B.E. PRINTING ENGINEERING FIRST YEAR FIRST SEMESTER – 2019
Subject: ENGINEERING MECHANICS

Time: 3 Hours **Full Marks: 100**

Different questions of same group are to be answered together.

Gr-A

Answer any **two (2)** from the following questions. *2 x 10 = 20Marks*

1. The 30-N force P is applied perpendicular to the portion BC of the bent bar. Determine the moment of P about point B and about point A. (Fig-1)
2. Determine the reaction forces at A, B and C as shown in Fig-2, where weight of each sphere W= 100N and all contact surfaces are smooth.
3. Prove that $l^2+m^2+n^2 = 1$, where l, m, n are direction cosines of Force vector F in xyz space.
4. State and prove Lami's theorem.

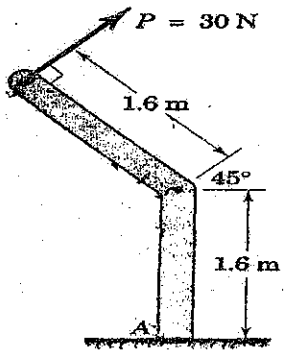

Fig-1

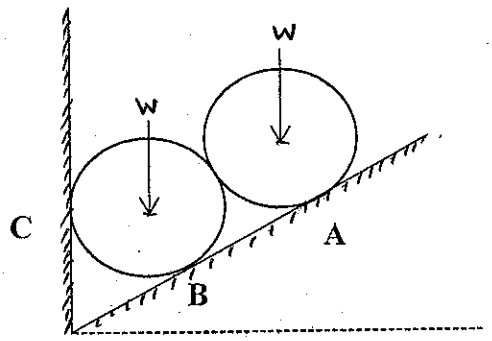

Fig-2

Gr-B

Answer any **two (2)** from the following questions. *2 x 15 = 30Marks*

1. Find the angle of tilt θ with the horizontal so that the contact force at B will be one -half that at A for the smooth cylinder (Fig-3)
2. The system of two blocks, cable and fixed pulley is initially at rest. Determine the horizontal force *P* necessary to cause motion when (a) P is applied to the 5-kg block and (b) P is applied to the 10-kg block. Determine the corresponding tension *T* in the cable for each case. (Fig-4)
3. Find minimum P to hold the system in equilibrium as shown in Fig-5. Given: coefficient of friction at floor, $\mu_f = 0.25$, at wall, $\mu_w = 0.30$ and between blocks, $\mu_b = 0.20$.

4. Find smallest W for the equilibrium of the system (Fig-6). Given that $\mu_A = 0.4$, $\Phi_B = 15°$

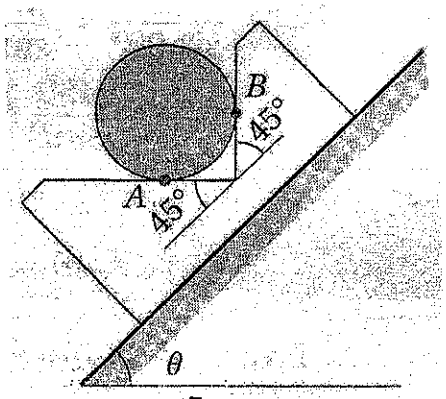

Fig-3

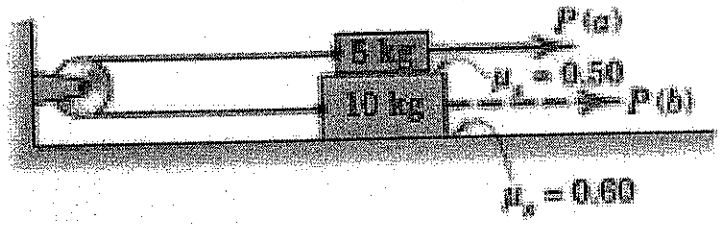

Fig-4

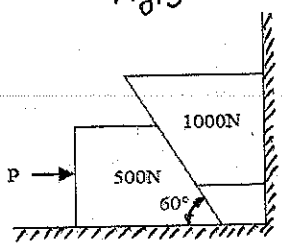

Fig.-5

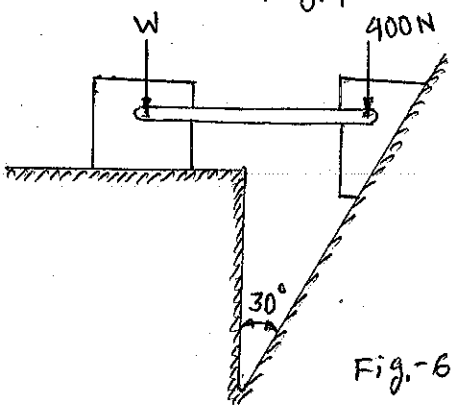

Fig.-6

Gr-C

Answer any **two (2)** from the following questions. *2 x 15 = 30Marks*

1. Determine the moment of inertia of the shaded area about the x-axis (Fig-7)
2. Find the centroid of the I-section as shown in Fig-8. .
3. Determine the coordinates of the centroid of the shaded area.(Fig-9)
4. Find the moment of inertia of a Semicircle about the Diameter.

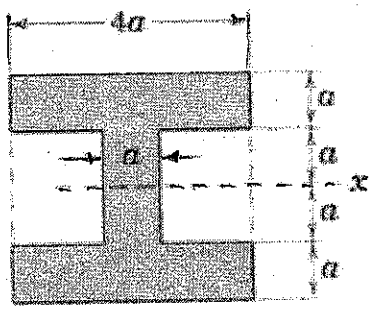

Fig.-7

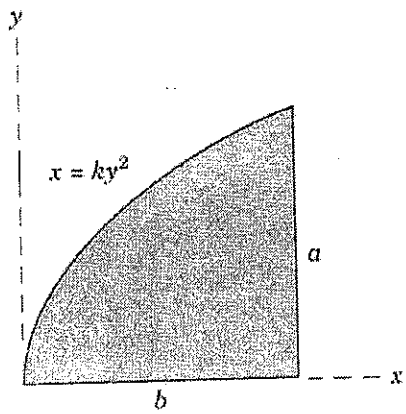

Fig.-9

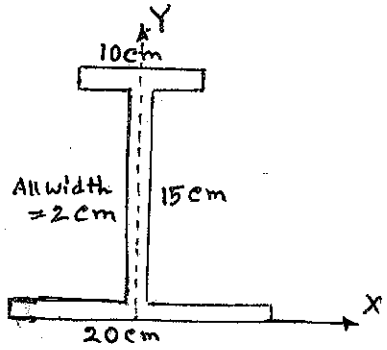

Fig.-8

P.T.O.

Gr-D

Answer any **two (2)** from the following questions. *2 x 10 = 20Marks*

1. a) A broadjumper approaches his takeoff board A with a horizontal velocity of 30 ft/sec. Determine the vertical component v_y of the velocity of his center of gravity at takeoff for him to make the jump shown. What is the vertical rise h of his centre of gravity. (Fig-10)
2. Derive the equation of trajectory for inclined projectile motion on level ground with assumptions and also find the time of flight of the projectile
3. A bullet is fired from a height of 120 m at a velocity of 360 kmph at an angle of 30° upwards. Neglecting air resistance, find (a) total time of flight, (b) horizontal range of the bullet (c) Maximum height reached by the bullet and (d) Final velocity if the bullet just before touching the ground.
4. A block weighing 2500 N rests on a level horizontal plane for which coefficient of friction is 0.20. This block is pulled by a force of 1000 N acting at an angle of 30° to the horizontal. Find the velocity of the block after it moves 30 m starting from rest. If the force of 1000N is then removed, how much further will it move? Use work energy method.

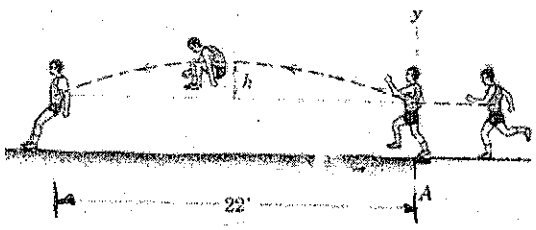

Fig.-10