

USN

## First/Second Semester B.E. Degree Examination, June/July 2019 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. Assume any missing data suitably.**

### Module-1

- 1 a. Explain briefly :
  - (i) Transportation Engineering
  - (ii) Structural Engineering
  - (iii) Environmental Engineering
  - (iv) Geotechnical Engineering
  - (v) Water resources and Irrigation Engineering (10 Marks)
- b. Explain (i) types of Bridge and Culverts with simple sketches (ii) Types of dams based on material, structural behaviour and functionality with simple sketches. (10 Marks)

OR

- 2 a. Explain
  - (i) Static and Dynamic
  - (ii) Kinematics and Kinetics
  - (iii) Couple and Moment
  - (iv) Force and its characteristics
  - (v) Transmissibility of forces (10 Marks)
- b. Find the moment of 500 N force about the point A, B, C and D as shown in Fig.Q2(b).

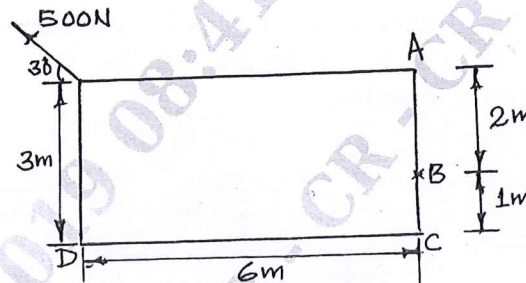


Fig.Q2(b)

(10 Marks)

### Module-2

- 3 a. State and prove Lami's theorem. (04 Marks)
- b. Find the resultant of coplanar concurrent forces shown in Fig.Q3(b). (08 Marks)

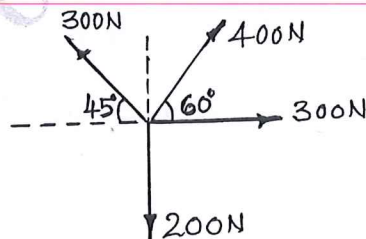


Fig.Q3(b)

- c. State and prove parallelogram law of forces. (08 Marks)

OR

- 4 a. Explain  
 (i) Limiting friction (ii) Angle of friction (iii) Angle of repose (iv) Coefficient of friction (08 Marks)
- b. Two blocks A and B weighing 2 kN and 1.5 kN are connected by a wire passing over a smooth frictionless pulley as shown in Fig.Q4(b). Determine the magnitude of force P required to impend the motion taking  $\mu = 0.2$ . (12 Marks)

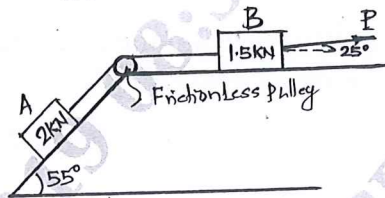


Fig.Q4(b)

**Module-3**

- 5 a. State and prove Varignon's theorem. (06 Marks)
- b. Two spheres each of radius 100mm and weight 5 kN is in a rectangular box as shown in Fig.Q5(b). Calculate the reactions at all the points of contact. (14 Marks)

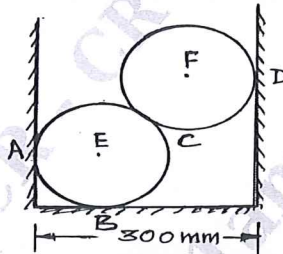


Fig.Q5(b)

OR

- 6 a. Explain the different types of supports with sketches. (06 Marks)
- b. A beam ABCDE has a flexible link BC as shown in Fig.Q6(b). Determine the support reactions at A, D and E. (14 Marks)

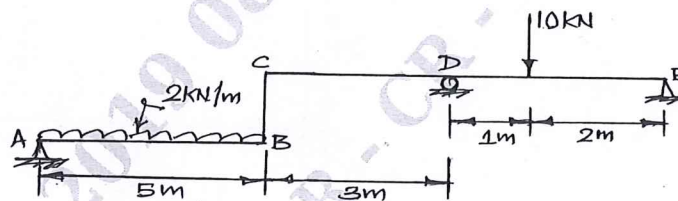


Fig.Q6(b)

**Module-4**

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- 7 a. State and prove parallel axis theorem. (06 Marks)
- b. Find the centroid of the shaded area shown in Fig.Q7(b), obtained by cutting a semicircle of diameter 100mm from the quadrant of a circle of radius 100 mm. (14 Marks)

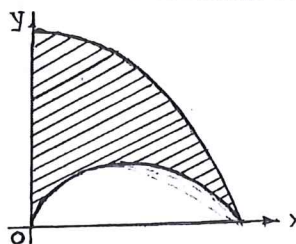


Fig.Q7(b)

OR

- 8 a. Explain the following (i) Centre of gravity (ii) Centroid (iii) Axis of symmetry. (06 Marks)  
 b. Determine the moment of inertia and radii of Gyration of the area shown in Fig.Q8(b) about the base AB and the centroidal axis parallel to AB. (14 Marks)

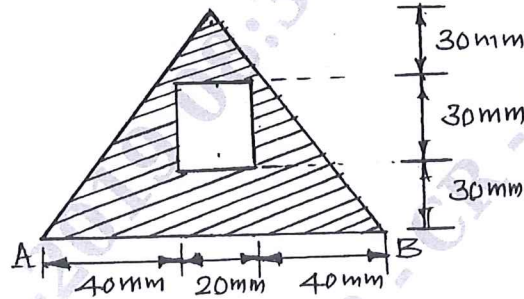


Fig.Q8(b)

**Module-5**

- 9 a. A stone is thrown upward with a velocity of 40 m/sec. Determine the time of the stone when it is at a height of 10m and is moving downwards. (10 Marks)  
 b. Two stones A and B are projected from the same point at inclination of  $45^\circ$  and  $30^\circ$  respectively to the horizontal. Find the ratio of the velocities of projection of A and B if the maximum height reached by them is the same. (10 Marks)

OR

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- 10 a. A highway curve of 250m radius is banked for a speed of 45 kmph. Determine the amount of super elevation if the width of the road is 16m. (06 Marks)  
 b. An elevator being lowered into a mine shaft starts from rest and attains a speed of 10 m/sec within a distance of 15m. The elevator alone has a mass of 500 kg and it carries a box of mass 600kg with it. Find the total tension in the cables supporting the elevator, during the accelerated motion. Also find the total pressure between the box and the floor of the elevator. (14 Marks)

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