CBCS SCHEME

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15CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2023
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

1 a. Explain briefly the role of civil engineers in the infrastructure development of a country. **(05 Marks)**

b. List the advantages of infrastructure development. **(05 Marks)**

c. A force of 200 N is acting on a block as shown in Fig.Q1(c). Find the components of force along x and y axis and also along and across the plane.

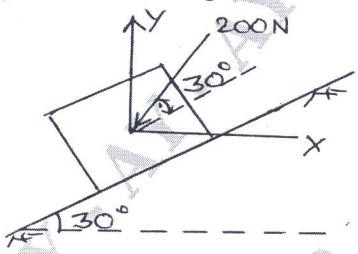

Fig.Q1(c) **(06 Marks)**

OR

2 a. Mention any four types of bridges and briefly explain any two types with neat sketch. **(08 Marks)**

b. Find the moment of 500 N force about the points A, B, C and D as shown in Fig.Q2(b).

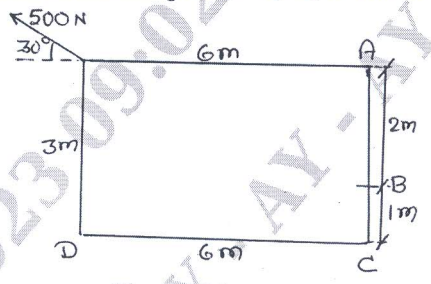

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. What is (i) Angle of friction (ii) Cone of friction? **(04 Marks)**

b. State laws of friction. **(04 Marks)**

c. Three forces acting on a hook are shown in Fig.Q3(c). Find the direction of the fourth force of magnitude 100 N such that the hook is pulled in x-direction only. Find the resultant force.

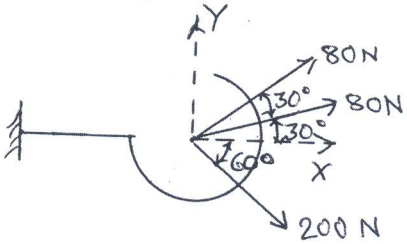

Fig.Q3(c) **(08 Marks)**

OR

4 a. State and prove Lami's theorem. **(06 Marks)**

b. An object weighing 1000 N is kept in position on a plane inclined at 30° to the horizontal by the application of a horizontal force P (Fig.Q4(b)). The coefficient of friction of the contact face is 0.25. Find the minimum and the maximum value of P, to keep the block in position.

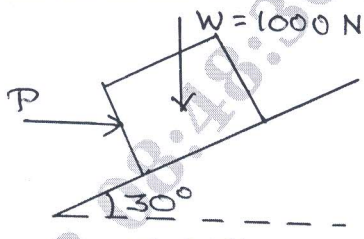

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. State and prove Varignon's theorem. **(06 Marks)**

b. Various forces to be considered for the stability analysis of a dam are shown in Fig.Q5(b). The dam is safe if the resultant of forces pass through middle third of the base. Verify whether the dam is safe.

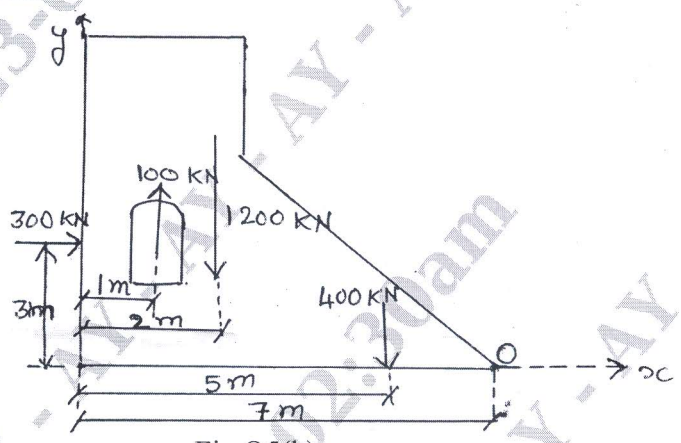

Fig.Q5(b) **(10 Marks)**

OR

6 a. Determine the reactions at A and B for the loaded beam shown in Fig,Q6(a).

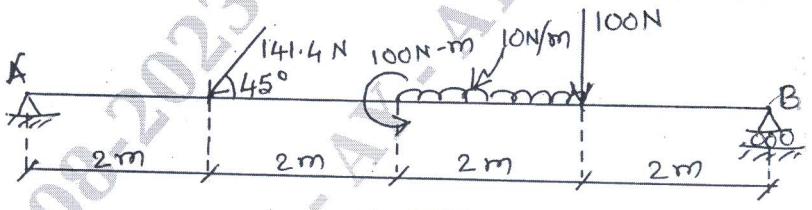

Fig.Q6(a) **(10 Marks)**

b. If the resultant R of two forces produces a clockwise moment of 475 N-m about A, calculate the value of θ and magnitude of resultant which will satisfy this condition. Refer Fig.Q6(b).

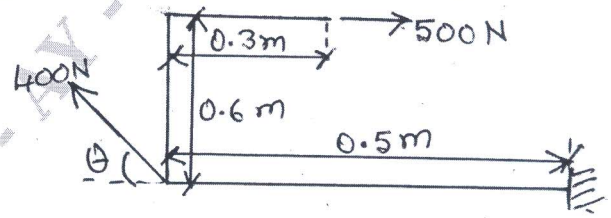

Fig.Q6(b) **(06 Marks)**

Module-4

7 a. Derive an expression to find the moment of inertia of a triangle about its centroidal axis. **(06 Marks)**

b. Locate the centroid of the shaded area of Fig.Q7(b) with respect to given x and y axes.

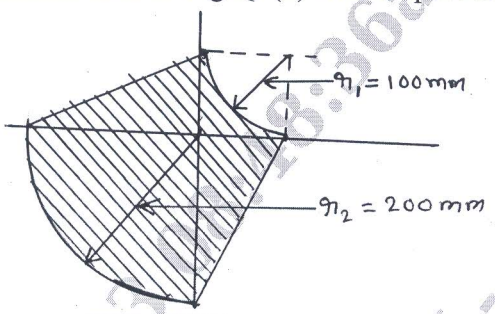

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive an expression to find the location of the centroid of a triangle. **(06 Marks)**

b. Calculate the polar moment of inertia of the area given in Fig.Q8(b). The centroid is located at a distance of 59.26 mm from the base of the area.

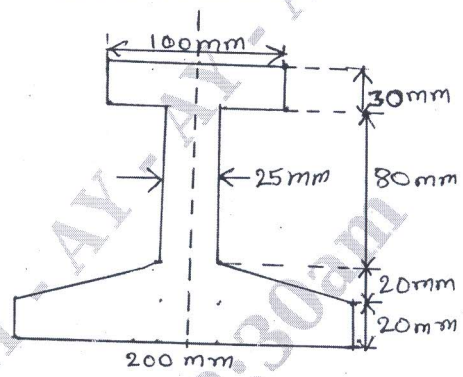

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Briefly explain different types of motion. **(06 Marks)**

b. A particle is projected at a velocity of 40 m/s at an angle 50° to the horizontal.

(i) Find the position of the particle and the magnitude and the direction of its velocity at t = 2 sec.

(ii) Find the time when the particle reaches the highest point of its flight and its height at this point.

(iii) Find also the horizontal range and the time of flight. **(10 Marks)**

OR

10 a. What is angle of projection, trajectory, velocity of projection and horizontal range? Briefly explain with a figure. **(06 Marks)**

b. A stone is thrown vertically upwards with a velocity of 20 m/s from the top of a tower 25m high. Calculate:

(i) The maximum height to which the stone will rise in its flight.

(ii) Velocity of stone during its downward travel at a point in the same level as the point of projection.

(iii) Time required to reach the ground.

Take g = 10 m/s^2. **(10 Marks)**

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