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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 $F = 1500\text{N}$ along A – A and B – B axes. Refer Fig.Q1(b). (05 Marks)

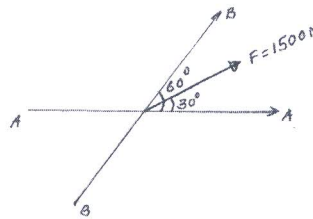


Fig.Q1(b)

- 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 O. (05 Marks)

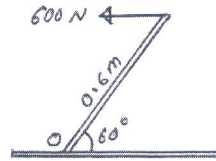


Fig.Q1(c)

- 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)

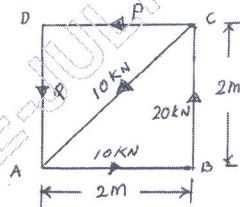


Fig.Q2(b)

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

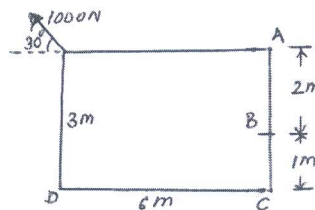


Fig.Q2(c)

Module-2

- 3 a. Define the following :
- Resultant
 - Law of parallelogram of forces
 - Principle of resolved parts
 - Composition of forces
 - 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)

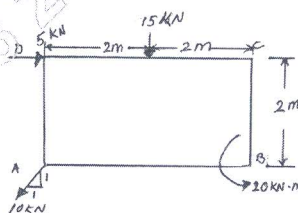


Fig.Q3(b)

- 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)

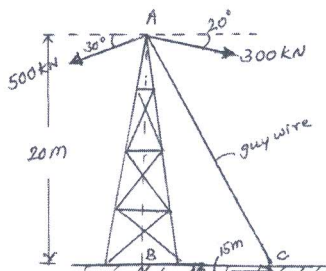


Fig. Q4(b)

- 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 $\sqrt{1000}\text{N}$. When the angle between forces is 60° , their resultant is $\sqrt{1300}\text{N}$. 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)

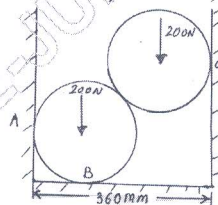


Fig.Q5(a)

- 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)

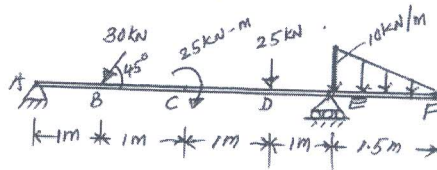


Fig.Q5(b)

- 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)

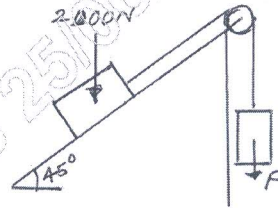


Fig.Q6(b)

- 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)

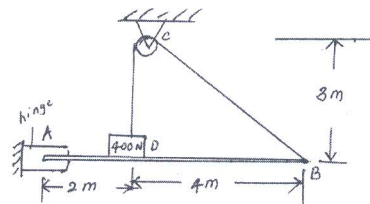


Fig.6Q(c)

Module-4

- 7 a. State and prove parallel axis theorem. (08 Marks)
 b. Determine the Centroid of the concrete dam shown in Fig.Q7(b) with reference to given x and y axis. (12 Marks)

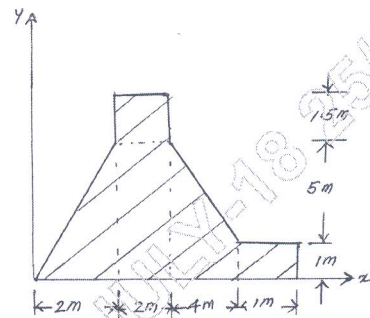


Fig.Q7(b)

- 8 a. From first principles, determine the centroid of a semicircular area. (08 Marks)
 b. Find the moment of inertia of the section shown in Fig.Q8(b) about the centroidal x-x axis and y-y axis. (12 Marks)

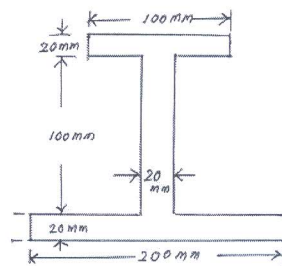


Fig.Q8(b)

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 from 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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