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14CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2018
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
at least ONE question from each part.

Module-1

1 a. Explain the role of civil engineer in the infrastructural development of a country. **(10 Marks)**

b. Determine the components of the force F = 1500N along A – A and B – B axes. Refer Fig.Q1(b). **(05 Marks)**
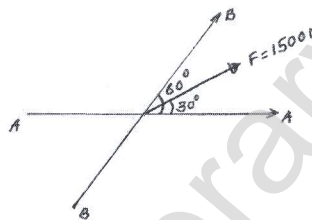

Fig.Q1(b)

c. Replace the horizontal 600N force acting on the lever as shown on Fig.Q1(c) by an equivalent force-couple system to act at 0. **(05 Marks)**
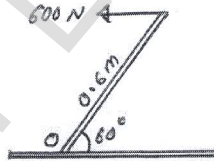

Fig.Q1(c)

2 a. Discuss classification of roads based on material of construction and based on Nagpur road plan. **(10 Marks)**

b. A square ABCD has forces acting along its sides as shown in Fig.2(b). Find the values of P and Q, if the system reduces to a couple. Also find the magnitude of the couple if the side of the square is 2m. **(05 Marks)**
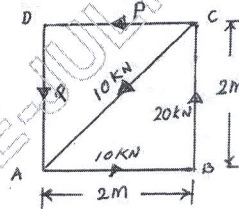

Fig.Q2(b)

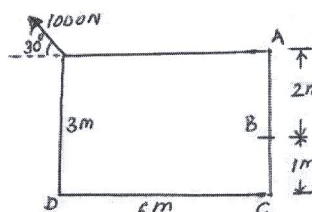c. Find the moment of 1000N force about points A, B, C and D as shown in Fig.Q2(c). **(05 Marks)**

Fig.Q2(c)

Module-2

3 a. Define the following :
   i) Resultant
   ii) Law of parallelogram of forces
   iii) Principle of resolved parts
   iv) Composition of forces
   v) Coplanar concurrent system.   (10 Marks)

   b. Determine the magnitude, direction and position of the resultant along AB for the given system of forces shown in Fig.Q3(b).   (10 Marks)
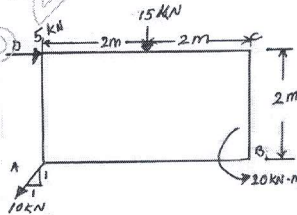

Fig.Q3(b)

4 a. State and prove Varignon's principle of moment.   (08 Marks)

   b. Two cables which have known tensions are attached to the top of pylon AB as shown in Fig.Q4(b). A third cable AC is used as a guy wire. Determine the tension in AC knowing that the resultant of the forces exerted at A by the three cables must be vertical.   (06 Marks)
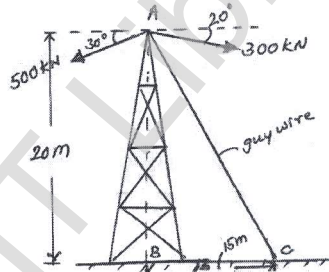

Fig. Q4(b)

   c. Two forces of magnitude P and Q act at a point on a body. When the angle between the forces is 90°, their resultant is $\sqrt{1000}$N. When the angle between forces is 60°, their resultant is $\sqrt{1300}$N. Determine the value of P and Q.   (06 Marks)

Module-3

5 a. Two smooth spheres each of radius 100mm and weight 200N rests in a channel as shown in Fig.Q5(a), Determine the normal reactions at points A, B and C on the channel.   (10 Marks)
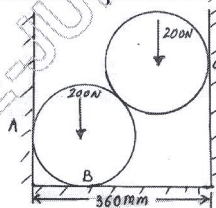

Fig.Q5(a)

   b. A beam ABCDEF is hinged at A, supported on rollers at E and carries loads as shown in Fig.Q5(b). Determine the reactions at the supports.   (10 Marks)
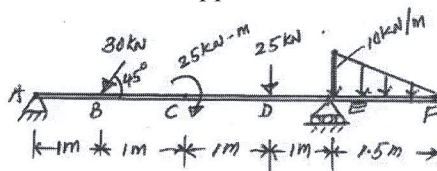

Fig.Q5(b)

6 a. State Columb's laws of dry friction. **(04 Marks)**

b. A block of weight 2000N is resting on an inclined plane which is inclined to horizontal at an angle of 45°. The block is connected by means of a string which passes over a frictionless pulley and to which an effort P is hung freely. Determine the minimum and maximum values of P for which the system is in equilibrium. The co-efficient of friction between the surfaces of contact is 0.25. Refer Fig.Q6(b). **(08 Marks)**
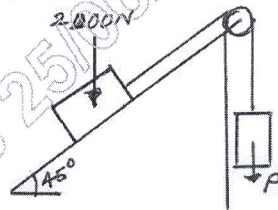

Fig.Q6(b)

c. A uniform beam AB hinged at A, is kept horizontal by supporting and settling a 400N weight with the help of a string tied at B and passing over smooth pulley at C. The bar weighs 200N. Determine the reactions at the support A and tension in the string. Refer Fig.Q6(c). **(08 Marks)**
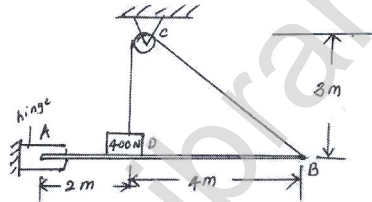

Fig.6Q(c)

Module-4

7 a. State and prove parallel axis theorem. **(08 Marks)**

b. Determine the Centriod of the concrete dam shown in Fig.Q7(b) with reference to given x and y axis. **(12 Marks)**
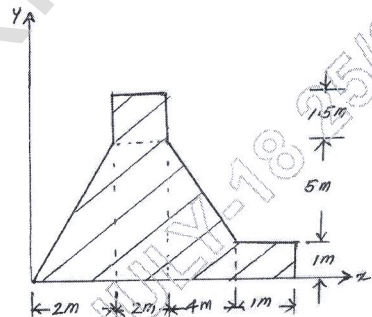

Fig.Q7(b)

8 a. From first principles, determine the centriod of a semicircular area. **(08 Marks)**

b. Find the moment of inertia of the section shown in Fig.Q8(b) about the centriodal x-x axis and y-y axis. **(12 Marks)**
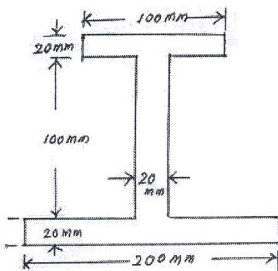

Fig.Q8(b)

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Module-5

9 a. What is a projectile? Define the following terms briefly with general equations where-ever possible i) Angle of projection ii) Time of flight iii) Horizontal range iv) maximum height attained by the projectile. **(10 Marks)**

b. A bullet moving at the rate of 300m/sec is fired into a thick wood penetrates up to 500mm. If it is fired into a 250mm thick target, find the velocity of emergence. Take the resistance to be uniform in both the cases. **(10 Marks)**

10 a. A particle, starting form rest, moves in a straight line, whose equation of motion is given by $S = 5t^3 - 3t^2 + 6$. Find the displacement, velocity and acceleration of the particle after 5 seconds. S is in meters. **(04 Marks)**

b. A particle is projected in air with a velocity of 120 m/sec at an angle of 30° with the horizontal. Determine : i) the horizontal range ii) maximum height reached by the particle and iii) the time of flight. **(08 Marks)**

c. A stone is dropped from the top of a building 100m high. At the same time another stone is thrown upwards from the foot of the building with a velocity of 50m/sec. When and where the two stones cross each other? **(08 Marks)**

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