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**First/Second Semester B.E. Degree Examination, June 2012**  
**Elements of Civil Engineering and Engineering Mechanics**

Time: 3 hrs.

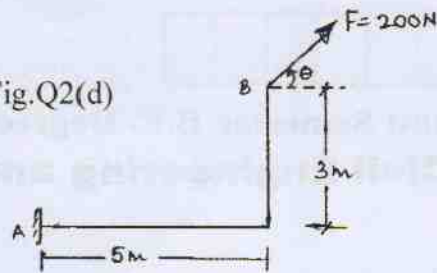
Max. Marks:100

- Note:** 1. Answer FIVE full questions choosing at least two from each part.  
2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.  
3. Answer to objective type questions on sheets other than OMR will not be valued.

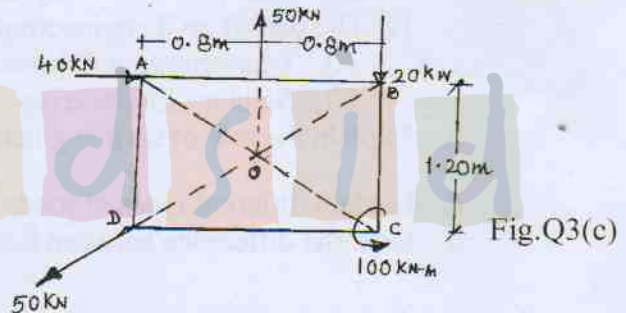
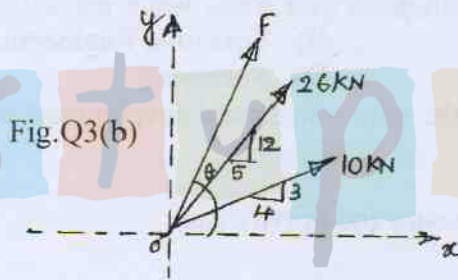
**PART – A**

1. a. Select the correct answer : (04 Marks)
- i) A Bascule bridge is a  
A) Floating bridge                      B) Arch bridge  
C) Suspension bridge                  D) Movable bridge
  - ii) Geotechnical engineering involves the study of  
A) Water                      B) Soil                      C) Air                      D) All of these
  - iii) Pick up a structure in which an inspection gallery is formed  
A) Dam                      B) Bridge                      C) Harbour                      D) Airport
  - iv) The part of civil engineering which deals with waste water and solid waste is called  
A) Transportation Engineering                  B) Structural Engineering  
C) Sanitary Engineering                      D) Surveying
- b. Explain the role of civil engineer in the infra – structural development of a nation. (06 Marks)
- c. Explain different types of roads. (06 Marks)
- d. Give the difference between Earthen dam and gravity dam. (04 Marks)
2. a. Select the correct answer : (04 Marks)
- i) The moment of a force about a moment centre is a measure of its  
A) Translatory effect                      B) Rotational effect  
C) Both A and B                      D) None of these
  - ii) Effect of force on a body depends on  
A) Magnitude                  B) Direction                  C) Position                  D) All of these
  - iii) Couple means two forces acting parallel and  
A) Equal in magnitude and in same direction  
B) Not equal in magnitude but in same direction  
C) Equal in magnitude but opposite in direction  
D) None of these
  - iv) The magnitude of the moment is \_\_\_\_\_ when a force is applied perpendicular to a lever  
A) Maximum                  B) Minimum                  C) Zero                      D) Negative
- b. State and explain principle of transmissibility of a force. (04 Marks)
- c. Explain equivalent force – couple system. (04 Marks)
- d. Determine angle  $\theta$  ( $0 \leq \theta \leq 180^\circ$ ) for the force  $F = 200\text{N}$  shown in fig.Q2(d), so that it produces (a) maximum moment about 'A' and (b) minimum moment about 'A'. Determine maximum and minimum moments. (08 Marks)

Fig.Q2(d)



3. a. Select the correct answer : (04 Marks)
- The process of finding the resultant of a system of forces is called  
A) Resultant B) Resolution C) Composition D) None of these
  - If two forces P and Q ( $P > Q$ ) act on the same straight line but in opposite direction their resultant is  
A)  $P + Q$  B)  $\frac{P}{Q}$  C)  $Q - P$  D)  $P - Q$
  - Component of a force at a right angles to its line of action is  
A) Zero B) Positive C) Negative D) None of these
  - In a coplanar concurrent force system if  $\Sigma H = 0$ , then the resultant is  
A) Horizontal B) Vertical C) Moment D) None of these
- b. The 26kN force is the resultant of two forces, one of which is shown in fig.Q3(b). Determine the other force. (08 Marks)



- c. A rigid plate is subjected to the forces as shown in fig.Q3(c), compute resultant of forces and position of resultant force with respect to centroid point 'O' of the plate. (08 Marks)
4. a. Select the correct answer : (04 Marks)
- Centroid of semicircle of radius 'R' about its centroidal axis parallel to diametric axis is  
A)  $\frac{3R}{4\pi}$  B)  $\frac{3R}{8\pi}$  C)  $\frac{4R}{\pi}$  D)  $\frac{4R}{3\pi}$
  - An axis over which one half of plane figure is just mirror image of the other half is  
A) Axis of symmetry B) Unsymmetrical axis  
C) Bottom most axis D) None of these
  - Moment of total area about its centroidal axis is  
A) Twice the area B) Three times the area  
C) Zero C) None of these
  - The centroid of a triangular lamina of height 'h' is situated at a distance \_\_\_\_ from its apex.  
A)  $\frac{h}{3}$  B)  $\frac{2h}{3}$  C)  $\frac{h}{2}$  D)  $\frac{h}{4}$



b. Locate the centroid of the shaded area shown in fig.Q4(b), with respect to point 'O'.

(08 Marks)

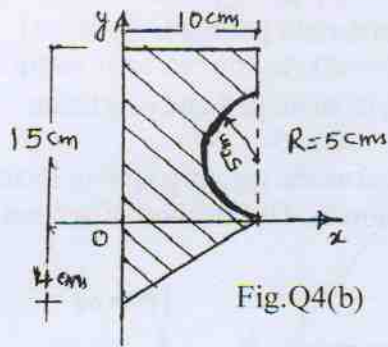


Fig.Q4(b)

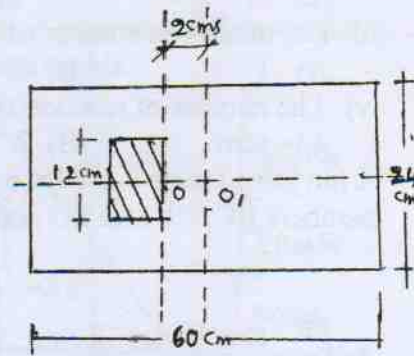


Fig.Q4(c)

c. The centroid of the rectangular area requires to be shifted from point 'O' to O<sub>1</sub> (2 cms). This is accomplished by removing hatch portion which is 12cm deep and symmetrical about X X-axis. Determine area of hatched portion shown in fig.Q4(c). (08 Marks)

**PART - B**

5. a. Select the correct answer :

(04 Marks)

- i) The force which is equal and opposite to resultant is
  - A) Resultant force
  - B) Moment
  - C) Equilibrant
  - D) None of these
- ii) A particle acted upon by the two forces of equal magnitude is in equilibrium. The angle between the forces is
  - A) 0°
  - B) 90°
  - C) 180°
  - D) 45°
- iii) The necessary condition of equilibrium of a coplanar concurrent force system is algebraic sum of \_\_\_\_\_ must be zero.
  - A) Horizontal and Vertical forces
  - B) Moment of forces
  - C) Horizontal vertical and moment of forces
  - D) None of these
- iv) Lami's equation can be applied when number of unknown forces are \_\_\_\_
  - A) TWO
  - B) Five
  - C) Four
  - D) Three

b. Determine the angle  $\theta$  for the system of strings ABCD in equilibrium as shown in fig.Q5(b). (08 Marks)

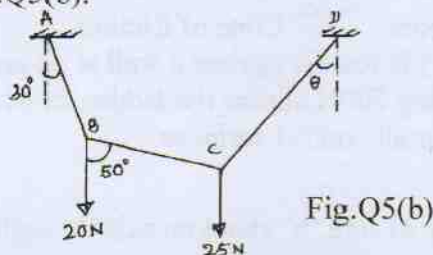


Fig.Q5(b)

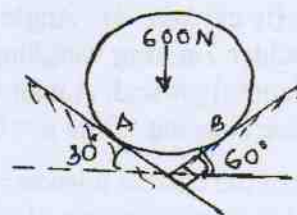


Fig.Q5(c)

c. A cylinder of weight 600N rests on smooth surfaces as shown in fig. Q5(c). Determine the reactions at contact points. The contact surfaces are perpendicular to each other. (08 Marks)

6. a. Select the correct answer :

(04 Marks)

- i) A cantilever beam is one in which \_\_\_\_\_
  - A) Both ends are fixed
  - B) Both ends are hinged
  - C) One end is fixed and other end is simply supported
  - D) One end is fixed and other end is free.

- ii) A truss is perfect when  
 A)  $m = 2j - 3$     B)  $2j = m + 3$     C)  $m = 3j - 2$     D)  $2j = m - 3$
- iii) The minimum number of members to form a perfect truss is  
 A) 1    B) 2    C) 3    D) 4
- iv) The number of reaction components at a hinged end of a beam  
 A) zero    B) 2    C) 3    D) 1
- b. A pin jointed truss is loaded and supported as shown in fig.Q6(b). Determine forces in members BC, GF and CG and nature of forces. Use method of section. (08 Marks)

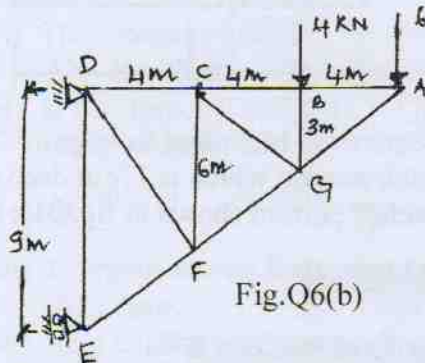


Fig.Q6(b)

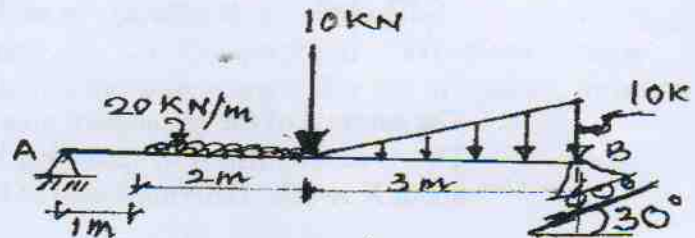


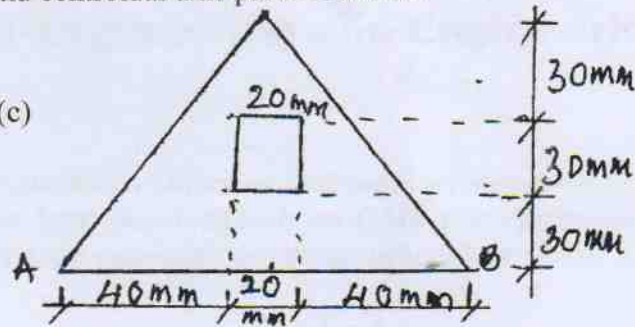
Fig.Q6(c)

- c. Find the reactions for the beam supported and loaded as shown in fig.Q6(c).(08 Marks)
7. a. Select the correct answer : (04 Marks)
- i) Compared to static friction, kinetic friction is  
 A) greater    B) smaller    C) very large    D) zero
- ii) Frictional force acts \_\_\_\_\_ to the surfaces in contact  
 A) Tangential    B) Normal    C) Inclined    D) None of these
- iii) The force of friction depends on  
 A) Area of contact    B) Roughness of surfaces  
 C) Both area of contact and roughness of surfaces  
 D) None of these
- iv) At the point of impending motion, the static frictional force is  
 A) Zero    B) Maximum    C) Minimum    D) Infinite
- b. State laws of static friction. (04 Marks)
- c. Briefly explain i) Angle of repose    ii) Cone of friction. (04 Marks)
- d. A ladder 7m long weighing 300N is resting against a wall at an angle of  $60^\circ$  to the horizontal ground. A man weighing 700N climbs the ladder, at what position does he induce slipping. Take  $\mu = 0.25$  for all contact surfaces. (08 Marks)
8. a. Select the correct answer : (04 Marks)
- i) Moment of inertia of a square of side 'b' about an axis through its centroid is  
 A)  $\frac{b^4}{12}$     B)  $\frac{b^4}{8}$     C)  $\frac{b^4}{36}$     D)  $\frac{b^3}{12}$
- ii) Moment of inertia of a triangle of base 'b' and height 'h' about its base is  
 A)  $\frac{bh^3}{36}$     B)  $\frac{bh^4}{36}$     C)  $\frac{hb^3}{12}$     D)  $\frac{Bh^3}{12}$
- iii) The unit of radius of gyration is  
 A) mm    B)  $\text{mm}^2$     C) KN - m    D)  $\text{mm}^4$
- iv) Which of the following equation relating to radii of gyration is correct?  
 A)  $K_{zz} = K_{xx} + K_{yy}$     B)  $K_{xx} = K_{yy} + K_{zz}$   
 C)  $K_{zz}^2 = K_{xx}^2 + K_{yy}^2$     D) None of these



- b. State and prove parallel axis theorem. (06 Marks)
- c. Determine moment of inertia and radius of gyration of the area shown in fig.Q8(c), about base AB and centroidal axis parallel to AB. (10 Marks)

Fig.Q8(c)



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