Code No: A10301 **MLR15**

MLR INSTITUTE OF TECHNOLOGY

(Autonomous Institute)

I B.Tech I Sem Supplementary/Improvement Examinations, February-2016

ENGINEERING MECHANICS-I

(MECHANICAL)

Note: 1. This question paper contains two parts A and B.

2. Part A is compulsory which carries 25 marks. Answer all Questions in part A.

3. Part B consists of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **[25 Marks]**

1. a) State the properties of a couple. [2M]
   b) State the converse of the law of polygon of forces. [2M]
   c) State the Pappu's - Guldinu's theorems. [2M]
   d) State parallel axis theorem. [2M]
   e) State the laws of dry friction. [2M]

2. a) State and prove law of parallelogram of forces. [3M]
   b) A force of magnitude 200 N is acting along the line joining P (2, 4, 6) m and Q (4, 7, 10) m. Find of the moment of the force about R (7, 10, 15) m. [3M]
   c) Determine the centroid of a rectangle of base 'b' and depth'd' from basic principle. [3M]
   d) Determine the area moment of inertia of a right triangle of base 'b' and height 'h' from basic principle. [3M]
   e) Determine the frictional force developed on the block shown in figure 1 below. Take coefficient friction between block and floor is 0.3, weight of the block W = 100 N and applied force P = 40 N. [3M]

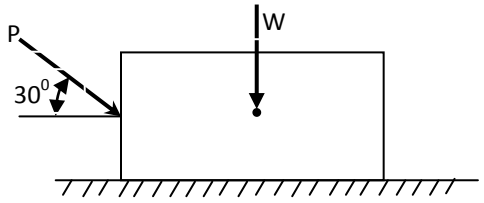

Figure 1

PART-B **[50 marks]**

3. Replace the system of forces and couple shown in figure 2 by a single force and a couple system at A. [10M]

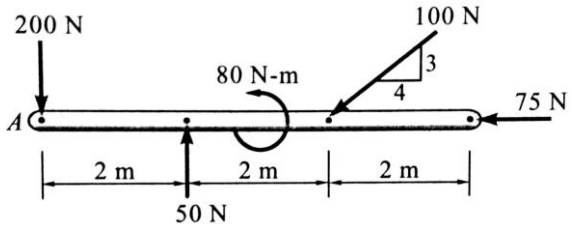

Figure 2

OR

4. A triangular plate ABC is subjected to four coplanar forces as shown in figure 3 below. Find the resultant completely and locate its position with respect to A. [10M]

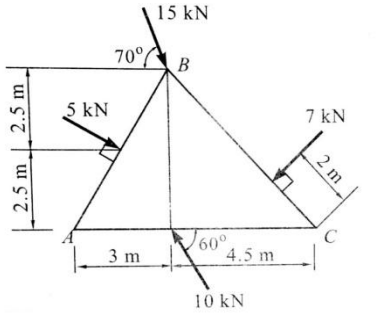

Figure 3

5. Three identical tubes of weights 8kN each are placed as shown in figure 4 below. Determine the forces exerted by the tubes on the smooth walls and floor. [10M]

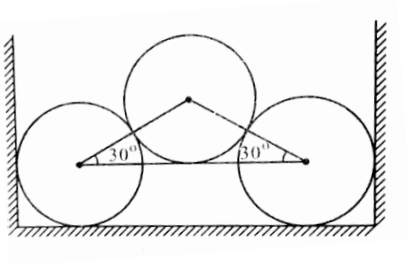

Figure-4

OR

6. Three identical spheres P, Q, R of weight W are arranged on smooth inclined surfaces as shown in figure 5 below. Determine the angle α, which will prevent the arrangement from collapsing. [10M]

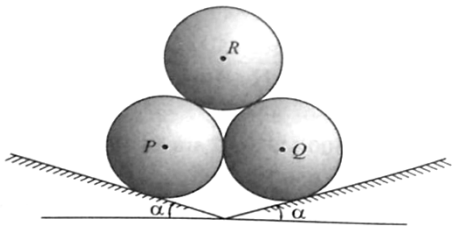

Figure 5

7. a) Determine the coordinates of the centroid of the shaded area shown in figure 6 below. [5M]

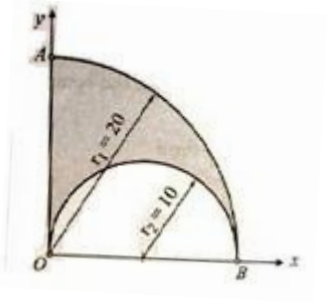

Figure 6

b) State and prove Pappu's and Guldinu's theorems. [5M]

OR

8. a) Determine the centroid of the I-section shown in figure 7 below. [5M]
All dimensions are in 'cm'

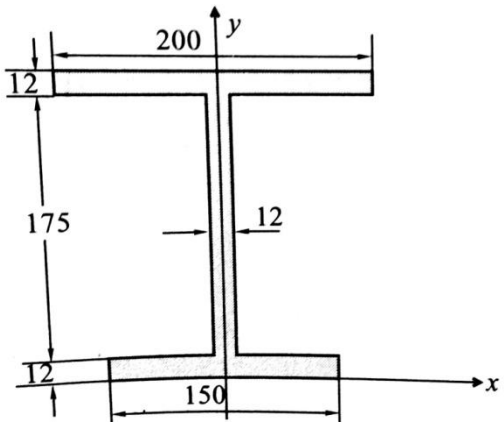

Figure-7

b) Deduce the expression from the basic principle to determine the centre of gravity of a hemisphere of radius R about its base. [5M]

9. Determine the area moment of inertia of a section shown in figure 8 about [10M]
   i) x-axis
   ii) y-axis
   iii) Parallel centroidal x-axis
   iv) Parallel centroidal y-axis
   All dimensions are in 'cm'

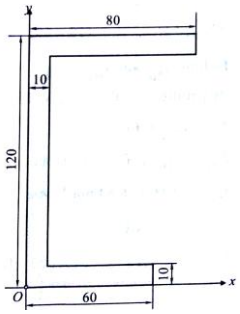

Figure-8

OR

10. Determine the mass moment of inertia of right circular cone of length 'L', base radius 'R' and mass 'M' about z-axis and y-axis. [10M]

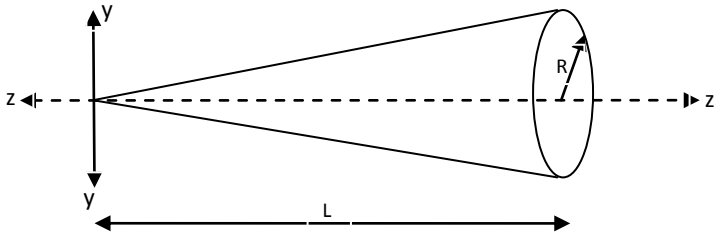

Figure-9

11. Two blocks W_1 and W_2 resting on two inclined planes are connected by a horizontal bar AB as shown in figure 10. If W_1equals 1000 N, determine the maximum value of W_2 for which the equilibrium can exist. The angle of limiting friction is 20^0 at all rubbing faces. [10M]

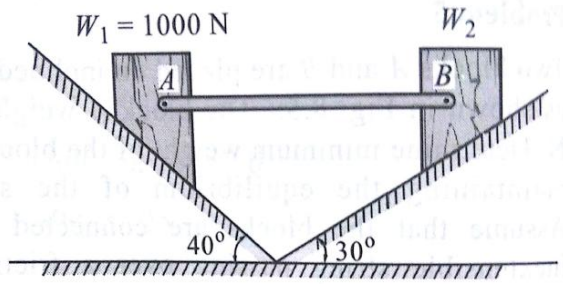

Figure-10

OR

12. A uniform ladder weighing 100 N and 5 meters long has lower end B resting on the ground and upper end A resting against a wall as shown in figure 11. The inclination of the ladder with horizontal is 60^0. If the coefficient of friction at all surfaces of contact is 0.25, determine how much distance up along the ladder a man weighing 600 N can ascent without causing to slip. [10M]

Figure 11

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