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First/Second Semester B.E. Degree Examination, Jan./Feb. 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 civil engineering in,
   i)   Structural Engineering
   ii) Transportation Engineering
   iii) Environmental Engineering
   iv) Geotechnical Engineering
   v)   Water resources engineering.   **(10 Marks)**
   b. State and explain the principle of :
   i) Transmissibility of forces
   ii) Physical independence of forces.   **(05 Marks)**
   c. Explain the role of civil engineer in infrastructural development.   **(05 Marks)**

OR

2 a. Define couple and mention its characteristics.   **(06 Marks)**
   b. Enumerate the different types of dams. State the functions of dams.   **(06 Marks)**
   c. Determine the moment of 400N force about points A, B, C and D as shown in Fig.Q2(c).
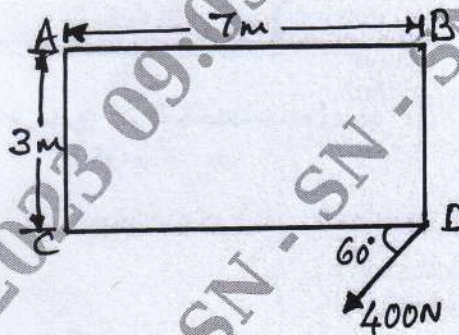

Fig.Q2(c)   **(08 Marks)**

Module-2

3 a. State and prove Lami's theorem. Also write the significance of the law.   **(10 Marks)**
   b. Find the resultant of coplanar concurrent forces shown in Fig.Q3(b).
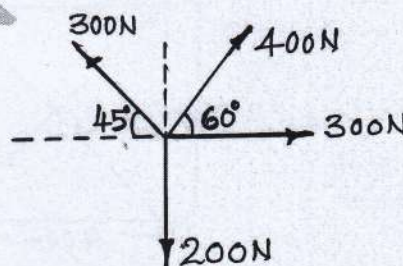

Fig.Q3(b)

(10 Marks)

OR

4 a. State the laws of static friction. **(04 Marks)**
   b. Define :
      i) Angle of friction
      ii) Coefficient of friction
      iii) Cone of friction. **(06 Marks)**
   c. Determine the force P just required to slide the block B in arrangement shown in Fig.Q4(c). Find also the tension in the string, take weight of block A = 500N, B = 1000N and μ = 0.2 (for all contact surfaces).
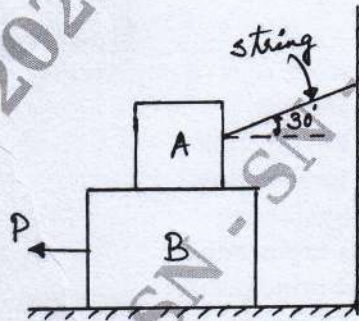

Fig.Q4(c) **(10 Marks)**

Module-3

5 a. State and prove Varignou's theorem of moment. **(10 Marks)**
   b. Determine the reactions at the supports A and B for the beam as shown in Fig.Q5(b).
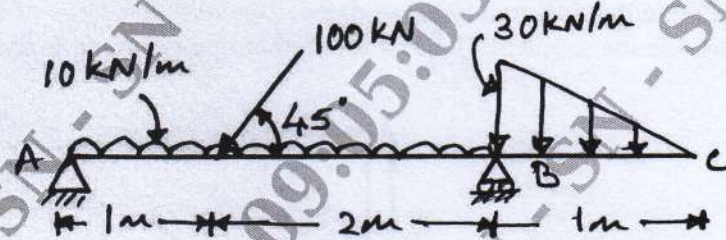

Fig.Q5(b) **(10 Marks)**

OR

6 a. Explain with neat sketch :
      i) Types of loads
      ii) Types of support
      iii) Types of beams. **(10 Marks)**
   b. Determine the resultant of the system of forces acting on a lamina as shown in Fig.Q6(b) locate the distance of the resultant from point '0'.
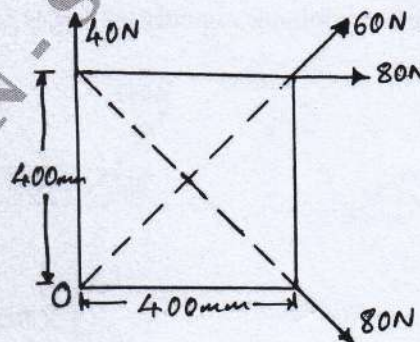

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. State and prove parallel axis theorem. **(08 Marks)**

   b. With reference to the co-ordinate axis x and y, locate the centroid of the shaded area as shown in Fig.Q7(b).
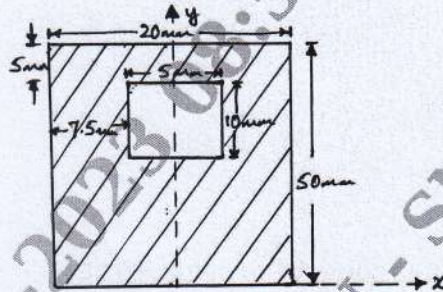

Fig.Q7(b) **(12 Marks)**

OR

8 a. Determine the centroid of a triangular lamina about its base by method of integration. **(08 Marks)**

   b. Determine the moment of inertia of the section along the horizontal axis passing through the centroid of the section shown in Fig.Q8(b).
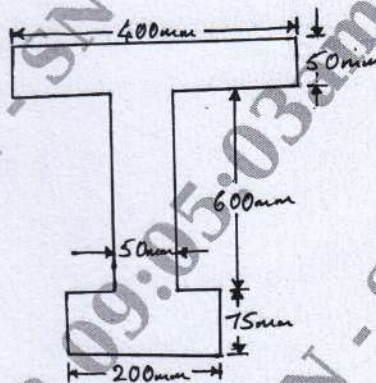

Fig.Q8(b) **(12 Marks)**

Module-5

9 a. A stone is dropped into a well. After 4 seconds the sound of splash is heard. If the velocity of sound is 330m/s. Find the depth of the well upto the water surface. **(10 Marks)**

   b. A projectile is launched from a gun. After 3.783 seconds, the velocity of the projectile is observed to make an angle of 30° with the horizontal and at 4.79 seconds it reaches its maximum height. Calculate the initial velocity and angle of projection. **(10 Marks)**

OR

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

   b. The motion of a particle starting from rest is defined by $a = 10t - t^2$, where a is in m/s^2 and t is in seconds. Find the displacement before it starts in reverse direction of motion and velocity when acceleration changes its direction. **(10 Marks)**

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