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)]

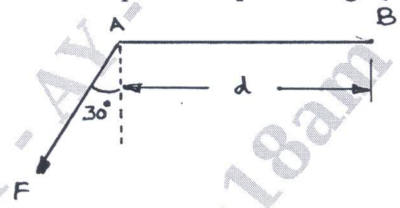

Fig.Q1(c) **(06 Marks)**

OR

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

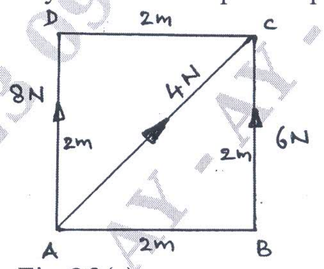

Fig.Q2(a) **(06 Marks)**

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

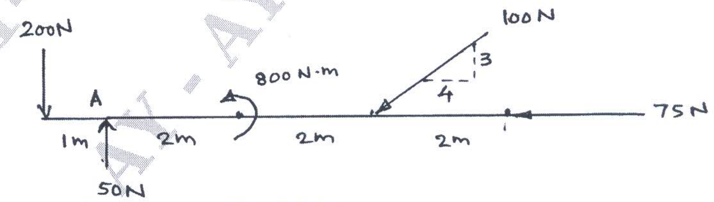

Fig.Q2(b) **(08 Marks)**

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)]

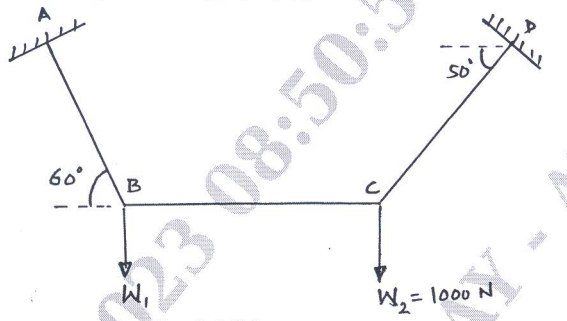

Fig.Q3(b) **(08 Marks)**

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.

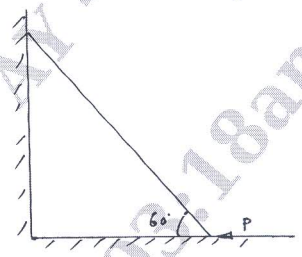

Fig.Q4(b) **(08 Marks)**

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

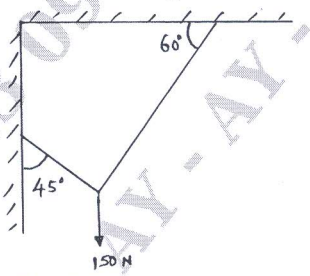

Fig.Q4(c) **(08 Marks)**

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).

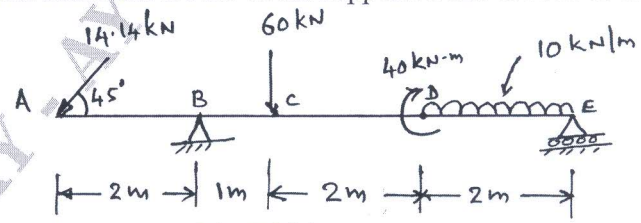

Fig.Q5(b) **(08 Marks)**

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.

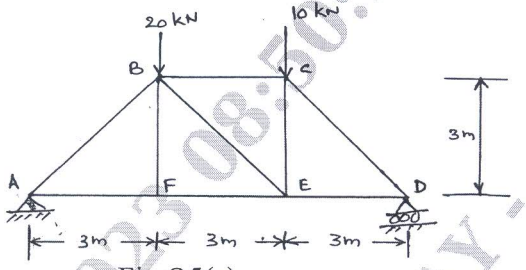

Fig.Q5(c) **(08 Marks)**

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?

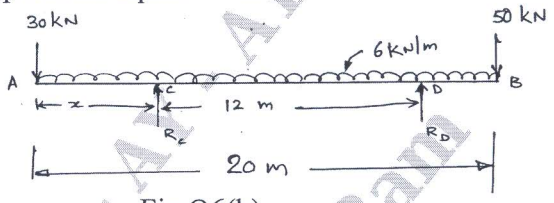

Fig.Q6(b) **(08 Marks)**

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

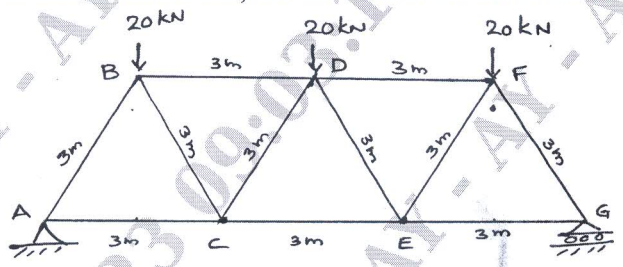

Fig.Q6(c) **(08 Marks)**

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).

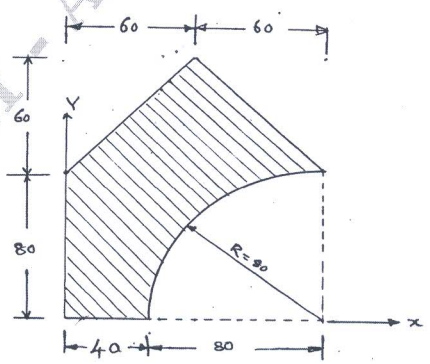

Fig.Q7(b) : All dimensions are in mm **(08 Marks)**

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

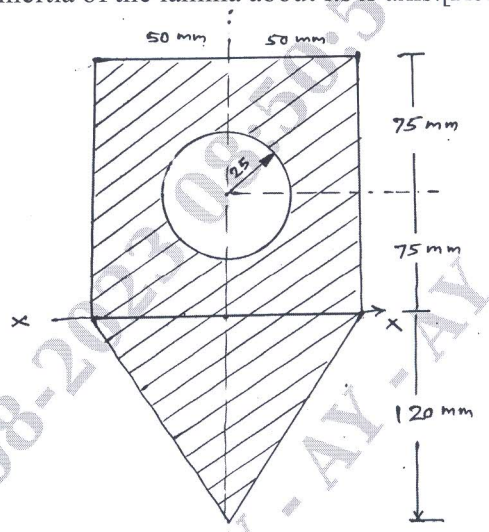

Fig.Q7(c) **(08 Marks)**

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).

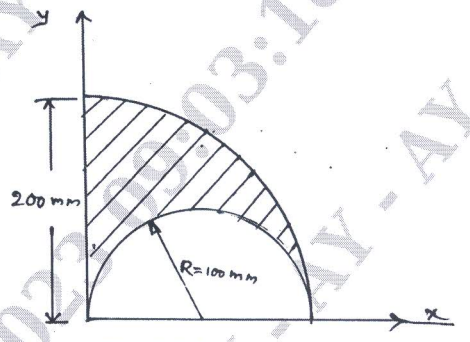

Fig.Q8(b) **(08 Marks)**

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

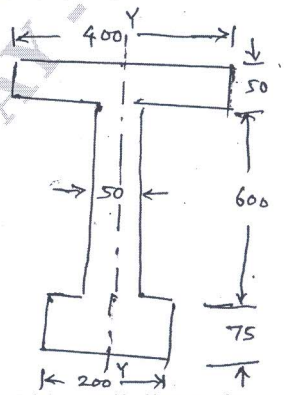

Fig.Q8(c) All dimensions are in mm **(08 Marks)**