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10CIV13/23

First/Second Semester B.E. Degree Examination, December 2011
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any 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) Abuttment is a part of
A) Road B) Bridge C) Dam D) Building

ii) Which of the following is not an irrigation infrastructure?
A) Dam B) Canal C) Jackwell D) Road

iii) Surveying mainly deals with
A) Communication B) Environment C) Material D) Measurement

iv) Geotechnical engineering mainly deals with
A) Space B) Air C) Earth D) Water

b. What are the purposes of dam? Name any four types of dams. **(08 Marks)**

c. Name : i) Types of roads ii) Types of bridges. **(08 Marks)**

2 a. Select the correct answer: **(04 Marks)**

i) Two forces having the same line of action are called
A) Coplanar parallel forces B) Non coplanar concurrent forces
C) Coplanar non concurrent forces D) Collinear forces

ii) The magnitude of the moment is zero, when the force is applied _____ the lever.
A) Perpendicular to B) Inline with C) At any angle to D) at 60° to

iii) Following is the unit of moment of a force
A) N B) Nm^2 C) N^2m D) Nm

iv) If two forces are parallel, then they cannot be
A) Coplanar B) Concurrent C) Non coplanar D) Non concurrent

b. A block of weight 200N is kept on the inclined plane and is fixed to the plane. Find the component of weight in the direction along the plane and perpendicular to the plane as indicated (Refer Fig. Q.2(b)) **(04 Marks)**

Fig. Q.2(b)

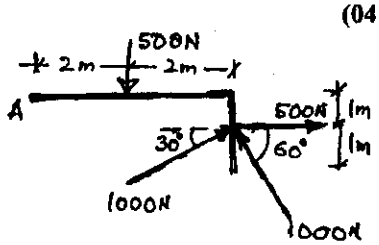

Fig. Q.2(c)

c. Replace the force system shown in Fig. Q.2(c) by a single force passing through A and moment of a couple. **(06 Marks)**

d. State Newton's laws of motion. **(06 Marks)**

3 a. Select the correct answer : **(04 Marks)**

i) The resultant of two concurrent forces becomes minimum if angle between them is _____

A) Zero B) 180° C) 90° D) 60°

ii) If two concurrent forces each of magnitude P act at right angles to each other, their resultant is

A) 2P B) Zero C) $P\sqrt{2}$ D) (P/2)

iii) The magnitudes of two given forces are 40N and 60N. Which of the following cannot be their resultant?

A) 20N B) 30N C) 40N D) 120N

iv) If the magnitude of resultant of two forces, of each magnitude P, is P, then the angle between the two forces is

A) Zero B) 45° C) 120° D) 60°

b. Compute the resultant of the forces, (Refer Fig.Q.3(b)) **(08 Marks)**

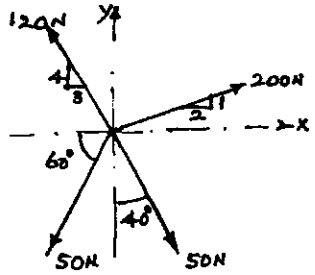

Fig.Q.3(b)

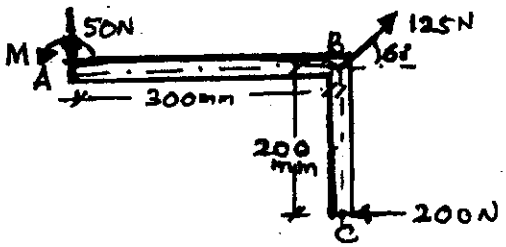

Fig. Q.3(c)

c. The three forces and a moment are applied to a bracket as shown in Fig. Q.3(c). Determine the moment, M, if the line of action of the resultant of the forces is to pass through B. Compute the resultant of the three forces and the moment. **(08 Marks)**

4 a. Select the correct answer : **(04 Marks)**

i) Moment of total area about its centroidal axis is _____

A) Twice the area B) Three times the area

C) Zero D) Area x(centroidal distance)^2

ii) For a steel ball of radius, R, _____

A) The centroid and centre of gravity are different

B) The centroid and centre of gravity are same

C) The centroid is half the centre of gravity D) None of these

iii) The co-ordinates of the centroid of a quadrant of a circle of radius, r is

A) $\bar{x} = \frac{4r}{3\pi}$, $\bar{y} = r$ B) $\bar{x} = r$, $\bar{y} = \frac{4r}{3\pi}$ C) $\bar{x} = \frac{4r}{3\pi}$, $\bar{y} = \frac{4r}{3\pi}$ D) $\bar{x} = r$, $\bar{y} = r$

iv) If the given plane figure is symmetrical about y–y axis only, then the centroid lies on —

A) The intersection of x–x axis and y–y axis B) x–x axis

C) y–y axis D) None of these

b. Determine the centroid of a semi circular area of radius r using method of integration. **(08 Marks)**

c. Locate the centroid of the shaded area. (All dimensions are in mm Refer Fig. Q.4(c)) **(08 Marks)**

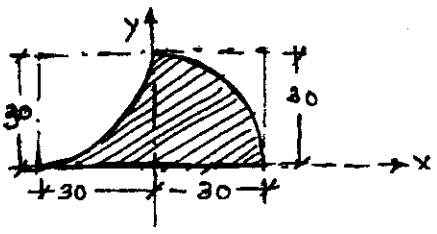

Fig. Q.4(c)

PART – B

5 a. Select the correct answer : **(04 Marks)**

i) A particle acted upon by two forces of equal magnitude having the same line of action is in equilibrium. The angle between the two forces is _____
A) 0° B) 90° C) 180° D) 45°

ii) For equilibrium of a body subjected to coplanar non concurrent forces, the _____
A) $\Sigma Fx = 0$ and $\Sigma Fy = 0$ B) $\Sigma Fx = 0$ and $\Sigma M = 0$
C) $\Sigma m = 0$ D) $\Sigma Fx = 0$, $\Sigma Fy = 0$ and $\Sigma m = 0$.

iii) Lami's theorem can be applied when _____ forces act on a body in equilibrium
A) Two B) Three C) Four D) None of the above

iv) A block of weight, W, is kept on a frictionless inclined plane making an angle, θ with the horizontal. The horizontal force, P, required to keep the block in equilibrium is
A) W sin θ B) (W/2)tan θ C) W tan θ D) (W/tan θ)

b. The collar of weight 264.6N may slide on a frictionless vertical rod and is connected to a 294N counter weight, C. Determine the value of 'h' for which the system is in equilibrium (Refer Fig. Q.5(b)) **(06 Marks)**

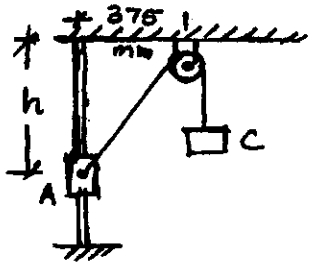

Fig. Q.5(b)

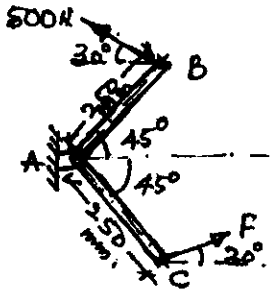

Fig. Q.5(c)

c. Find the force, F acting on the crank for equilibrium and also find the reaction at support. Refer Fig. Q.5(c) both arms of the crank are of 250mm length **(10 Marks)**

6 a. Select the correct answer : **(04 Marks)**

i) For a beam, if one end is supported on roller and the other on hinge, the beam is said to be
A) Fixed B) Hinged C) Cantilever D)Simply supported

ii) For a fixed end of a beam, the number of reaction components are _____
A) Three B) Two C) One D) Zero

iii) A cantilever beam is one in which _____
A) Both ends are fixed B) One end is fixed and other is free
C) Both ends are hinged D) Both ends are free

iv) A horizontal simply supported beam AB of length 5m is acted upon by a vertical point load of 10kN at a distance of 2m from A. The reactions of A and B respectively are
A) 4kN and 6kN B) 6kN and 4kN C) 5kN and 5kN D) 10kN and zero

b. Calculate the reactions at A, for the beam shown in Fig. Q.6(b). The beam is hinged at A and supported by cable at C. Self weight of the beam is 2kN/m (udl) as indicated. **(06 Marks)**

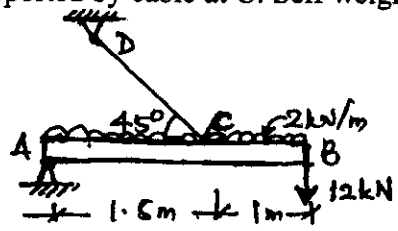

Fig. Q.6(b)

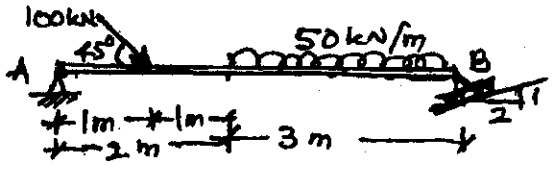

Fig. Q.6(c)

c. For the beam shown in Fig. Q.6(c), calculate the reactions at the supports. (Hinged support at A and roller support at B) **(10 Marks)**

7 a. Select the correct answer : **(04 Marks)**

i) Angle of friction is angle between _____
A) The incline and horizontal B) The normal reaction and friction force
C) The weight of the body and friction force D) Normal reaction and resultant

ii) The force of friction depends upon_____
A) Area of contact B) Roughness of surface
C) Both area of contact and roughness of surface D) None of these

iii) Compared to static friction, kinetic friction is _____
A) Greater B) Smaller C) Zero D) Very large

iv) If θ is the angle of friction and α is the angle of repose then which relation is correct?
A) $\theta = \frac{1}{\alpha}$ B) $\theta = \alpha$ C) $\theta = \tan\alpha$ D) $\alpha = \tan\theta$.

b. The position of the machine block B is adjusted by moving the wedge A. Knowing that the coefficient of static friction is 0.35 between all surfaces of contact, determine the force, P required to raise the block. B neglect the weight of wedge. (Refer Fig. Q.7(b). Weight of block B is 2kN. **(10 Marks)**

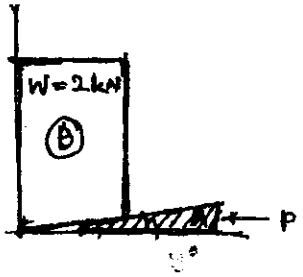

Fig. Q.7(b)

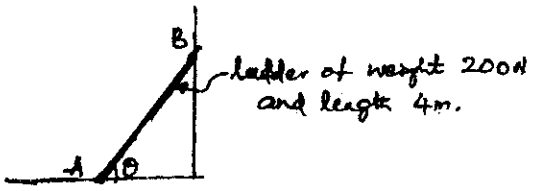

Fig. Q.7(c)

c. A ladder of 4m weighing 200N is supported by a horizontal floor and vertical wall as shown in Fig. Q.7(c). If a man of weight 650N climbs to the top of the ladder, determine the indication of the ladder with reference of the floor at which the ladder is to be placed to prevent slipping. Take the co–efficient of friction for all surfaces of contact as 0.25.**(06 Marks)**

8 a. Select the correct answer : **(04 Marks)**

i) The moment of inertia of a circle of diameter D about its centroidal axis is _____
A) $\pi D^2/32$ B) $\pi D^2/64$ C) $\pi D^4/32$ D) $\pi D^4/64$

ii) Moment of inertia is a _____
A) First moment of area B) Second moment of area
C) Third moment of area D) None of these

iii) Polar moment of inertia of a plane area is _____
A) Ixx X Iyy B) Ixx + Iyy C) Ixx / Iyy D) None of these

iv) The unit of moment of inertia of an area is _____
A) m^2 B) m C) m^4 D) m^3

b. State and prove parallel axis theorem : **(06 Marks)**

c. Find the moment of inertia of plane lamina (shaded) shown in Fig. Q.8(c) about x–x axis as indicated. **(10 Marks)**

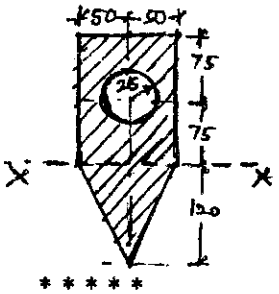

Fig. Q.8(c)

All dimensions in mm

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