CBCS SCHEME

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17CIV13/23

First/Second Semester B.E. Degree Examination, July/August 2021
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain briefly the scope of any three fields of civil engineering. **(06 Marks)**

b. Explain the principles in engineering mechanics. **(06 Marks)**

c. Fig. Q1 (c) shows a Cantilever beam with two forces and a couple:

(i) Determine the resultant of the system.

(ii) Determine the equivalent system through A. **(08 Marks)**

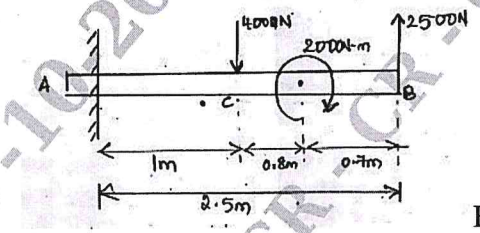

Fig. Q1 (c)

2 a. Draw typical cross section of a road and explain its components. **(06 Marks)**

b. With neat sketches, explain the classification of force system. **(06 Marks)**

c. A horizontal force of 1000 N is acting on the lever AB. Find the equivalent system at the support B. Refer Fig. Q2 (c). **(08 Marks)**

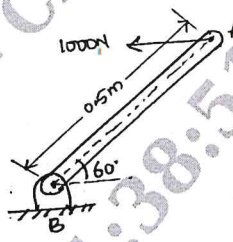

Fig. Q2 (c)

3 a. State and explain parallelogram law of forces. **(06 Marks)**

b. Find the resultant of the coplanar concurrent force system shown in Fig. Q3 (b). **(06 Marks)**

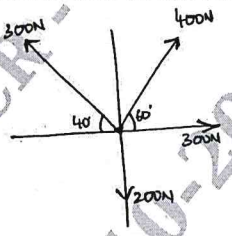

Fig. Q3 (b)

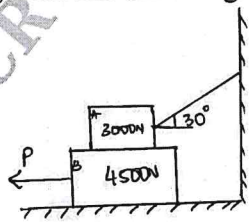

Fig. Q3 (c)

c. A block weighing 4500 N resting on horizontal surface supports another block of 3000 N as shown in Fig. Q3 (c). Find the horizontal force 'P' required to just move the block to the left. Take μ for all contact surface as 0.3. **(08 Marks)**

4 a. Define Friction. Explain the types of friction. **(05 Marks)**

b. Find the value of W, which is required to maintain equilibrium configuration as shown in Fig. Q4 (b) **(07 Marks)**

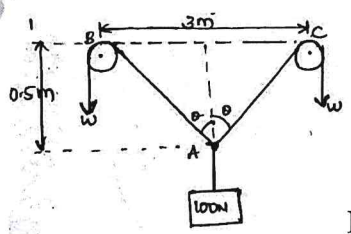

Fig. Q4 (b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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c. Two identical rollers, each weighing 4000 N, are placed in a trench as shown in Fig. Q4 (c). Assuming that all contact surfaces are smooth, determine the reactions at contact points A, B, C and D. **(08 Marks)**

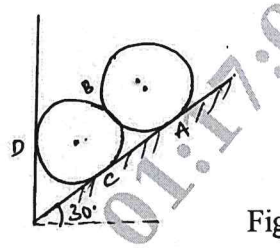

Fig. Q4 (c)

5 a. State and prove Varignon's principle of moments. **(08 Marks)**

b. Find the magnitude, direction and position of the resultant force with respect to point 'A' as shown in Fig. Q5 (b). **(06 Marks)**

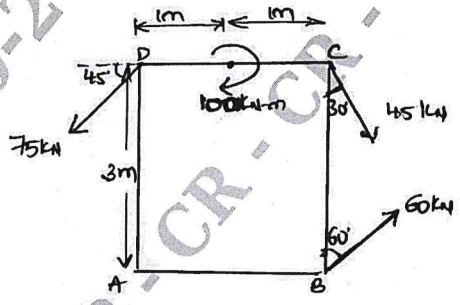

Fig. Q5 (b)

c. Find the support reactions of the beam loaded as shown in Fig. Q5 (c). **(06 Marks)**

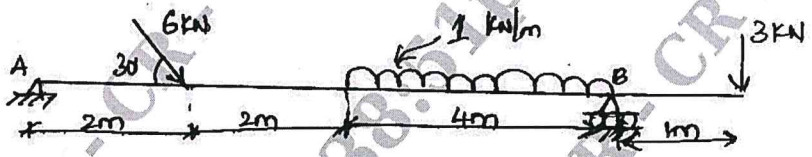

Fig. Q5 (c)

6 a. Explain with neat sketches, different types of supports. **(04 Marks)**

b. Determine the reactions at A and E for the beam loaded as shown in Fig. Q6 (b). **(08 Marks)**

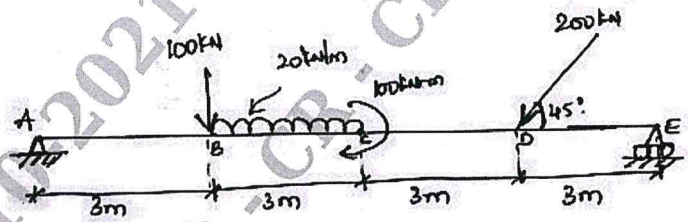

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Fig. Q6 (b)

c. Determine the resultant and equillibriant of the forces acting as shown in Fig. Q6 (c) with respect to Point A. **(08 Marks)**

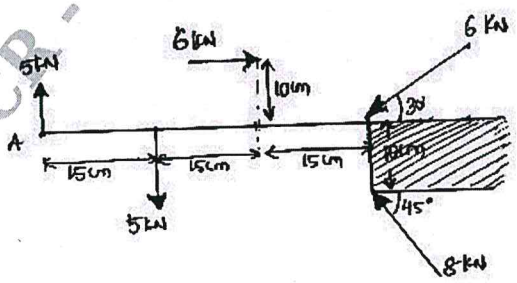

Fig. Q6 (c)

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7 a. Locate the centroid of triangle from the first principles. **(10 Marks)**

b. Determine the moment of inertia and radius of gyration of the area shown in Fig.Q7 (b) about the base AB and centroidal axis parallel to AB. **(10 Marks)**

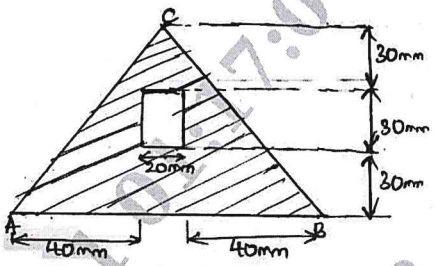

Fig. Q7 (b)

8 a. State and prove parallel axes theorem. **(08 Marks)**

b. Locate the centroid of the shaded area as shown in Fig. Q8 (b). **(12 Marks)**

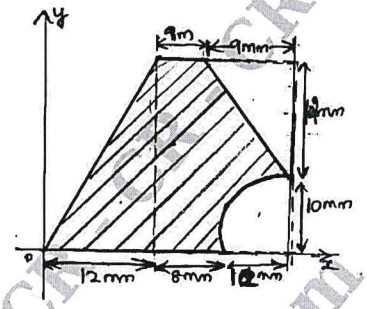

Fig. Q8 (b)

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9 a. Define the following terms : (i) Rectilinear motion. (ii) Curvilinear motion (iii) Projectile motion **(06 Marks)**

b. Explain with neat sketch, the following :
(i) Angle of projection (ii) Time of flight (iii) Horizontal range. **(06 Marks)**

c. A ball is thrown vertically into the air at 36 m/s. After 3 seconds another ball is thrown vertically up. With what initial velocity must the second ball have to pass the first at 30 m from the ground? **(08 Marks)**

10 a. Define super elevation. Why is it necessary to provide super elevation? **(04 Marks)**

b. Derive an expression for path of projectile. **(06 Marks)**

c. A projectile is fired from the top of cliff 150 m height with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance, determine (i) The greatest elevation above the cliff (ii) The great elevation above the ground reached by the projectile. (iii) The horizontal distance from the gun to the point where the projectile strikes the ground. Refer Fig. Q10 (c). **(10 Marks)**

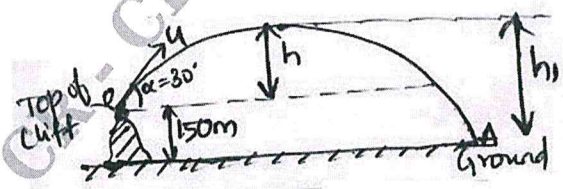

Fig. Q10 (c)

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