CBCS SCHEME

USN | | | | | | | | | | |

18CIV14/24

First/Second Semester B.E. Degree Examination, June/July 2023
Elements of Civil Engineering and Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the scope of any two following fields of engineering:
(i) Geotechnical Engineering (ii) Water Resources Engineering
(iii) Environmental Engineering **(06 Marks)**

b. Differentiate between : (i) Statics and dynamics
(ii) Couple and Moment
(iii) Concurrent and Non-concurrent forces
(iv) Coplanar and Non-coplanar forces **(08 Marks)**

c. Transfer the force F acting at point A to point B. [Refer Fig.Q1(c)]

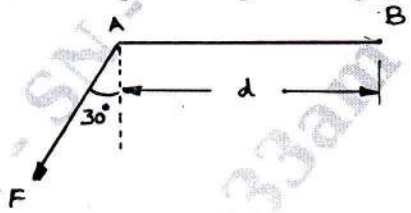


Fig.Q1(c) **(06 Marks)**

OR

2 a. Determine the resultant of the force system with respect to point B. [Refer Fig.Q2(a)]

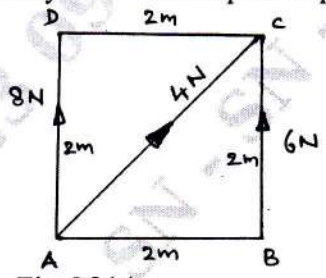


Fig.Q2(a) **(06 Marks)**

b. Replace the system of forces and couple in Fig.Q2(b) by a single force couple system at A.

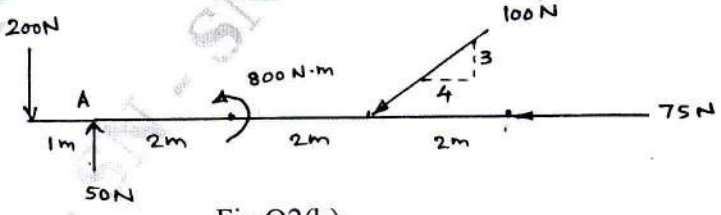


Fig.Q2(b) **(08 Marks)**

c. Explain characteristics of a force. **(06 Marks)**

Module-2

3 a. State and prove Lami's theorem. **(08 Marks)**

b. Find the forces in all he wires (AB, BC and CD) and the load W_1 to keep the wire BC horizontal. Take $W_2 = 1000$ N. [Refer Fig.Q3(b)]

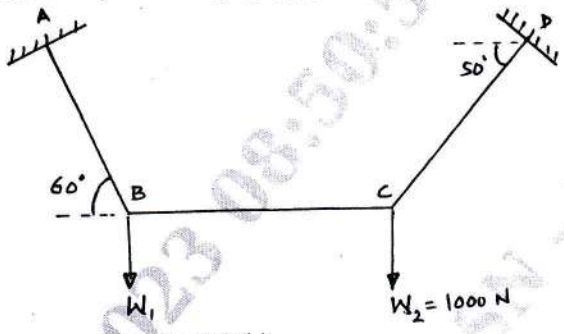


Fig.Q3(b) **(08 Marks)**

c. What is cone of friction? Explain. **(04 Marks)**

OR

4 a. What are different types of friction? Explain. **(04 Marks)**

b. A ladder 3m in length and weighing 200N is place on a rough wall at an inclination of 60° as shown in Fig.Q4(b). The coefficient of friction between ladder and wall is 0.28 and between ladder and floor is 0.34. A man weighing 600N is to reach to the top of the ladder. Calculate the horizontal force to be applied at the floor level to prevent the ladder from slipping.

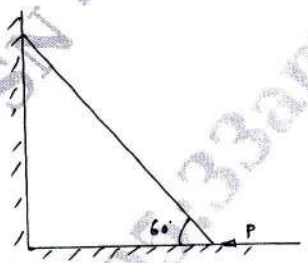


Fig.Q4(b) **(08 Marks)**

c. Find the forces developed in the wires supporting an electric fixture as shown in Fig.Q4(c).

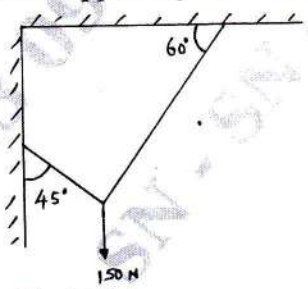


Fig.Q4(c) **(08 Marks)**

Module-3

5 a. Briefly explain different types of supports. **(04 Marks)**

b. Determine the support reactions for the beam supported and loaded as shown in Fig.Q5(b).

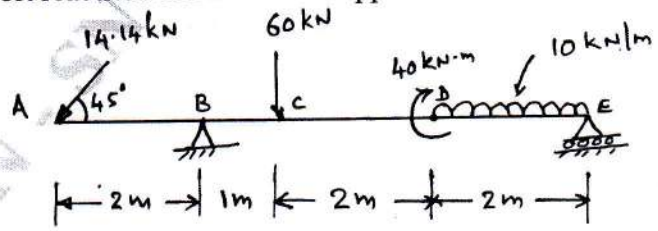


Fig.Q5(b) **(08 Marks)**

c. Analyse the truss shown in Fig.Q5(c) by method of joints. Tabulate the results and indicate the nature of forces in each member.

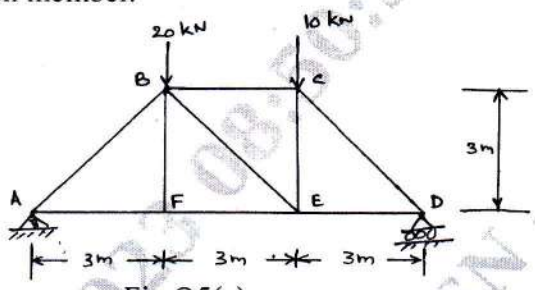


Fig.Q5(c) **(08 Marks)**

OR

6 a. Explain method of sections to analyse the plane frames. **(04 Marks)**

b. A beam 20m long supported on two intermediate supports, 12m apart, carries an u.d.l. of 6 kN/m and two concentrated loads of 30 kN at left end A and 50 kN at right end B as shown in Fig.Q6(b). How far away should the support C be located from end A so that the reactions at both the supports are equal?

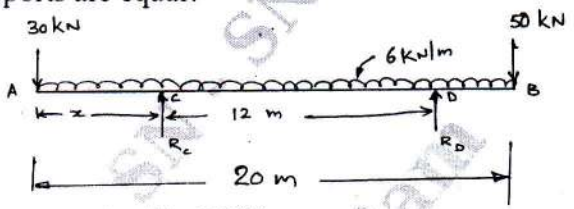


Fig.Q6(b) **(08 Marks)**

c. Determine the forces in the members BD, CD and CE in the truss shown in Fig.Q6(c).

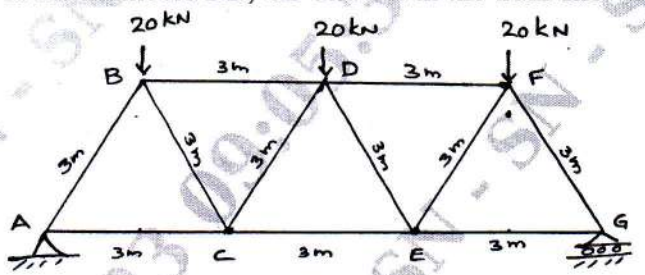


Fig.Q6(c) **(08 Marks)**

Module-4

7 a. Show that the centroid of a semicircle is at a distance of $\frac{4r}{3\pi}$ from the diametrical axis from first principles. **(04 Marks)**

b. Find the coordinates of the centroid of the shaded area with respect to the axes shown in Fig.Q7(b).

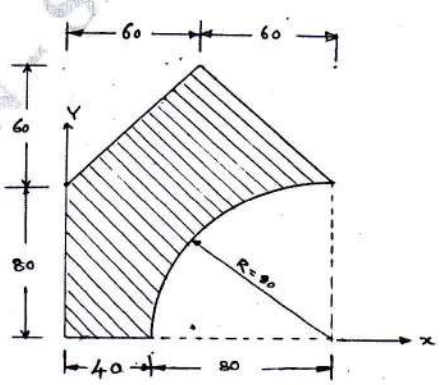


Fig.Q7(b) : All dimensions are in mm **(08 Marks)**

c. Determine the moment of inertia of the lamina about its x-axis.[Refer Fig.Q7(c)]

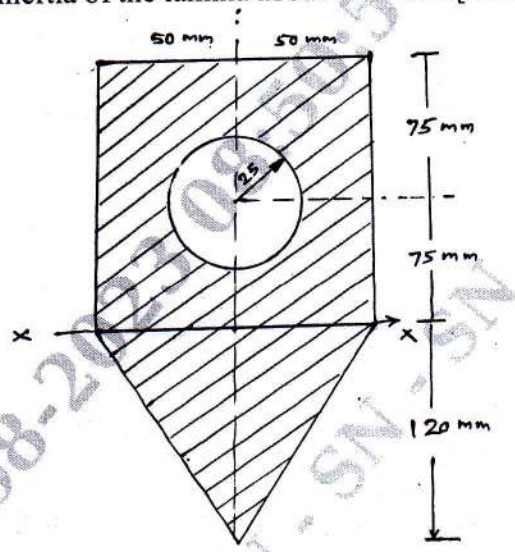


Fig.Q7(c) **(08 Marks)**

OR

8 a. Show that the moment of inertia of a rectangle with width b and depth d about its centroidal x-axis is $\frac{bd^3}{12}$ from first principles. **(04 Marks)**

b. Locate the centroid of the lamina shown in Fig.Q8(b).

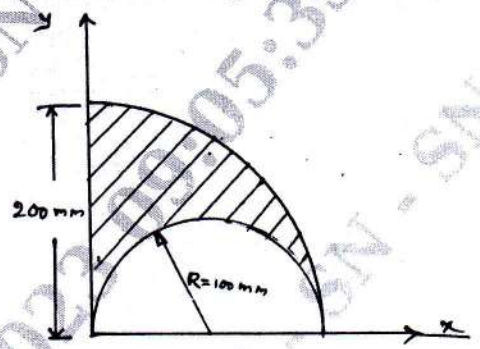


Fig.Q8(b) **(08 Marks)**

c. Find the moment of inertia along the horizontal and vertical axis passing through the centroid of the section shown in Fig.Q8(c).

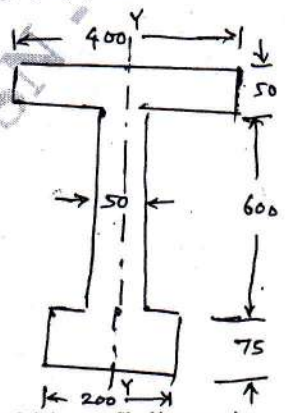


Fig.Q8(c) All dimensions are in mm **(08 Marks)**

Module-5

9 a. Differentiate : (i) Kinetics and Kinematics (ii) Velocity and speed **(04 Marks)**

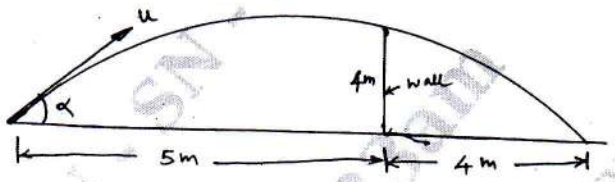
b. Two stations P and Q are 5.2 km apart. An automobile starts from rest from station P and accelerates uniformly to attain a speed of 48 kmph in 30 seconds. This speed is maintained until the brakes are applied. The automobile comes to rest at station Q with a retardation of 1 m/s. Determine the total time required to cover the distance between these two stations. **(08 Marks)**

c. Derive the expression for the time required to reach the maximum height of a projectile and hence show that the horizontal range as $\left(\frac{n^2 \sin 2\alpha}{g}\right)$. **(08 Marks)**

OR

10 a. Explain D'Alembert's principle. **(04 Marks)**

b. A boy throws a ball so that it may just clear a wall 4m high. The boy is at a distance of 5m from the wall. The ball was found to hit the ground at a distance of 4m on the other side of the wall as shown in Fig.Q10(b). Find the velocity of projection of the ball and the angle of projection.



(Figure not to scale)

Fig.Q10(b) **(08 Marks)**

c. A police officer observes a car approaching at the unlawful speed of 60 kmph. He gets on his motorcycle and starts chasing the car, just as it passes in front of him. After accelerating it for 10 sec., at a constant rate, the officer reaches his top speed of 75 kmph. How long does it take the officer to overtake the car from the time he started? **(08 Marks)**

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