USN

First/Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
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 about impact of infrastructure on socioeconomic development of a society. **(06 Marks)**

   b. Write a short note on:
      i) Transportation Engineering
      ii) Water resource Engineering. **(06 Marks)**

   c. Determine the resultant of forces which are acting over a body as shown in Fig.Q.1(c). **(08 Marks)**
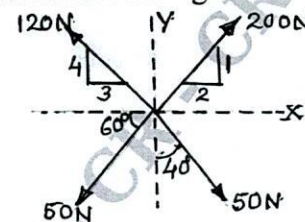

Fig.Q.1(c)

OR

2. a. State and prove law of parallelogram of forces. **(06 Marks)**

   b. State and prove Varignon's theorem of moment. **(06 Marks)**

   c. Determine the resultant of force system acting over a body as shown in Fig.Q.2(c). Also locate the position of resultant with respect to point D. **(08 Marks)**
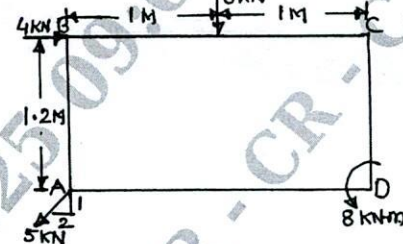

Fig.Q.2(c)

Module-2

3. a. Explain the following:
      i) Coefficient of friction
      ii) Cone of friction. **(04 Marks)**

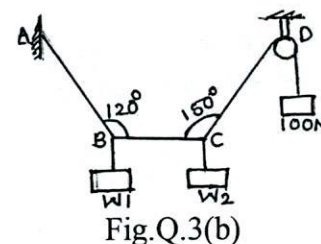   b. Determine the value of W_1 and W_2 as shown in Fig.Q.3(b) to keep the member BC horizontal. **(08 Marks)**

Fig.Q.3(b)

   c. Determine the necessary force 'P' acting parallel to the plane as shown in Fig.Q.3(c) in order to cause motion to impend. Take $\mu = 0.25$. **(08 Marks)**
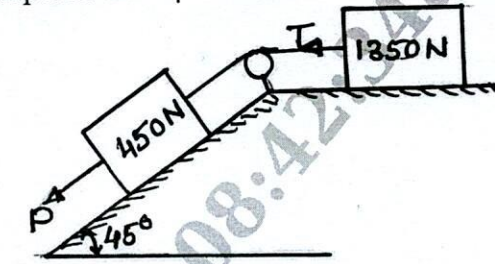

Fig.Q.3(c)

OR

4. a. What is equilibrium? What are conditions of equilibrium for concurrent and on concurrent force system? **(04 Marks)**

   b. Three cylinders A, B and C of diameter 200 mm, 300 mm and 250 mm having weight of 75 N, 200 N and 100 N respectively are placed in a rectangular tough as shown in Fig.Q.4(b). Assuming contact surfaces as smooth, determine the reactions between cylinder A and vertical wall. **(10 Marks)**
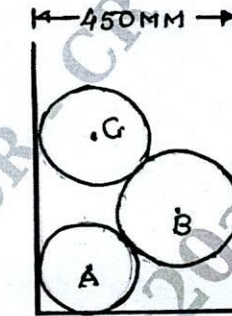

Fig.Q.4(b)

   c. A uniform ladder of weight 850 N and of length 6 m rest on a horizontal ground and cleans against a smooth vertical wall. The angle made by the ladder with the horizontal is 65°, when a man of weight 700 N stands on the ladder at a distance of 4 m. From the top of the ladder at a distance of 4 m from the top of the ladder as shown in Fig.Q.4(c). The ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor. **(06 Marks)**
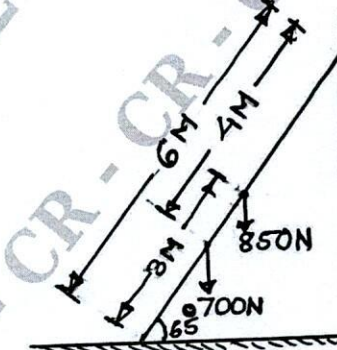
Fig.Q.4(c)

Module-3

5. a. Explain briefly about different types of supports provided for beams. **(06 Marks)**

   b. What are assumptions made in the analysis of rigid frames? **(06 Marks)**

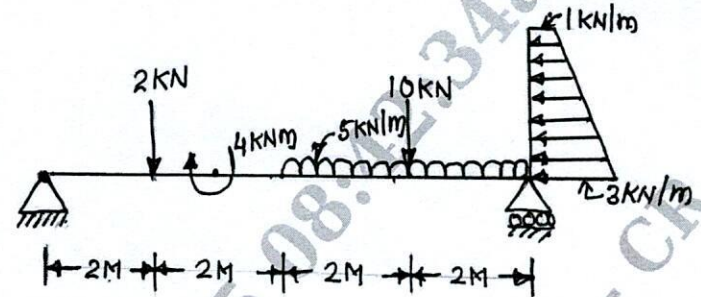c. Find the reactions at support A and B for the beam as shown in Fig.Q.5(c). **(08 Marks)**

Fig.Q.5(c)

OR

6 a. Differentiate between statically determinate and statically indeterminate structure. **(04 Marks)**

b. Explain different types of clouds in the analysis of beams. **(03 Marks)**

c. Find the support reactions and member forces for the pin jointed plane truss as shown in Fig.Q.6(c) by method of joints. Also tabulate the results. **(13 Marks)**
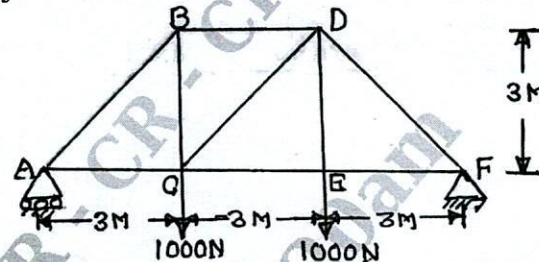

Fig.Q.6(c)

Module-4

7 a. Determine the centroid of semicircular lamina of radius 'R' using method of integration. **(08 Marks)**

b. Determine the moment of inertia of the section as shown in Fig.Q.7(b) about its centroidal axis. Calculate the least radius of gyration for the section. **(12 Marks)**
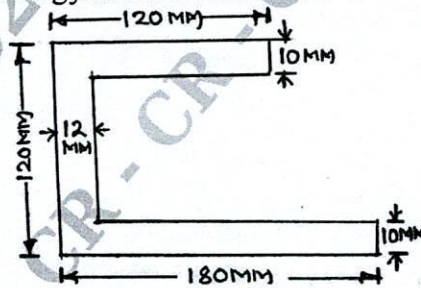

Fig.Q.7(b)

OR

8 a. State and prove parallel axis theorem. **(06 Marks)**

b. Derive an expression for moment of inertia of a triangular lamina with respect to its horizontal centroidal axis. **(06 Marks)**

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c. Locate the centroid of the shaded area as shown in Fig.Q.8(c) with respect to point 'O'. **(08 Marks)**
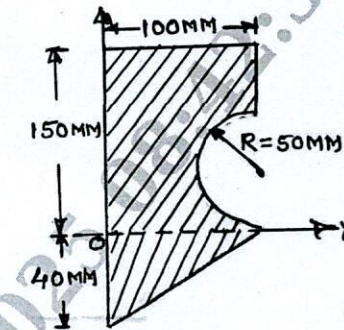

Fig.Q.8(c)

Module-5

9 a. What is Projectile? Define the following term:
i)   Angle of projection
ii) Horizontal range
iii) Vertical height
iv) Time of flight. **(10 Marks)**

b. A burglar's car starts at an acceleration of 2 m/sec². A police vigilant party came after 5 sec and continued to chase the burglar's car with a uniform velocity of 20 m/sec. Find the time taken in which the police van will overtake the car. **(10 Marks)**

OR

10 a. State D'Alembert's principle and write its significance in structural dynamics. **(06 Marks)**

b. Define:
i)   Centrifugal force
ii) Superelevation **(04 Marks)**

c. Find the least initial velocity with which a projectile is to be projected so that it clears a wall of 4 m height located at a distance of 5 m and strikes the ground at a distance 4 m beyond the wall as shown in Fig.Q.10(c). The point of projection is at the same level as the foot of the wall.
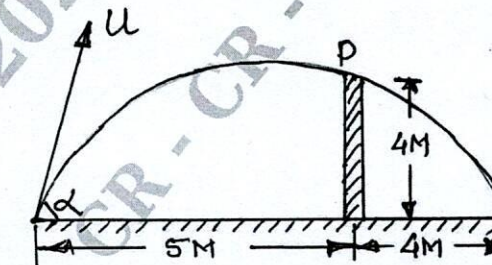

Fig.Q.10(c)

(10 Marks)

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