CBCS SCHEME

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21CIV14/24

First/Second Semester B.E. Degree Examination, June/July 2024
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. Discuss the role of a civil engineer in the development of a nation. **(08 Marks)**

b. Explain the importance of the following fields of civil engineering:
i) Structural engineering
ii) Environmental engineering
iii) Transportation engineering. **(12 Marks)**

OR

2 a. "Civil engineering is one of the basic needs of the society and nation". Justify the statement. **(08 Marks)**

b. Highlight the significance of the following streams of civil engineering:
i) Water resources and irrigation engineering
ii) Building materials
iii) Geotechnical engineering. **(12 Marks)**

Module-2

3 a. Explain with examples:
i) Resolution and composition of forces
ii) Moment and couple. **(06 Marks)**

b. Compute the magnitude and direction of the unknown force, if the resultant force of 72kN acts along the positive direction of Y axis as shown in Fig.Q.3(b). **(06 Marks)**

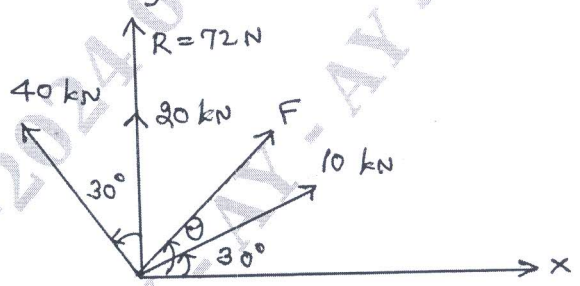

Fig.Q.3(b)

c. Calculate the force P required to cause impending motion in the system shown in Fig.Q.3(c). Assume smooth pulley and coefficient of friction for all contact surfaces as 0.20.

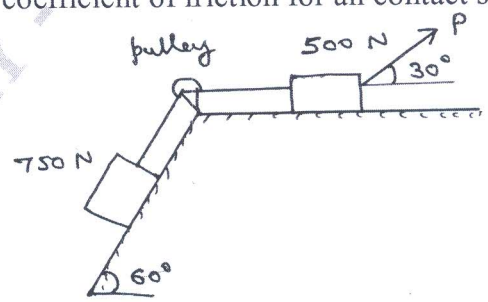

Fig.Q.3(c) **(08 Marks)**

OR

4 a. Explain with sketches:
   i) Principle of transmissibility of a force
   ii) Varignon's theorem of moments. **(06 Marks)**

b. Determine the magnitude, direction and the X-intercept of the resultant of the force system shown in Fig.Q.4(b) with respect to point A. **(06 Marks)**

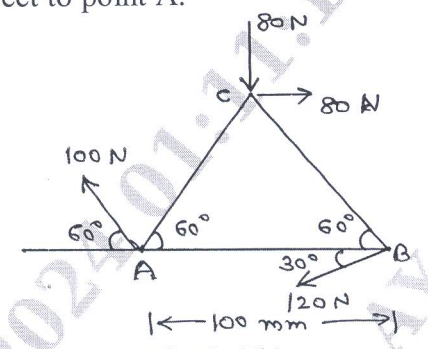

Fig.Q.4(b)

c. Define angle of limiting friction. Compute the value of θ required to move the 900N block down the plane as shown in Fig.Q.4(c). Take the coefficient of friction for all contact surfaces as 1/3. **(08 Marks)**

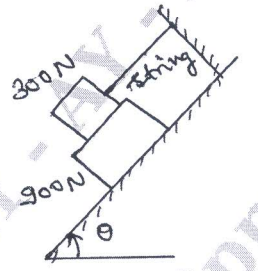

Fig.Q.4(c)

Module-3

5 a. State and prove "Parallel axis theorem". **(06 Marks)**

b. Derive the expression for locating the centroid of a semi-circular lamina from first principles. **(06 Marks)**

c. Determine the moment of inertia of the shaded area shown in Fig.Q.5(c) with respect to
   i) Horizontal centroidal axis
   ii) The base BC.
   All dimensions given are in mms.

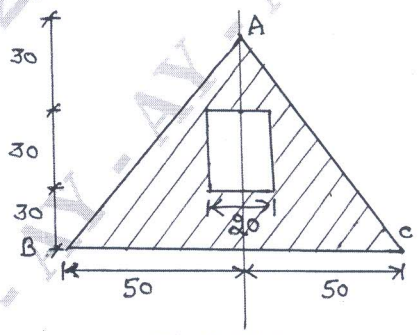

Fig.Q.5(c) **(08 Marks)**

OR

6 a. Define the following terms and give the relevant expressions:
   i) Polar moment of inertia
   ii) Radius of gyration
   iii) Section modulus. **(06 Marks)**

b. Deduce the expression for the moment of inertia of a triangular lamina about its base. Hence, obtain the expression about the horizontal centroidal axis. **(06 Marks)**

c. Determine the centroid of the shaded area with reference to the axes shown in Fig.Q.6(c). All the dimensions are in mms.

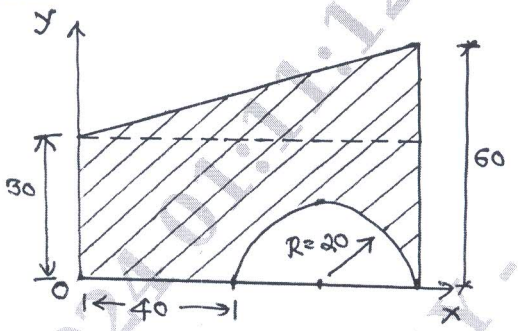

Fig.Q.6(c)

(08 Marks)

Module-4

7 a. Compute the support reactions of the beam shown in Fig.Q.7(a). **(10 Marks)**

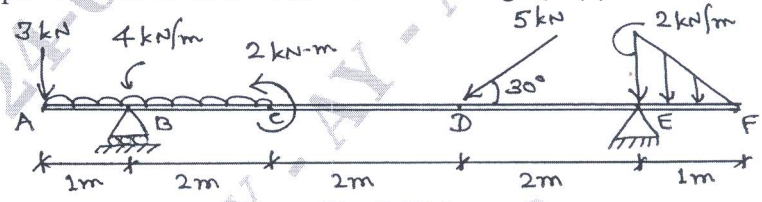

Fig.Q.7(a)

b. Determine the forces in the members of the truss shown in Fig.Q.7(b) by method of joints. Tabulate the results. **(10 Marks)**

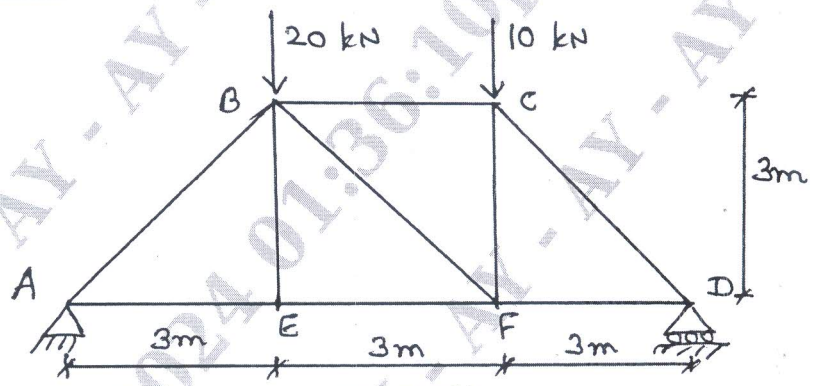

Fig.Q.7(b)

OR

8 a. Distinguish between hinged support and fixed support with sketches. **(04 Marks)**

b. Compute the support reactions in the beam shown in Fig.Q.8(b). **(06 Marks)**

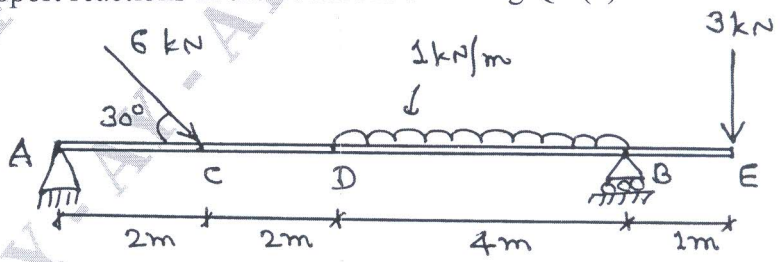

Fig.Q.8(b)

c. Determine the forces in the members GC, BC, DF, CD and EF of the truss shown in Fig.Q.8(c) by method of sections. **(10 Marks)**

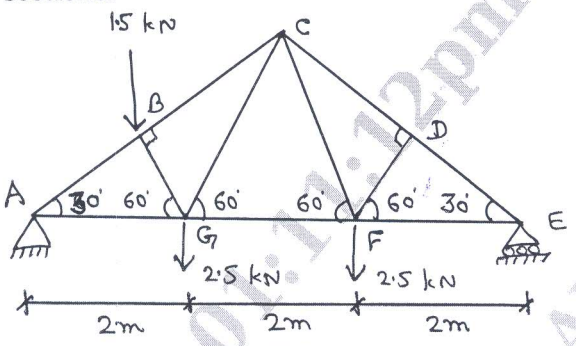

Fig.Q.8(c)

Module-5

9 a. With sketches, explain:
   i) Range and trajectory of a projectile.
   ii) Super elevation and its advantages. **(06 Marks)**

b. A motorist is travelling at 80kmph, when he observes a traffic light 200m ahead of him turns red. The traffic light is timed to stay red for 10 seconds. If the motorist wishes to pass the light without stopping, just as it turns green, determine:
   i) The required deceleration of the motor
   ii) The speed of the motor as it passes the light. **(06 Marks)**

c. Two weights 800N and 200N are connected by a string and they move along a rough horizontal plane under the action of a force of 400N applied as shown in Fig.Q.9(c). Taking the friction coefficient between the weights and the plane as 0.30, determine the acceleration of the weights and tension in the string by D'Alembert's principle. **(08 Marks)**

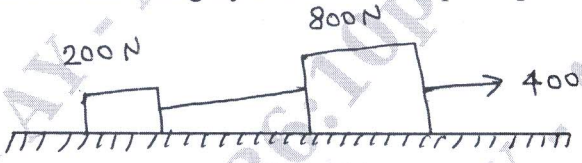

Fig.Q.9(c)

OR

10 a. Distinguish between :
   i) Instantaneous velocity and average velocity.
   ii) Constant acceleration and variable acceleration.
   iii) Rectilinear motion and curvilinear motion. **(06 Marks)**

b. The horizontal component of velocity of a projectile is twice the vertical component. Compute the range on the horizontal plane, if the projectile passes through a point 18m horizontally and 3m vertically above the point of projection. **(06 Marks)**

c. Two bodies weighing 300N and 450N are hung to the ends of a rope passing over a smooth pulley as shown in Fig.Q.10(c). Calculate the tension in the string and acceleration of the system by D'Alembert's principle. **(08 Marks)**

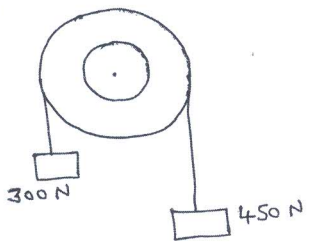

Fig.Q.10(c)

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