Roll No. | | | | | | | | | | |

B.E./B.Tech. (Full Time) Degree End Semester Examinations, April/May 2013

Common to

Mechanical/civil/Production/Aeronautical/Industrial/Manufacturing/Automobile/Rubber and Plastics/Agricultural and Irrigation/geo Informatics/Electrical and Electronics/Material Science/Mining/Printing/ceramic/Chemical/Food/Industrial Biotechnology/Leather/Textile / Apparel

Second Semester

GE 8251 ENGINEERING MECHANICS
(Regulation 2012)

Time: 3 Hours | Answer ALL questions | Max. marks: 100

PART-A (10 x 2 = 20 marks)

1. State Lami's theorem.

2. The cable exerts a force, F = 100 N as shown in Figure 1. Find the components of force along X, Y and Z directions.

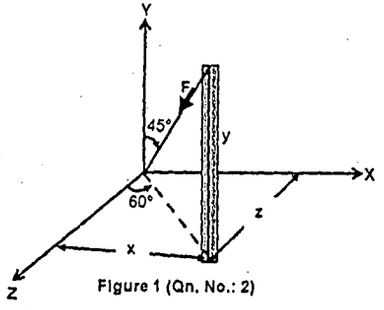

Figure 1 (Qn. No.: 2)

3. The weighted cylinders in Figure 2 are smooth. Draw free body diagrams of cylinders A and B separately.

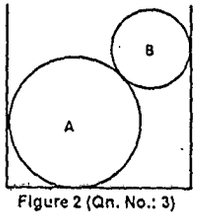

Figure 2 (Qn. No.: 3)

4. Find the moment of forces about point O shown in Figure 3. It is enough to use scalar approach to find the moment.

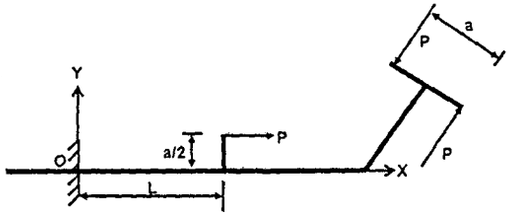

Figure 3 (Qn. No.: 4)

5. Calculate the surface area formed by the given inclined line shown in Figure 4 using Pappus and Guldinus theorem. Note: Given inclined line is revolved by 2π about X axis.

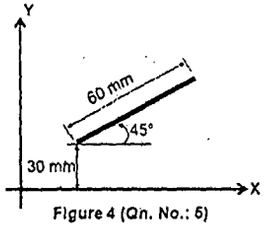

Figure 4 (Qn. No.: 5)

6. Calculate the second mass moment of inertia about X- axis. Second mass moment of inertia about Centroidal axis X_c is 200 kgcm^2 and mass of the given component shown in Figure 5 is 15 kg.

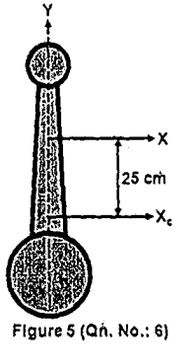

Figure 5 (Qn. No.: 6)

7. Acceleration of a Particle is defined by $-k/x^2$. The Particle starts with no initial velocity at X = 800 mm. It is observed that velocity is 6 m/s at X = 500 mm. Find the value of 'k'.

8. Define coefficient of restitution and D' Alembert's principle.

9. Whether the body shown in Figure 6 slide or not. Give suitable reason. Static coefficient of friction between surfaces is assumed to be $1/\sqrt{3}$.

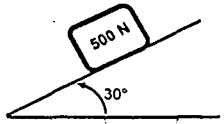

Figure 6 (Qn. No.: 9)

10. Draw free body diagrams of Wedges shown in Figure 7. Static Coefficient of friction between all surfaces of contact is 0.1.

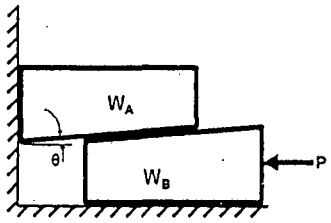

Figure 7 (Qn. No.: 10)

PART B (5 x 16 = 80)

11. (i) If the wall is smooth, calculate the minimum coefficient of static friction, μ_s, between the ladder and the floor such that the ladder is in equilibrium with self weight (W) of 10 kg and length of 2 m. (Figure 8) **[6]**

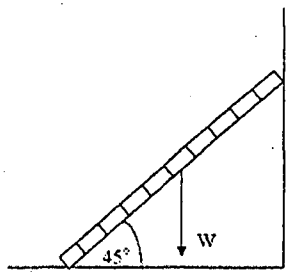

Figure 8 (Qn. No.: 11 (i))

(ii) Find the range of force P for which equilibrium of given system (refer Fig.9) is maintained. The coefficient of friction between incline and body is 0.15. There is no friction between pulley and rope. **[10]**

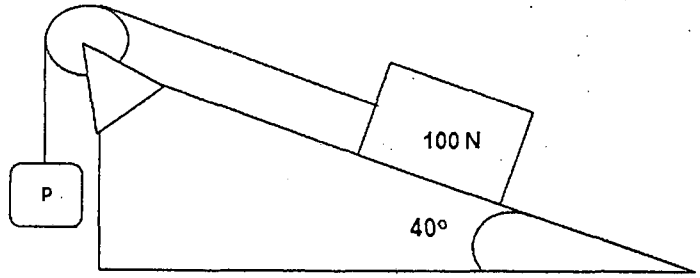

Figure 9 (Qn. No.: 11 (ii))

12. (A) Three ropes are anchored in ground to prevent the upward lift of balloon. Determine tension in ropes AB, AC and AD when the upward thrust of Balloon is 50 N.(all dimensions are in mm, figure 10) **[16]**

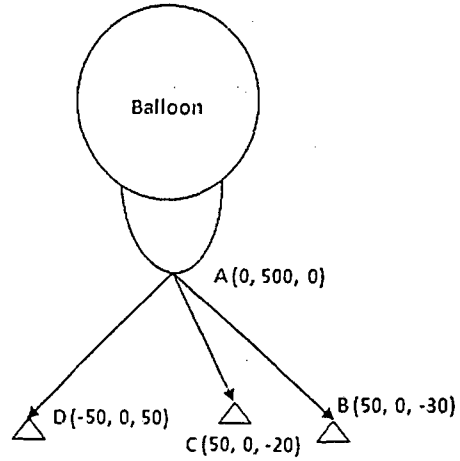

Figure 10 (Qn. No.: 12.A)

(OR)

12. (B) (i) Calculate the force developed at cable AC.(figure 11) [4]

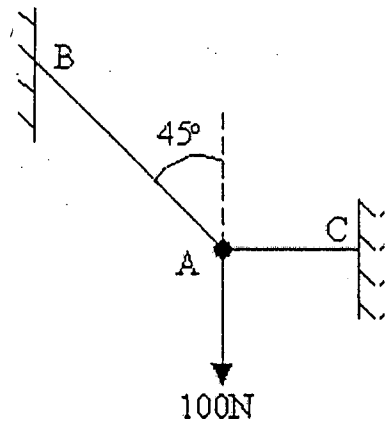

Figure 11 (Qn. No.: 12.B (i))

(ii) Find Tension in Cable CA and CB. The distances of OA, OB and OC are 20cm, 50cm, and 50cm respectively. The weight of W is 50N. (Refer Fig 12). [12]

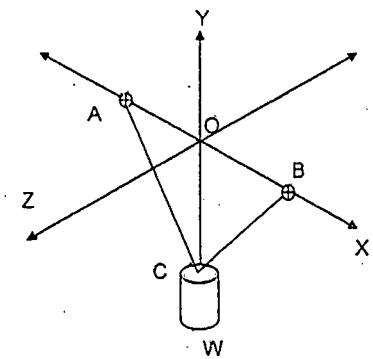

Figure 12 (Qn. No.: 12.B (II))

5

13. (A) (i) A beam AB (Figure 13) is hinged at the end A and roller supported at the end B. Determine the reaction forces at A and B supports. [8]

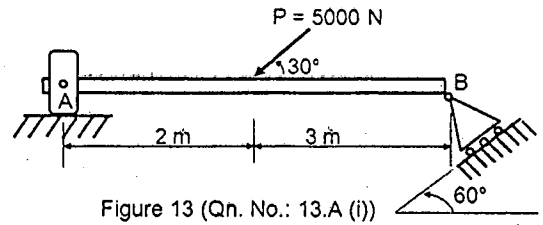

Figure 13 (Qn. No.: 13.A (i))

(ii) For the regular Pentagon ABCDE shown in Figure 14, find the moment about points A and B. Note: Forces P and Q are aligned to the corresponding edges. [8]

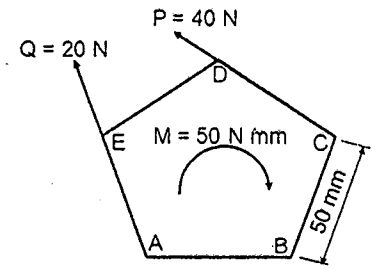

Figure 14 (Qn. No.: 13.A (ii))

(OR)

13. (B) Find the tension in the cables AC and BC and the reactions at the ball and socket joint at point O (Refer Figure 15). [16]

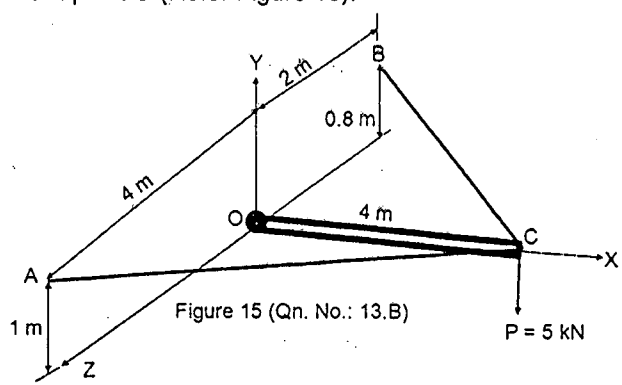

Figure 15 (Qn. No.: 13.B)

6

14. (A) Determine the area moment of inertia about vertical centroidal axis of the shaded region shown in Figure 16. [16]

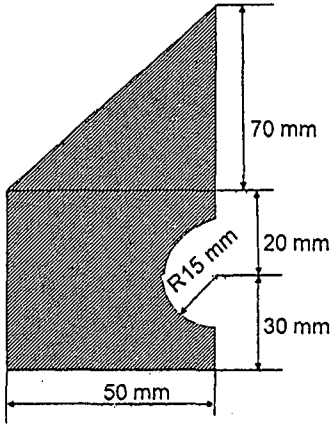

Figure 16 (Qn. No.: 14. A)

(OR)

14. (B) (i) Derive mass moment of inertia about the axis of the right circular cone where density, height and base radius of the cone are ρ, h and R respectively. [8]

(ii) Find centroid of mass and volume of given configuration as shown in Figure 17.The density of Aluminum and steel are 2700 kg/m^3 and 7800 kg/m^3 respectively. [8]

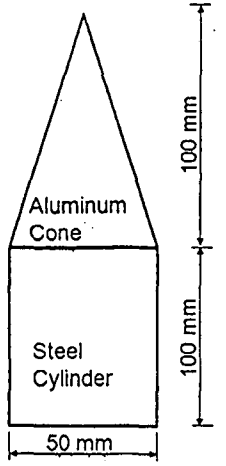

Figure 17 (Qn. No.: 14. B)

15. (A) (i) A projectile is fired from a hill top at an angle of 45° with the horizontal with an initial velocity of 60 m/s. The hill top is 90 m above the neighbouring ground level. Find the highest point above the ground level reached by the projectile. Also find the horizontal distance between the point of firing and the projectile meets the ground. Neglect air resistance. [10]

(ii) A bus is moving along a curved road of radius 600 m at a speed of 40 km/hr. The driver applied the brake suddenly and reduced the speed to 10 km/hr at a constant rate in 5 seconds. Find the tangential and normal components of the acceleration immediately after the application of brake also find the magnitude and direction of the acceleration immediately after the application of brake. [6]

(OR)

15. (B) A block and pulley system is shown Figure 18. The coefficient of kinetic friction between block and plane is 0.2. the pulley is friction less. Find the acceleration of the blocks and the tension in the string when the system just released from rest. Also find the time required for the 50 kg block to come down by 3 m. [16]

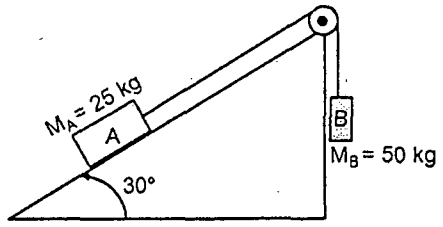

Figure 18 (Qn. No.: 15. B)