31/10/13

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B.E./B.Tech (Full Time) END SEMESTER EXAMINATIONS, NOV / DEC 2013

SECOND SEMESTER – (REGULATIONS: 2004/ 2008)

COMMON TO ALL BRANCHES

GE 181 / GE 9151 ENGINEERING MECHANICS

Time: 3hrs **Max. Marks: 100**

Answer All Questions

PART-A (10 x 2 = 20 Marks)

1 What are the equations of equilibrium for a rigid body acted upon by a system of forces?

2 What is meant by angle of friction? What is its relation to friction coefficient and angle of repose?

3 Determine whether the systems of forces shown in Fig.3 are in equilibrium?

4 State and explain Varignon's theorem?

5 Locate the centroid of the lamina shown in the Fig.5.

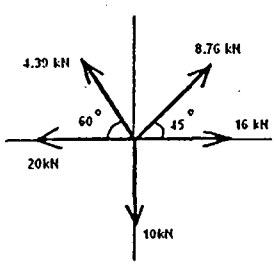

Fig.3

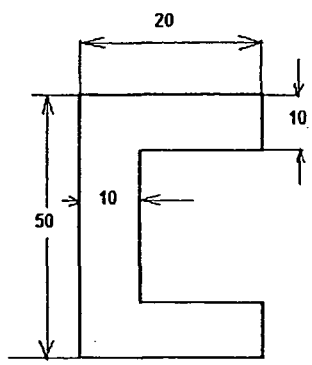

Fig.5

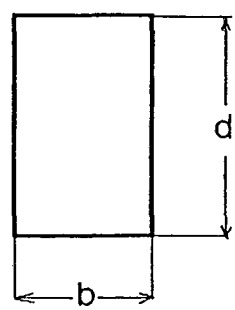

Fig.6

6 State parallel axes theorem and use it to determine the moment of inertia of the rectangle shown in Fig.6 about its bottom edge.

7 A man weighing 750N is travelling in a lift with an acceleration of $2m/s^2$. What is the force exerted by the man on the floor when moving (i) upwards (ii) downwards.

8 An aircraft of mass 10000kg is flying at a velocity of 300 km/ph at a height of 3000m above ground level. Calculate the total energy possessed by the aircraft.

9 Explain clearly what is coefficient of restitution.

10 With a neat sketch explain what is centre of percussion.

PART-B (5 x 16 = 80 Marks)

11. i) Two cylinders of diameters 60mm and 30mm and weighing 160N and 40N respectively are placed as shown in Fig.11.a. Assuming all the contact surfaces to be smooth, find the reactions at A,B and C.

ii) The three cables are secured to a ring at B and the turn buckle at C as shown in Fig 11.b. is tightened until it supports a tension of 1.6 kN. Calculate the moment M, produced by the tension in cable AB about the base of the mast at D.

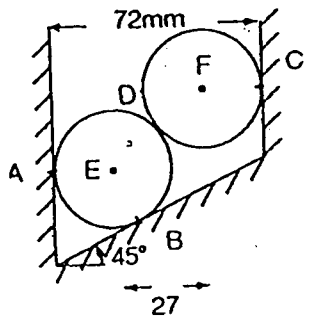

Fig.11.a

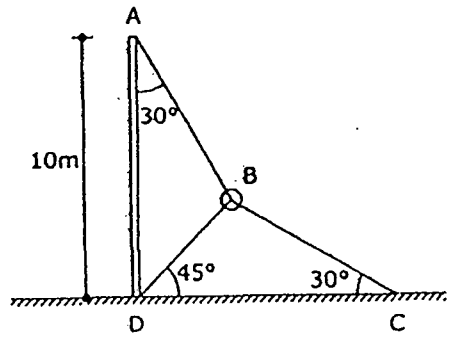

Fig.11.b

12.a A tripod supports a load of 2kN as shown in Fig.12.a. The ends P,Q and R are in the x-z plane. Find the force in the three legs of the tripod.

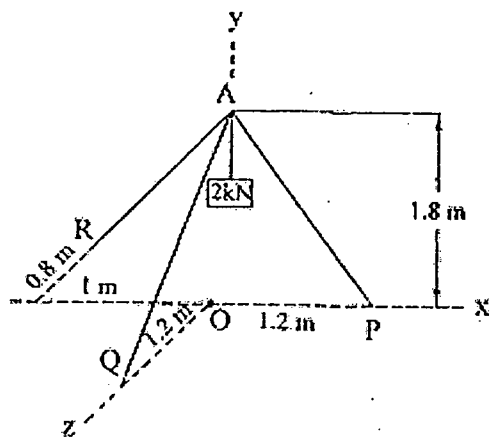

Fig 12.a

OR

12.b Determine the resultant of the three forces acting on the dam shown in Fig.12.b and locate its intersection with the base AB. For a good design, this intersection should occur within the middle third of the base. Comment whether it is a good design or not.

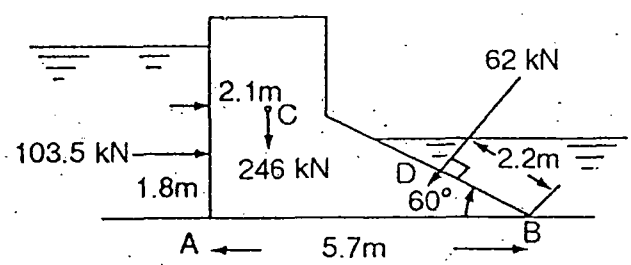

Fig.12.b

13.a i) Find the Moment of Inertia of the channel section about the axis YY passing through the centroid C as shown in Fig.13.a.i. All the dimensions are in cm.

ii) Find the location of the principal axes and determine the maximum and minimum values of moments of inertia of the rectangular plate about the point P shown in Fig.13.a.ii

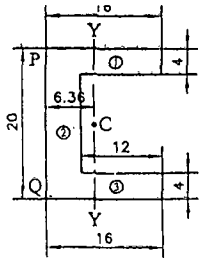

Fig 13.a.i

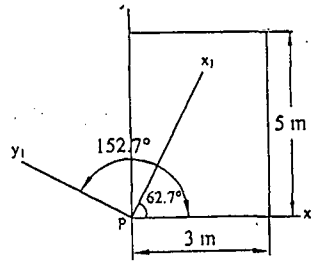

Fig 13.a.ii

OR

13.b Find the position of the Centre of gravity of a plane area shown in Fig.13.b

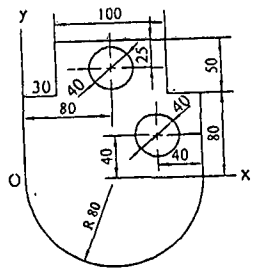

Fig.13.b

14.a i) A bullet is projected in such a way that it just grazes the tops of two buildings each of height 15m situated at 25m and 140m from the projection point on the same line as shown in Fig.14.a.i. Find the angle and velocity of projection of the bullet.

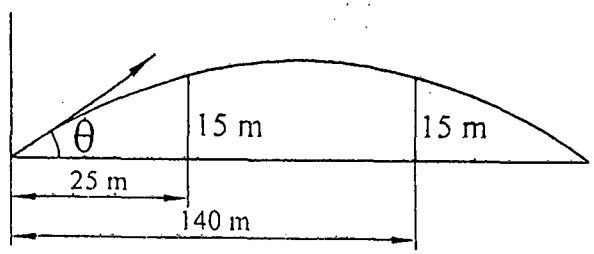

Fig.14.a.i

ii) A car of mass 1200kg negotiates a curve of radius 400m at a constant speed of 45km/h. What must be the force of the tyres on the road so that the motion along the curve is maintained? Assume that there is no banking of the curve.

OR

14.b i) A body of mass 25kg resting on a horizontal table is connected by a string passing over a smooth pulley at the edge of the table to another body of mass 3.75kg and hanging vertically as shown in Fig.14.b. Initially, the friction between 25kg mass and the table is just sufficient to prevent the motion. If an additional 1.25kg is added to the 3.75kg mass, find the acceleration of the masses.

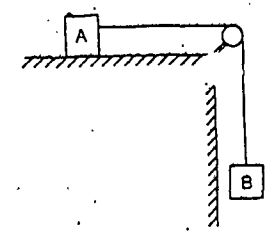

Fig.14.b.i

ii) A car of mass 1500kg is driven down an inclined road at a speed of 60 km/h as shown in Fig.14.b.ii. A force of 5kN is applied to bring the car to a standing halt. Calculate the distance travelled by the car from the instant the force is applied, to the instant the car comes to rest.

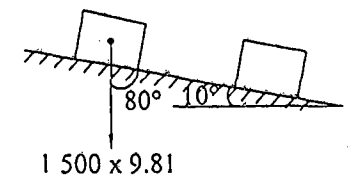

Fig 14.b.ii

15.a i) A bullet of mass 40g fired at a velocity of 500m/s hits a block of mass 5kg travelling with a velocity of 15m/s on a smooth horizontal plane as shown in Fig.15.a.i and gets embedded in it. Find the velocity of the combined unit of block and bullet after impact.

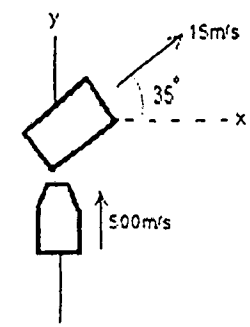

Fig. 15.a.i

ii) A ball is dropped from a height of 10 m above a rigid horizontal concrete floor. The ball strikes the floor and rebounds to a height of 6.5m. Find the coefficient of restitution between the ball and the concrete floor.

OR

15.b i) Two blocks of weight 1 kN and 2kN are kept on a horizontal plane as shown in Fig.15.b.i. The coefficient of friction between the blocks is 0.25 and that between 2kN block and the plane is 0.3. Find the minimum force A required to just move the 2kN block when (a) the cable is tied to the 1 kN block tightly (b) the cable is removed.

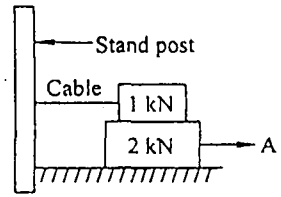

Fig.15.b.i

ii) A small pulley of radius 100mm is connected to the shaft of an electric motor. A belt connects this pulley with a bigger pulley of radius 300mm. Contact angle between the bigger pulley and the belt is 230°. The maximum permissible tension in the belt is 2000N. The coefficient of friction μ_s between the belt and both pulleys is 0.25. Find the torque exerted by the belt on the bigger pulley. Also check that μ_s utilised in the case of bigger pulley at the time of slipping in the smaller pulley is less than 0.25.

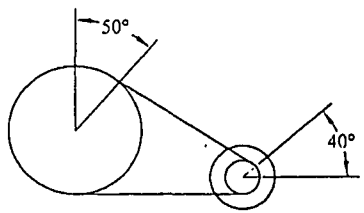

Fig.15.b.ii

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