

**First/Second Semester B.E. Degree Examination, Dec.2018/Jan.2019**  
**Elements of Civil Engineering & Engineering Mechanics**

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting ONE full question from each module.**

**Module – 1**

- 1 a. Give the classification of dam with neat sketches. (10 Marks)  
 b. A 100 N vertical force is applied at the end of a lever that is attached to a shaft as shown in Fig. Q1 (b). Determine : (i) The moment of the force about O. (ii) The horizontal force at A that will produce same moment about O. (iii) The minimum force at A to produce same moment about O. (06 Marks)

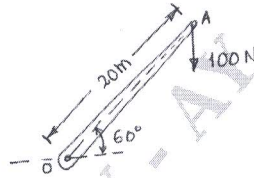


Fig. Q1 (b)

- c. Define force. List the characteristics of a force. (04 Marks)
- 2 a. State the Newton's laws of motion. (03 Marks)  
 b. A 5 kN force acts on a link as shown in Fig. Q2 (b). Replace the force by an equivalent-force couple system acting at point B. (07 Marks)

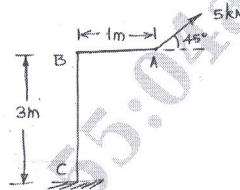


Fig. Q2 (b)

- c. State and explain 'Principle of Transmissibility'. (04 Marks)  
 d. Explain briefly the scope of civil engineering in (i) Environmental engineering (06 Marks)  
 (ii) Irrigation engineering.

**Module – 2**

- 3 a. Differentiate between : (i) Resultant and equilibrant (ii) Resolution and composition of forces (iii) Concurrent and non-concurrent forces. (06 Marks)  
 b. Resolve 600 N force shown in Fig. Q3 (b) along,  
 (i) Horizontal and Vertical components.  
 (ii) Parallel and normal to the inclined plane. (08 Marks)  
 c. A cylinder is to be lifted by two cables as shown in Fig. Q3 (c) knowing that the tension in one cable is 600 N, determine the magnitude and direction of the force P so that the resultant is a vertical force of 900 N. (06 Marks)

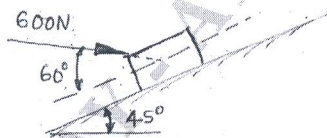


Fig. Q3 (b)

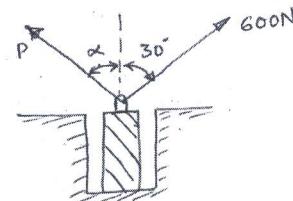


Fig. Q3 (c)

- 4 a. State and prove Varignon's theorem. (07 Marks)  
 b. Find the resultant of the force system acting on the plate ABCD as shown in Fig. Q4 (b) with respect to point A. (13 Marks)

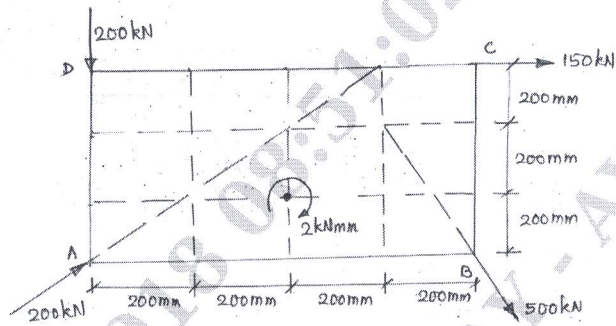


Fig. Q4 (b)

**Module – 3**

- 5 a. List the conditions of equilibrium for:  
 (i) Coplanar concurrent force system.  
 (ii) Coplanar nonconcurrent force system. (05 Marks)  
 b. What do you mean by statically determinate beams? Give examples with sketches. (05 Marks)  
 c. A small block of weight 1000 N is placed on an inclined plane at  $30^\circ$  as shown in Fig. Q5 (c). If  $\mu = 0.25$ , determine the horizontal force for, (i) impending motion up the plane and (ii) impending motion down the plane. (10 Marks)



Fig. Q5 (c)

- 6 a. Define : (i) Angle of friction (ii) Angle of repose (iii) Cone of friction. (06 Marks)  
 b. State and prove Lami's theorem. (04 Marks)  
 c. Determine the support reactions for the beam loaded as shown in Fig. Q6 (c). (10 Marks)

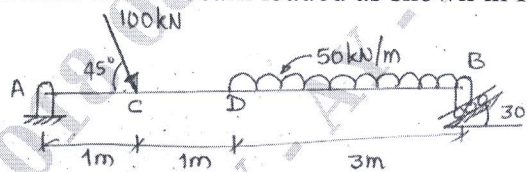


Fig. Q6 (c)

**Module – 4**

- 7 a. State and prove parallel axis theorem. (06 Marks)  
 b. Derive the expression for centroid of a circular sector. (07 Marks)  
 c. Find the coordinates of the centroid of a shaded area shown in Fig. Q7 (c) with respect to x and y axes. (07 Marks)

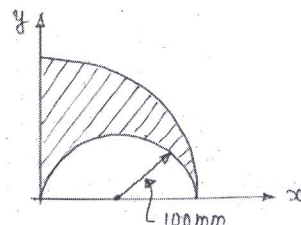


Fig. Q7 (c)



- 8 a. Define radius of gyration. Give expression. (04 Marks)  
 b. Derive an expression for MI of a rectangle about one of its side. (06 Marks)  
 c. Determine MI and radius of gyration of T-section shown in Fig. Q8 (c) about axis AB. (10 Marks)

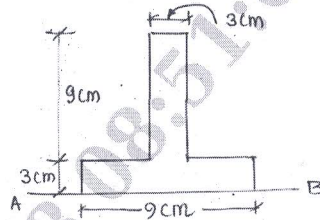


Fig. Q8 (c)

**Module – 5**

- 9 a. Define (i) Instantaneous velocity (ii) Average velocity (04 Marks)  
 b. Derive the displacement equation in terms of constant acceleration, initial velocity and time. (04 Marks)  
 c. Three marks A, B and C spaced at a distance of 100 m are made along a straight road. A car starting from rest and accelerating uniformly passes the mark A and takes 10 sec to reach B and further 8 sec to reach mark C. Calculate : (i) the magnitude of the acceleration of the car, (ii) the velocity of car at A (iii) the velocity of car at B (iv) the distance of mark A from the starting point. (12 Marks)
- 10 a. Define superelevation. What is its necessity? (04 Marks)  
 b. A stone is dropped into a well and the sound of splash is heard after 3.63 sec. How far below is the surface of water? Assume velocity of sound as 330 m/s. (08 Marks)  
 c. A canon ball is fired from a point A on a vertical cliff with a horizontal velocity of 120 m/s as shown in Fig. Q10 (c). If the canon is located 60 m above the water surface, determine the time for the canon ball to strike the water surface and the range R. (08 Marks)

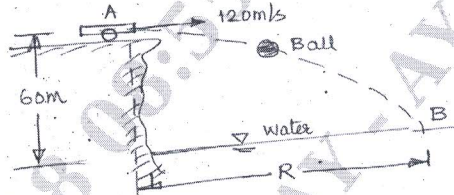


Fig. Q10 (c)

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