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18CIV14/24

# First/Second Semester B.E. Degree Examination, June/July 2024
## Elements of Civil Engineering and Mechanics

Time: 3 hrs.

Max. Marks: 100

*Note:1. Answer any FIVE full questions, choosing ONE full question from each module.*
*2. Missing data, if any may be suitably assumed.*

## Module-1

1   a. Explain briefly the scope of civil engineering in, (i) Transportation engineering (ii) Water resources and Irrigation engineering. **(08 Marks)**

   b. What are the effects of infrastructural facilities on socio-economic development of a country? **(06 Marks)**

   c. State and explain the law of transmissibility with its limitations. **(06 Marks)**

### OR

2   a. State and prove Varignon's theorem of moments. **(06 Marks)**

   b. Two cables attached at the top of a tower carries guy wire AB as shown in Fig. Q2 (b). Determine the tension in guy wire such that the resultant of forces in all the three cables acts vertically downwards. Also find the resultant force. **(10 Marks)**
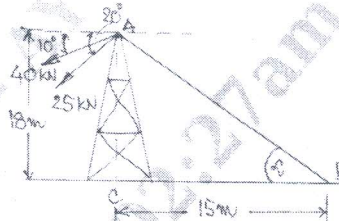


Fig. Q2 (b)

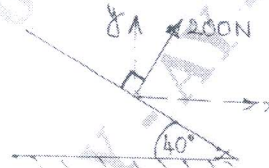   c. Find the components of 200 N force shown in Fig. Q2 (c) along general x and y axes shown.



Fig. Q2 (c)

**(04 Marks)**

## Module-2

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

   b. A system of cables with loads at joints B and C are shown in Fig.Q3 (b). Calculate the tension in the strings and also calculate the angle α. **(10 Marks)**
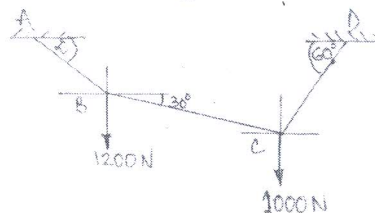


Fig.Q3 (b)

   c. What is a free body diagram? Explain with an example. **(04 Marks)**

**OR**

4  a.  State the laws of dry friction.                                    (06 Marks)
   b.  A block of weight 1000 N is resting on an inclined plane as shown in Fig. Q4 (b). Find the magnitude of horizontal force P to cause impending motion of the block, (i) Up the plane (ii) Down the plane. Take coefficient of friction = 0.25.                                    (08 Marks)
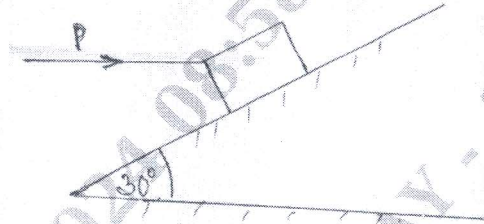


Fig. Q4 (b)

   c.  Show that the angle of friction is equal to angle of repose.                                    (06 Marks)

## Module-3

5  a.  Explain the different types of beams.                                    (06 Marks)
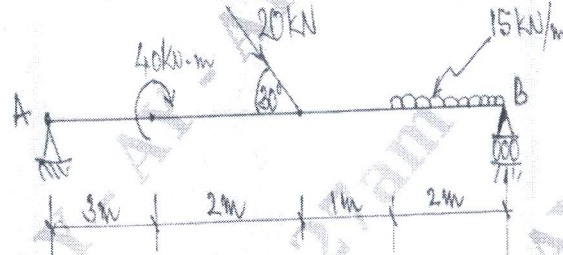   b.  Determine the reactions developed at supports of the beam shown in Fig. Q5 (b).



Fig. Q5 (b)                                    (10 Marks)

   c.  Name the types of loads and explain any two of them.                                    (04 Marks)

**OR**

6  a.  What are perfect and imperfect trusses? Explain.                                    (06 Marks)
   b.  List the assumptions in the analysis of trusses.                                    (04 Marks)
   c.  Find the forces in the members of the truss shown in Fig. Q6 (c), using method of joints and tabulate member forces.                                    (10 Marks)
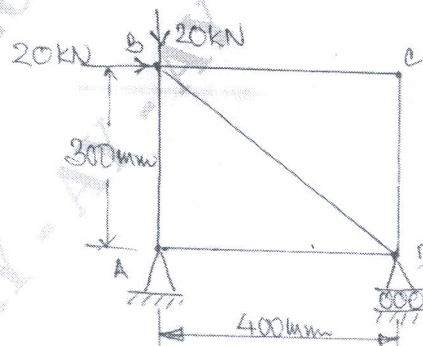


Fig. Q6 (c)

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## Module-4

7  a.  Determine the expression for the centroid of an isosceles triangle from first principles.

**(08 Marks)**

   b.  Locate the position of centroid for the lamina with a circular cutout shown in Fig. Q7 (b).
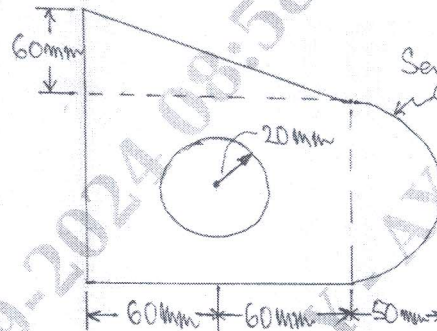
**(12 Marks)**



Fig. Q7 (b)

**OR**

8  a.  Derive an expression for the moment of inertia of a circle by the method of integration.

**(08 Marks)**

   b.  Determine the MI of section shown in the Fig. Q8 (b) about the centroidal axis.   **(12 Marks)**
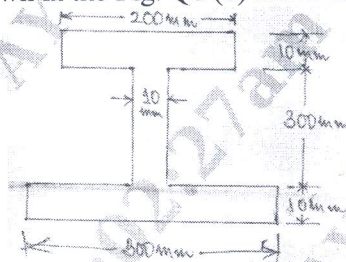


Fig. Q8 (b)

## Module-5

9  a.  Derive the equations of motion.   **(08 Marks)**

   b.  A stone is dropped from the top of a tower 50 m high. At the same time, another stone is thrown up from the foot of the tower with a velocity of 25 m/sec. What distance from the top and after how much time the two stones cross each other.   **(12 Marks)**

**OR**

10  a.  Define the following terms :
   (i)   Projectile
   (ii)  Angle of projection
   (iii) Horizontal range
   (iv)  Time of flight   **(08 Marks)**

   b.  A projectile is fired from the top of cliff 150 m height with an initial velocity of 180 m/sec at an angle of elevation of $30°$ to horizontal. Neglecting air resistance, determine (i) the greatest elevation above cliff  (ii) the great elevation above the ground reached by the particle  (iii) the horizontal distance from the gun to the point where the projectile strikes the ground.   **(12 Marks)**

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