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15CIV13/23

First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Elements of Civil Engineering and Mechanics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- Name any five fields of civil engineering and explain any one in detail. (08 Marks)
 - Find the magnitude of force 'F' such that a single equivalent replacing force can pass through point B. Also determine that equivalent force and couple at B. [Refer Fig.Q1(b)].

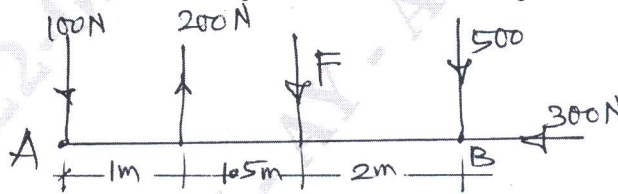


Fig.Q1(b)

(08 Marks)

OR

- List various types of bridges and explain any one in detail with a neat sketch. (06 Marks)
 - Explain what is lateral force and also explain its distribution on surface. (04 Marks)
 - Explain with example that the moment of a force about a point depends not only on the magnitude of the force but also on the location of point with respect to force. (06 Marks)

Module-2

- Find the resultant of two forces acting along AC and AD as shown in Fig.Q3(a). ABCDE is a singular pentagon of side 3m.

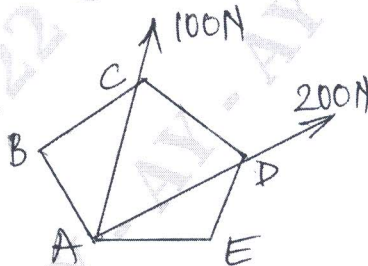


Fig.Q3(a)

(06 Marks)

- Distinguish between angle of repose and angle of friction. (04 Marks)
- Find the maximum force 'P' as shown in Fig.Q3(c) such that the block will not move. Weight of the block is 500 N. The force 'P' is parallel to the incline acting up the plane. Angle of inclination is 30° with horizontal. Take $\mu = 0.3$.

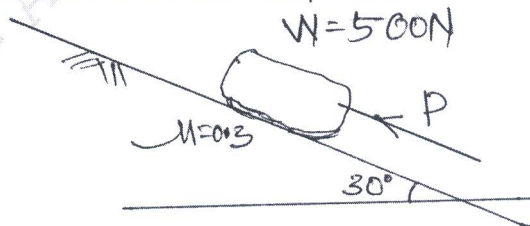


Fig.Q3(c)

(06 Marks)

OR

- 4 a. State conditions in which Lami's theorem is applicable. (04 Marks)
 b. Find the minimum force 'P' required to pull the two blocks kept one above the other on horizontal rough surface with $\mu = 0.1$. Take coefficient of friction between the blocks $\mu = 0.3$. [Refer Fig.Q4(b)]

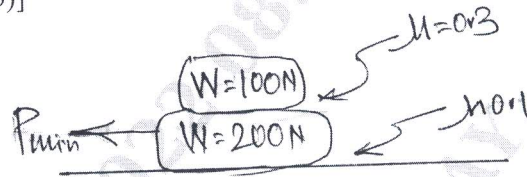


Fig.Q4(b)

(04 Marks)

- c. Find the minimum force 'P' required to be applied horizontally as shown in Fig.Q4(c). Such that the rope AB becomes loose enough without any tension in it.

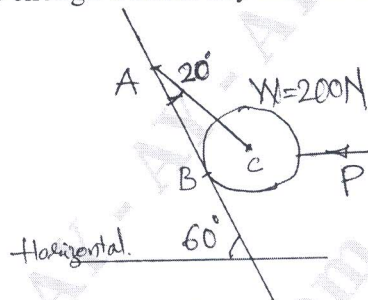


Fig.Q4(c)

(08 Marks)

Module-3

- 5 a. ABCD is a rectangle with forces acting as shown in Fig.Q5(a). Find the resultant effect of the forces on the object.

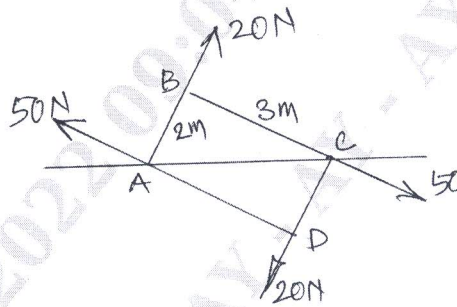


Fig.Q5(a)

(04 Marks)

- b. State and explain Varignon's theorem. (04 Marks)
 c. Beam AB is supported and acted upon by the forces as shown in Fig.Q5(c). Find intensity of uniformly distributed load such that the vertical component of reaction at 'A' is zero. Also find reactions at both the supports.

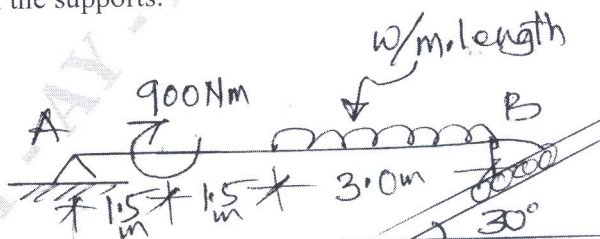


Fig.Q5(c)

(08 Marks)

OR

- 6 a. List the types of beam supports and explain their effects with neat sketches. (04 Marks)
- b. A person is pulling an inclined pole ABC with a rope BD as shown in Fig.Q6(b). If pulling force is 400 N find what is rotational effect felt at point 'A' and also what is the force with which the pole is being pushed in along the pole direction.

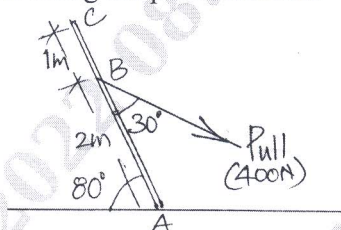


Fig.Q6(b)

(06 Marks)

- c. Find the resultant of the forces shown in Fig.Q6(c) and also its position with respect to point 'A'.

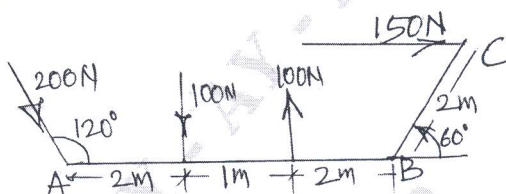


Fig.Q6(c)

(06 Marks)

Module-4

- 7 a. State and prove parallel axis theorem of moment of inertia. (06 Marks)
- b. Locate centroid of area shown in Fig.Q7(b) with reference to point 'O'.

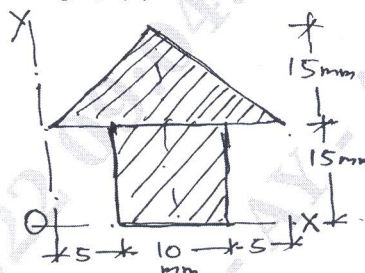


Fig.Q7(b)

(06 Marks)

- c. A rectangle ABCD has $AB = 15$ cm and $BC = 25$ cm. Determine moment of inertia about axis passing along BC. (04 Marks)

OR

- 8 a. From basics of differential calculus locate the centroid of right angled triangle ABC with angle B equal to 90° , base BC and height $AB = h$. (06 Marks)
- b. Determine moment of inertia of given Fig.Q8(b) about an axis passing through centroid and parallel to base AD.

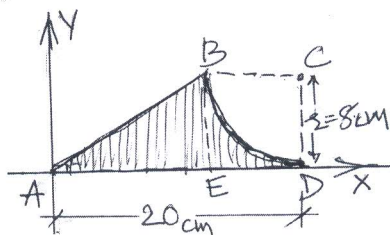


Fig.Q8(b)

(10 Marks)

Module-5

- 9 a. Find range 'R' and maximum height 'H' achieved by a ball projected at angle of 60° with horizontal at a velocity of 20 m/s. (04 Marks)
- b. A disc rotates about its centre making 4 revolutions per second. What is angular velocity of any point on the disc about the centre? Also determine linear velocity of a point on the disc which is at distance radially 0.6 m from the centre. (04 Marks)
- c. An object is falling from top of building vertically downwards. It is observed that it took time of 0.1 s to pass a window opening of height 2m. Find the height above the window from where the object fell down. (08 Marks)

OR

- 10 a. A vehicle travels along a curve of radius 100 m at a speed of 72 kmph on a smooth road. What angle of super elevation is necessary so that vehicle does not skid? (04 Marks)
- b. Body 'A' moves 5 m/s due east and body 'B' moves towards north at 8 m/s. Find relative velocity of 'B' with respect body 'A'. (04 Marks)
- c. A ball can be thrown with velocity of 29.43 m/s. Find the greatest range that can be achieved, on horizontal surface. Determine the angles of projections if the range has to be 50 m. (08 Marks)
