem.
c. The resultant of two forces P & Q is at right angles to P. Find the angle between the forces.
d. State the laws of solid friction.
e. Define perfect truss and also list the assumptions made in the analysis of trusses.
f. State and prove the Perpendicular axis theorem of moment of inertia of plane figure.
g. Differentiate between centroid and centre of gravity.
h. Define D'Alembert's principle.
i. State the law of conservation of momentum.
j. A cricket ball of mass 175 gm is moving with a speed of 36 km/hr. What average force will be required to stop the ball in 0.2 second.

SECTION B

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

a. Two cylinder of diameters 100 mm and 50 mm, weighting 200 N and 50 N, respectively are placed in a trough as shown in **fig.1.** Neglecting friction, find the reactions at contact surfaces 1, 2, 3 and 4.

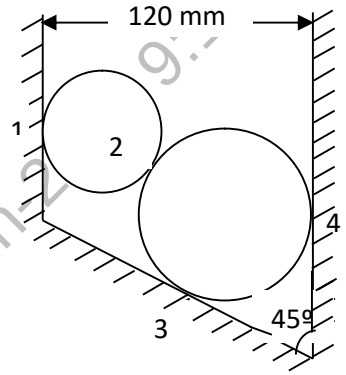

Fig.1

b. A 10 m long uniform ladder weighing 500 N is resting on a rough horizontal floor and inclined at an angle of 30° with the vertical wall. A man weighing 800 N climbs the ladder up to 4 m point, from the ground and along the ladder. The ladder is held in position by another man standing on the ground by applying a horizontal force P at a vertical height, 1.2 m from ground level. Find the force he must apply if coefficient of friction for all contact surfaces is 0.2.

c. 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.2**. Assume pulleys as frictionless and weightless.

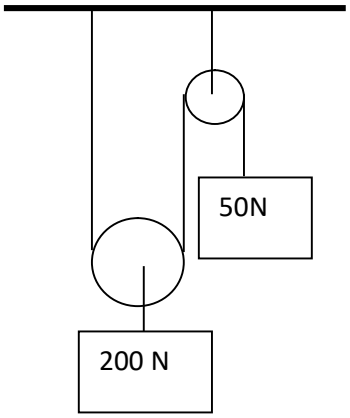

Fig.2

d. From the first principle, determine the moment of inertia of a triangle about its centroidal axis parallel to the base.

e. A block weighing 2500N rests on a level horizontal plane for which coefficient of friction is 0.20. This block is pulled by a force of 1000N acting at an angle of 30° to the horizontal. Find the velocity of block after it moves 30 m starting from rest. If the force of 1000 N is then removed, how much further will it move? Use work energy method.

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. Define force and moment of force? Four forces of magnitude 10 KN, 15 KN, 20 KN and 40 KN are acting at a point. The angle made by 10 KN, 15 KN, 20 KN and 40 KN with X-axis are 30º, 60º, 90º and 120º respectively. Find the magnitude and direction of the resultant force.

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.

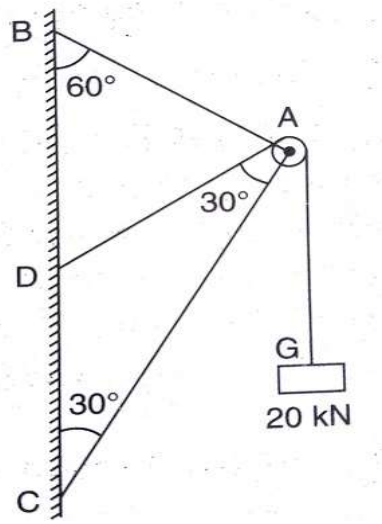

Fig.3

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

a. Determine the magnitude and nature of forces in the various members of the truss loaded and supported as shown in fig.4. Given AD=DB=2 m, CD=1.5 m.

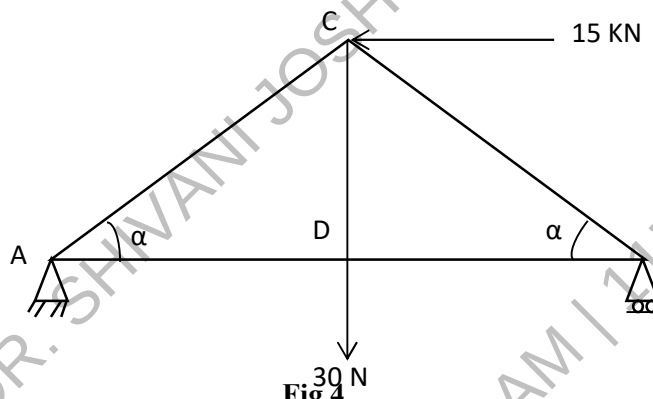

Fig.4

b. A beam 6 m long is loaded as shown in fig.5. It has two point loads of 5 KN and 4 KN and uniformly distributed load of 1.5 KN/m. Calculate the reactions at the support.

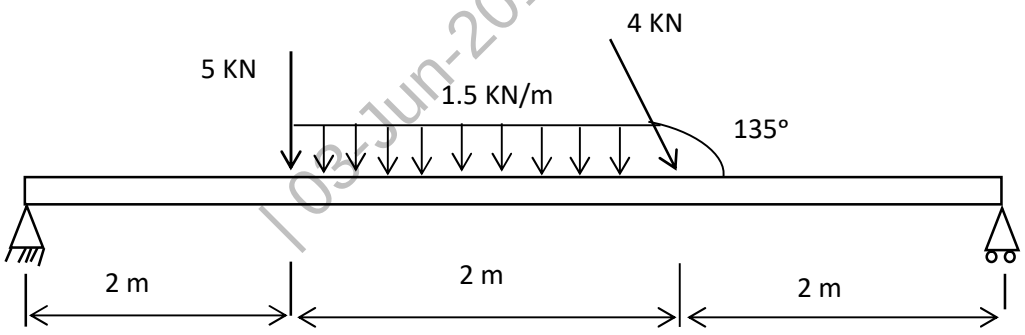

Fig. 5

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

a. Find the polar moment of inertia of I-section as shown in fig.6.

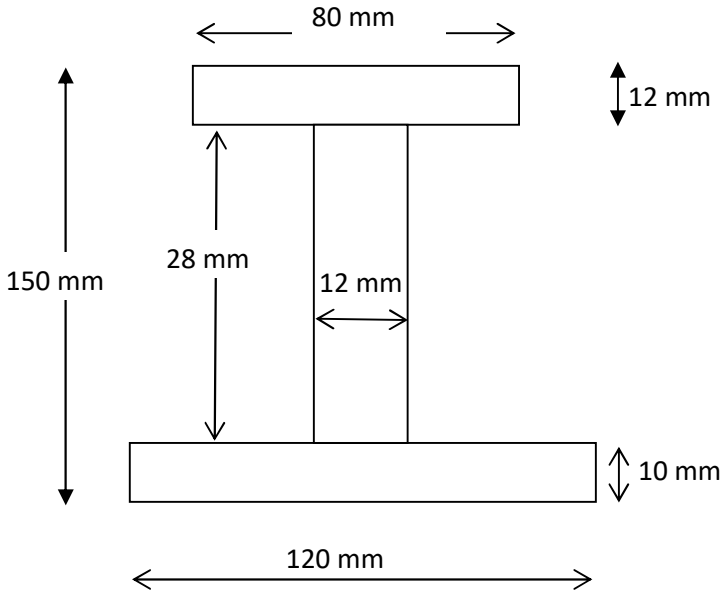

Fig.6

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

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

a. A wheel rotating about a fixed axis at 20 r.p.m. is uniformly accelerated for 70 second during which time it makes 50 revolutions. Find angular velocity at the end of this interval and time required for speed to reach 100 revolutions per minute.

b. A particle moves along a straight line with an acceleration described by the equation $a = -8s^{-2}$ where a is in m/s^2 and s in m. When t= 1 s, s = 4 m and v= 2 m/s. Determine the acceleration when t = 2s.

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

a. A body of weight 200 N is initially stationary on a 45° inclined plane. What distance along the inclined plane must the body slide, before it reaches a speed of 2 m/s? The coefficient of friction between the body and the plane is 0.1.

b. Write short notes on:
   (i) Principle of virtual work and its application
   (ii) Principle of conservation of momentum and its application.