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10CIV13/23

**First/Second Semester B.E. Degree Examination, June/July 2017**  
**Elements of Civil Engineering and Engineering Mechanics**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, choosing at least two from each part.**

**PART – A**

- 1 a. Choose the correct answers for the following :
- Geotechnical Engineering involves the study of \_\_\_\_\_.  
 A) Air                      B) Highway                      C) Soil                      D) Dams
  - Bascule bridge is a \_\_\_\_\_ bridge.  
 A) Floating                      B) Movable                      C) Arch                      D) Suspension
  - Reinforced cement concrete (RCC) comes under \_\_\_\_\_.  
 A) Structural Engineering                      B) Geotechnical Engineering  
 C) Transportation Engineering                      D) Hydraulics
  - Kerbs are components of \_\_\_\_\_.  
 A) Bridges                      B) Buildings                      C) Dams                      D) Roads.                      **(04 Marks)**
- b. What are the purposes of dams? List out any four types. **(06 Marks)**
- c. Explain briefly the scope of civil engineering in the following :  
 i) Geotechnical engineering    ii) Environmental engineering. **(10 Marks)**
- 2 a. Choose the correct answers for the following :
- Effect of force on a body depends on \_\_\_\_\_.  
 A) Direction                      B) Position                      C) Magnitude                      D) All of these.
  - In a tug of war, two opposing teams are pulling the rope with equal and opposite forces of 1000N at each end. The tension in the rope is \_\_\_\_\_.  
 A) 0                      B) 1000N                      C) 2000N                      D)  $1000\sqrt{2}$  N.
  - In coplanar concurrent force system, if  $\sum H = 0$ , then the direction of resultant is \_\_\_\_\_.  
 A) Horizontal                      B) Moment                      C) Vertical                      D) None of these.
  - The magnitude of the moment is \_\_\_ when a force is applied perpendicular to the lever.  
 A) Zero                      B) Negative                      C) Minimum                      D) Maximum. **(04 Marks)**
- b. State and explain basic principles of idealization in engineering mechanics. **(06 Marks)**
- c. Four Coplanar forces acting at a point are as shown in Fig Q2(c) out of which one of the forces is unknown whose magnitude is "F". If the resultant is 250N acting along X axis, determine the magnitude of unknown force "F" and its direction "θ". **(10 Marks)**

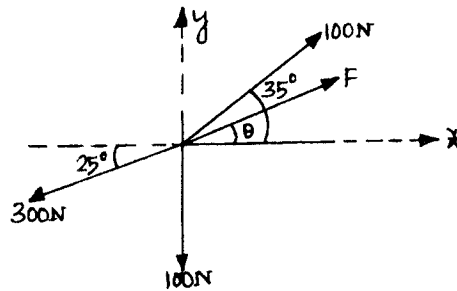


Fig. Q2(c)

- 3 a. Choose the correct answers for the following :
- The method of finding the resultant of a system of forces is called \_\_\_\_\_.  
 A) Resultant                      B) Resolution                      C) Composition                      D) None.

- ii) Varignon's theorem is not applicable for \_\_\_\_\_ force system.  
 A) Coplanar non-concurrent                      B) Non-coplanar non-concurrent  
 C) Concurrent                                      D) Parallel.
- iii) In a coplanar concurrent force system, if  $\sum V=0$ , then the resultant is \_\_\_\_\_.  
 A) Horizontal                      B) Vertical                      C) Moment                      D) None.
- iv) If two forces of magnitude  $\frac{P}{2}$  act at right angles to each other, then their resultant is \_\_\_\_\_.  
 A)  $2P$                       B)  $P\sqrt{2}$                       C)  $\frac{P}{\sqrt{2}}$                       D)  $\frac{P}{2}$ .                      (04 Marks)
- b. State and prove the principle of moments.                      (08 Marks)
- c. Find the resultant and direction of the coplanar force system acting on a body OABC as shown in Fig. Q3(c). Also find the points where the resultant will cut the X and Y axis.                      (08 Marks)

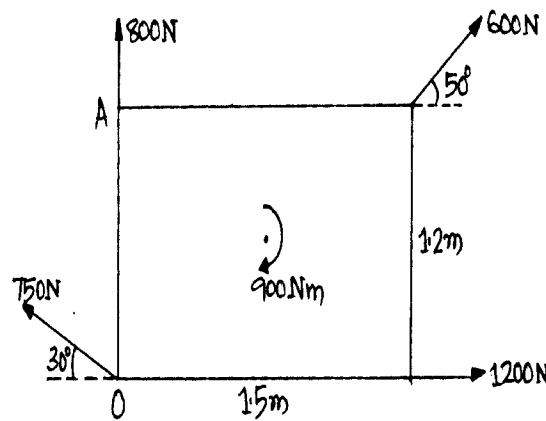


Fig. Q3(c)                      (08 Marks)

- 4 a. Choose the correct answers for the following :
- i) The moment of total about the centroidal axis is \_\_\_\_\_.  
 A) Zero                      B) Twice the area                      C) Thrice the area                      D) None.
- ii) The co-ordinates of the centroid of the right angled triangle shown in Fig. Q4(a)(i) is \_\_\_\_\_.  
 A)  $(\frac{b}{3}, \frac{h}{3})$                       B)  $(\frac{2b}{3}, \frac{h}{3})$                       C)  $(\frac{b}{3}, \frac{2h}{3})$                       D)  $(\frac{2b}{3}, \frac{2h}{3})$
- iii) If a plane Figure is symmetrical about y-y axis, the centroid their in \_\_\_\_\_.  
 A) X-axis                      B) y-y axis                      C) Bottom                      D) Top.
- iv) The centroid of a semicircle of radius R about a centriodal axis parallel to its diametrla axis is \_\_\_\_\_.  
 A)  $\frac{3R}{4\pi}$                       B)  $\frac{3R}{8\pi}$                       C)  $\frac{4R}{\pi}$                       D)  $\frac{4R}{3\pi}$                       (04 Marks)

- b. Locate the centroid for the shaded area as shown in Fig. Q4(b).                      (08 Marks)

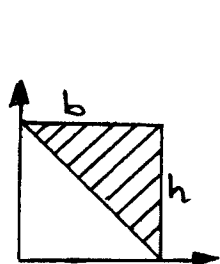


Fig. Q4(a)(ii)

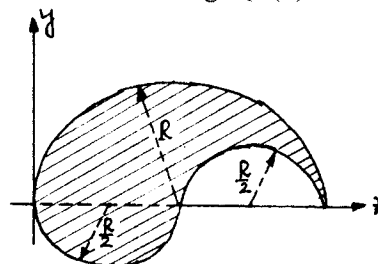


Fig Q4(b)

- c. Determine the centroid of the area shown in Fig. Q4(c)

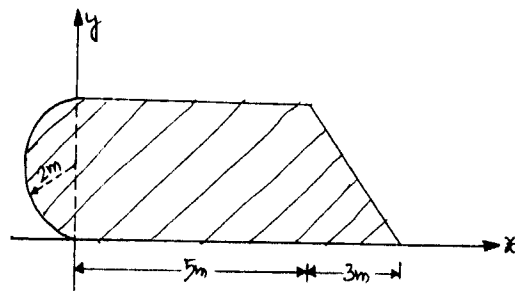


Fig. Q4(c)

(08 Marks)

**PART – B**

- 5 a. Choose the correct answers for the following :

- i) Lami's theorem is valid for \_\_\_\_\_.
  - A) Two concurrent forces in equilibrium
  - B) Four concurrent forces in equilibrium
  - C) Three concurrent forces in equilibrium
  - D) None.
- ii) A particle is acted upon by two forces of equal magnitude and is in equilibrium. The angle between the two forces is \_\_\_\_\_.
  - A) Zero
  - B) 90°
  - C) 180°
  - D) 45°
- iii) The force which is equal and opposite to the resultant is \_\_\_\_\_.
  - A) Resultant force
  - B) Force
  - C) Moment
  - D) Equilibrant.
- iv) In a non-concurrent force system, if  $\sum H = 0$  and  $\sum V = 0$ , then the resultant is \_\_\_\_\_.
  - A) Positive force
  - B) Negative force
  - C) Moment
  - D) Zero.

(04 Marks)

- b. Find the reaction from the inclined plane and tension in string for the arrangement shown in Fig. Q5(b). Take the weight of the ball as 500N.

(06 Marks)

- c. The system of connected flexible cables shown in Fig. Q5(c) in supporting loads 100N and 500N at B and D respectively. Find the tension in various segments.

(10 Marks)

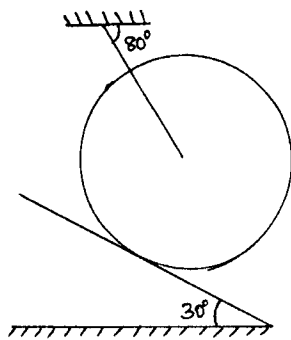


Fig. Q5(b)

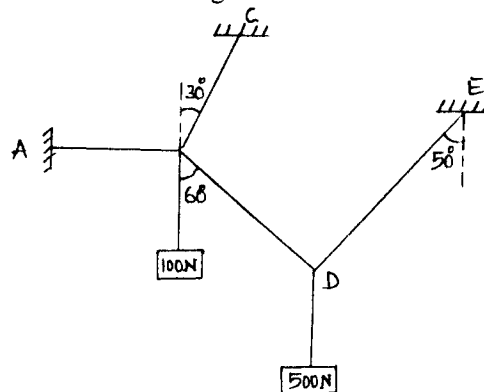


Fig Q5(c)

- 6 a. Choose the correct answers for the following :

- i) At the fixed end of the cantilever beam, the numbers of unknown reactions are \_\_\_\_\_.
  - A) 1
  - B) 2
  - C) 3
  - D) 4
- ii) The support reaction for statically determinate beams can be determined by applying \_\_\_\_\_.
  - A) Conditions of static equilibrium
  - B) Lami's theorem
  - C) Varignon's principle
  - D) None.
- iii) The portion of the beam extending beyond supports is known as \_\_\_\_\_ beam.
  - A) Propped cantilever
  - B) Continuous
  - C) Overhanging
  - D) Cantilever.
- iv) The beam with three or more supports is known as \_\_\_\_\_ beam.
  - A) Cantilever
  - B) Fixed
  - C) Propped
  - D) Continuous.

(04 Marks)

- b. Explain the different types of supports and loads on the beam with the help of neat sketch.

(08 Marks)

- c. A beam ABCDEF is hinged at A and supported on rollers at E and carries the loads as shown in Fig. Q6(c). Determine the reactions at supports. (08 Marks)

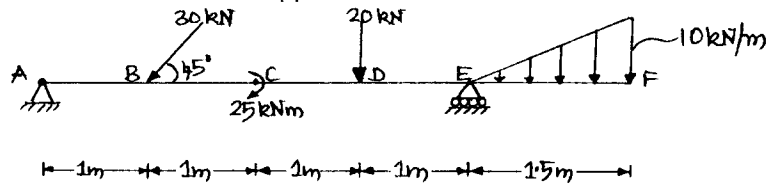


Fig. Q6(c)

- 7 a. Choose the correct answers for the following :
- The frictional force is independent of \_\_\_\_\_.  
 A) Coefficient of friction B) Angle of friction C) Area of contact D) None.
  - The coefficient of friction depends on \_\_\_\_\_.  
 A) Area of contact B) Shape and surface C) Strength of surface D) None.
  - The force of friction developed at the contact surface is always \_\_\_\_\_.  
 A) Parallel to the plane and along the direction of applied force  
 B) Perpendicular to the plane  
 C) Parallel to the plane and opposite to the direction of motion D) All of these.
  - The angle of friction is the angle between \_\_\_\_\_.  
 A) Inclined and horizontal surface  
 B) The normal reaction and the frictional force  
 C) The weight of the body and the frictional force  
 D) The normal reaction and the resultant. (04 Marks)
- b. State the laws of static and dynamic friction. (08 Marks)
- c. A block weighing 1000N rests on a plane inclined at  $20^\circ$  to the horizontal. If  $\mu = 0.25$ , find the force required to push the block up the plane when the line of action makes an angle of  $30^\circ$  with the plane as shown in Fig. Q7(c) (08 Marks)

- 8 a. Choose the correct answers for the following :
- The moment inertia is a \_\_\_\_\_.  
 A) First moment of area B) Second moment of area  
 C) Third moment of area D) None.
  - The unit of radius of gyration of an area is a \_\_\_\_\_.  
 A) N/m B)  $N/m^2$  C)  $m^3$  D) m
  - The moment of inertia of a circle with 'D' as diameter about its centroidal axis is \_\_\_\_\_.  
 A)  $\frac{\pi D^2}{32}$  B)  $\frac{\pi D^2}{64}$  C)  $\frac{\pi D^4}{32}$  D)  $\frac{\pi D^4}{64}$
  - The moment of inertia of a triangular section about base 'b' and height 'h' is \_\_\_\_\_.  
 A)  $\frac{bh^3}{36}$  B)  $\frac{bh^3}{12}$  C)  $\frac{bh^3}{64}$  D) None. (04 Marks)
- b. Derive the expression for moment of inertia of a semicircular lamina of radius 'R' about a centroidal axis parallel to the diameter. (06 Marks)
- c. Determine the moment of inertia about the centroidal axis for a lamina shown in Fig. Q8(c). (10 Marks)

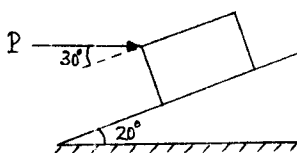


Fig Q7(c)

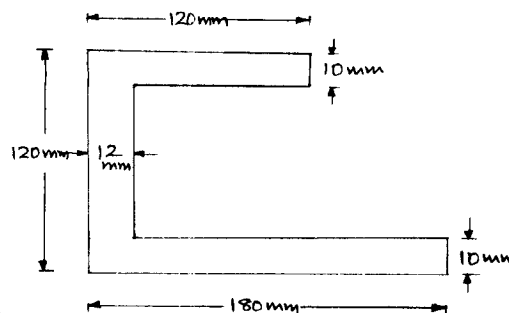


Fig Q8(c)