

# CBCS SCHEME

USN

HAD 16CVO22

15CIV13/23

## First/Second Semester B.E. Degree Examination, Dec.2019/Jan.2020 Elements of Civil Engineering and Mechanics

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Explain briefly the role of civil engineers in the infrastructure development of a country. (06 Marks)  
b. Draw typical cross section of a road and explain its components. (06 Marks)  
c. A 100N vertical force is applied to the end of a lever which is attached to a shaft as shown in Fig.Q.1(c). Determine:  
i) Moment of force about 'O' (04 Marks)  
ii) The horizontal force applied at 'A' which creates same moment about 'O'. (04 Marks)

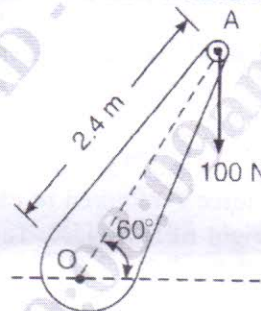


Fig.Q.1(c)

OR

- 2 a. Reduce the system in Fig.Q.2(a) to  
i) Single force  
ii) Single force and couple at A  
iii) Single force and couple at B (06 Marks)

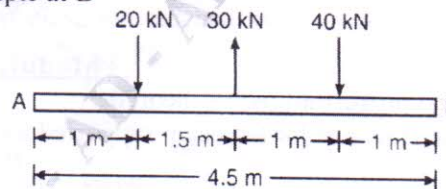


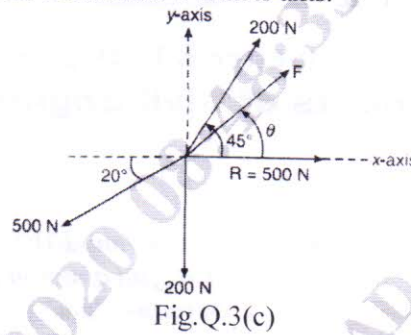
Fig.Q.2(a)

- b. Define couple. Explain its characteristics. (04 Marks)  
c. Distinguish between Gainty Dam and Earthen Dam. (06 Marks)

### Module-2

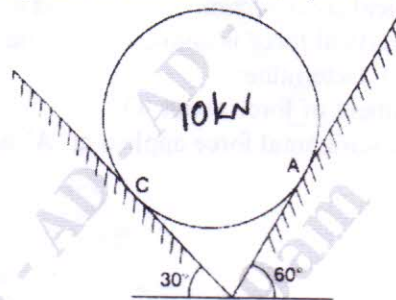
- 3 a. State and prove parallelogram law of forces. (06 Marks)  
b. State the laws of static friction. (04 Marks)

- c. Four coplanar forces acting at a point are as shown in Fig.Q.3(c). One of the forces is unknown and its magnitude is as shown by 'F'. The resultant is 500N and is along x-axis. Determine the force 'F' and its inclination  $\theta$  with x-axis. (06 Marks)

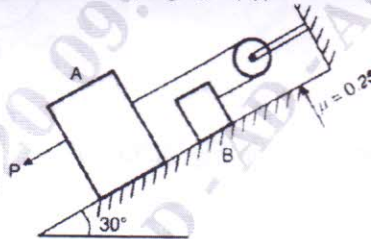


OR

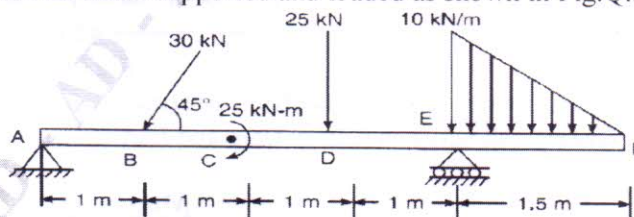
- 4 a. State and prove Lami's theorem. (04 Marks)  
b. Determine the reactions at the point of contact for the sphere shown in Fig.Q.4(b). (04 Marks)



- c. Determine the force P required to cause motion of blocks to impend. Take the weight of A as 90N and weight of B as 45N. Take the coefficient of friction for all contact surfaces as 0.25. Consider the pulleys as frictionless (Fig.Q.4(c)). (08 Marks)

**Module-3**

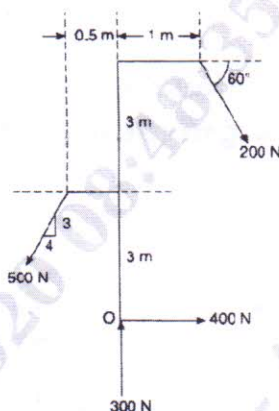
- 5 a. State and prove Varignon's theorem. (06 Marks)  
b. Find the reactions for the beam supported and loaded as shown in Fig.Q.5(b). (10 Marks)



OR

- 6 a. Explain different type of supports with sketches and reactions. (06 Marks)  
 b. Determine the resultant of the four forces acting on a frame as shown in Fig.Q6(b) with respect to point 'O'. (10 Marks)

Fig.Q.6(b)

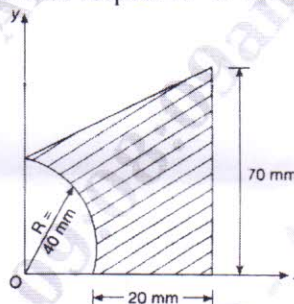
**Module-4**

- 7 a. Derive an expression for the centroid of semicircle with respect to base. (06 Marks)  
 b. Compute the Radii of gyration about its centroidal axes Fig.Q.7(b). (10 Marks)

OR

- 8 a. Derive an expression for the moment of inertia of a quadrant about its centroidal axes. (08 Marks)  
 b. Determine the position of centroid with respect to 'O' shown in Fig.Q.8(b). (08 Marks)

Fig.Q.8(b)

**Module-5**

- 9 a. What is Projectile? Define the following term briefly: i) Angle of projection ii) Horizontal range iii) Vertical height and iv) Time of flight. (08 Marks)  
 b. A stone is thrown vertically upward from the top of tower 20m high with a velocity of 15m/s. Find: i) The highest elevation reached by the stone ii) The time required for the stone to cross the top of tower during its downward motion and corresponding velocity. (08 Marks)

OR

- 10 a. What is super elevation? What is its purpose? (04 Marks)  
 b. The particle moves along a curve of characteristic  $x = 0.65y^2$ . Its value of motion is  $x = 4r^2$  at the instant when  $t = 3s$ . Determine: i) The displacement of particle from origin ii) The velocity of particle iii) The acceleration of particle. (06 Marks)  
 c. The acceleration of a particle is defined by  $a = -3m/s^2$  if  $V = 9m/s$  and  $V = 9m/s$  and  $x = 0$  when  $t = 0$ . Determine: i) Velocity ii) Distance travelled at  $t = 9s$ . (06 Marks)

\*\*\*\*\*