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06CIV13/23

First/Second Semester B.E. Degree Examination, Dec.09/Jan.10

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 in 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. i) The part of civil engineering which deals with design of slabs, beams, columns, footings etc is called :
A) Transportation engineering B) Structural engineering
C) Geotechnical engineering D) Water supply engineering

ii) The science of map making is known as :
A) Estimation B) Surveying C) Town planning D) Construction technology

iii) The structure which provides passage over the obstacles like valley, river without closing the way under neath is :
A) Dam B) Bridge C) Harbour D) Airport

iv) Pick up a structure in which an inspection gallery is formed :
A) Gravity dam B) Bridge C) Harbour D) Airport **(04 Marks)**

b. Explain different types of dams, with neat sketches. **(08 Marks)**

c. Explain briefly the scope of civil engineering in :
i) Structural engineering ii) Transportation engineering **(08 Marks)**

2 a. i) Principle of transmissibility of forces states that, when a force acts upon a body, its effect is :
A) Minimum if it acts at the C.G. of the body
B) Maximum if it acts at the C.G. of the body
C) Same at every point on its line of action
D) Different at different points on its line of action

ii) Two parallel forces equal in magnitude and opposite in direction and separated by a definite distance are said to form :
A) Moment B) Couple C) Resultant D) Equilibriant

iii) Effect of a force on a body depends upon its :
A) Direction B) Position C) Magnitude D) All of these

iv) The forces which pass through a single point and lie in the same plane are :
A) Collinear forces B) Coplanar non-concurrent forces
C) Coplanar concurrent forces D) None of these **(04 Marks)**

b. Explain briefly : i) force and its characteristics ii) Couple and its characteristics. **(06 Marks)**

c. A force $F_1 = 1200$ N is acting vertically on an incline [Refer Fig.Q2(c)]. Find its components along X and Y axes. **(05 Marks)**

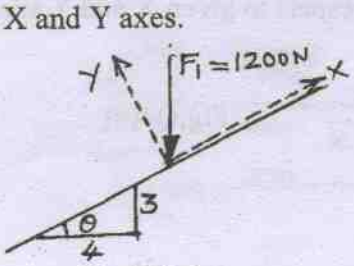

Fig.Q2(c)

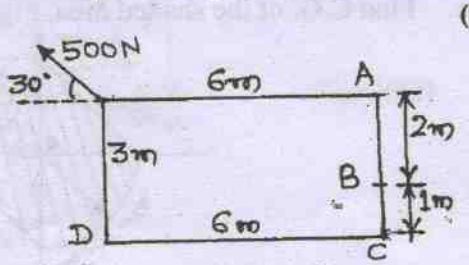

Fig.Q2(d)

d. Find the moment of 500 N force about the points A, B, C, D as in Fig.Q2(d). **(05 Marks)**

3 a. i) The single force which will have the same effect as the system of forces is :
A) Couple B) Resultant C) moment D) Force

ii) If two forces M and N (M > N) act on the same straight line but in opposite direction, their resultant is :
A) (M + N) B) M/N C) (N - M) D) (M - N)

iii) If the resultant of coplanar concurrent force system acts along horizontal X-axis, then :
A) $\Sigma Fx = 0$ B) $\Sigma Fx = R$ C) $\Sigma Fy = R$ D) None of these.

iv) The resultant of force system shown in Fig.Q3(a)(iv) :
A) 65 N B) 40 N
C) 76.32 N D) 32.76 N

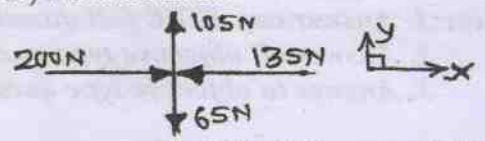

Fig.Q3(a)(iv) **(04 Marks)**

b. Three forces acting on a hook are as shown in Fig.Q3(b). Find the direction of the fourth force of magnitude 100 N such that the hook is pulled in X-direction only. Find the resultant force. **(08 Marks)**

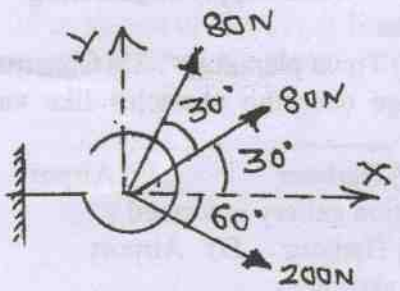

Fig.Q3(b)

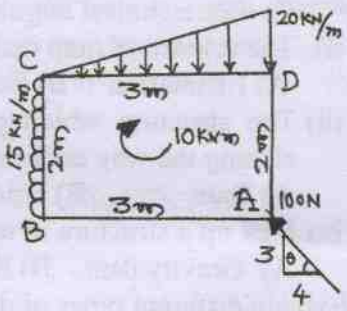

Fig.Q3(c)

c. Find magnitude and direction of the resultant force; also find X and Y intercepts of resultant force with respect to point A. [refer Fig.Q3(c)] **(08 Marks)**

4 a. i) The centroid of a triangle of height "h" is located at a --- distance from its base:
A) $h/2$ B) $2h/3$ C) $h/3$ D) h

ii) An axis over which one half of the 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

iii) If the given plane figure is symmetrical about vertical Y-Y axis, the centroid lies on :
A) X axis B) Vertical Y-Y axis C) Bottom D) Top

iv) The centriod of a plane lamina will not be at its geometrical center if it is a :
A) Rectangle B) Circle C) Right angled triangle D) Square **(04 Marks)**

b. Find C.G. of the shaded area, Fig.Q4(b) with respect to given X and Y axes.

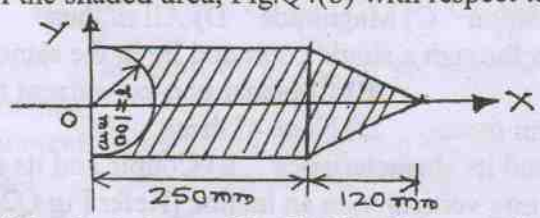

Fig.Q4(b)

(06 Marks)

c. Find C.G. of the shaded area, Fig.Q4(c) with respect to given X and Y axes.

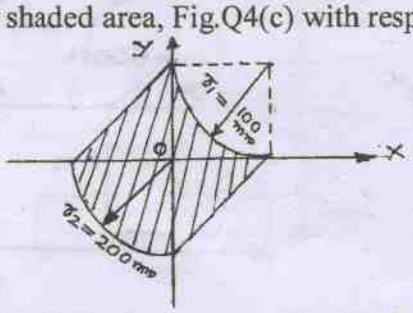

Fig.Q4(c)

(10 Marks)

PART – B

5 a. i) The force which is equal and opposite to resultant is :
A) Force B) Equilibriant C) Moment D) None of these

ii) The Lame's equation can be applied when number of unknown forces are :
A) Two B) Three C) Five D) None of these

iii) The necessary condition of equilibrium of co-planar concurrent force system is :
A) $\Sigma Fy = \Sigma Fx$ B) $\Sigma Fx = 0, \Sigma Fy = 0$ C) $\Sigma M = 0$ D) $\Sigma Fx - \Sigma Fy = 1$

iv) A system that possesses a resultant :
A) Will be in equilibrium B) Will be under rest
C) Will not be in equilibrium D) None of these **(04 Marks)**

b. Find the tension in the string and reaction at the contact surface for the cylinder of Wt = 1000 N placed as shown in Fig.Q5(b). Solve by Lame's theorem. **(06 Marks)**

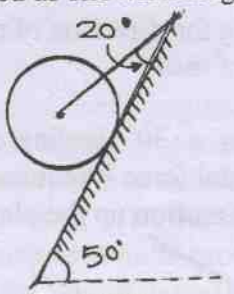

Fig.Q5(b)

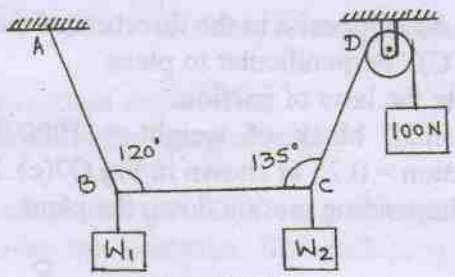

Fig.Q5(c)

c. In the Fig.Q5(c) shown, the portion BC is horizontal. Pulley is frictionless. Find tension in each part of the string and also find W_1 and W_2 using equations of equilibrium only. **(10 Marks)**

6 a. i) The number of reaction components at an hinged end of a beam are :
A) 0 B) 2 C) 3 D) 1

ii) UDL stands for :
A) Uniform dead load B) Uniform door load C) Uniformly distributed load D) None

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

iv) At the fixed end of cantilever, number of unknown reaction components are :
A) 1 B) 2 C) 3 D) 4 **(04 Marks)**

b. Find reactions for a cantilever beam, shown in Fig.Q6(b) **(04 Marks)**

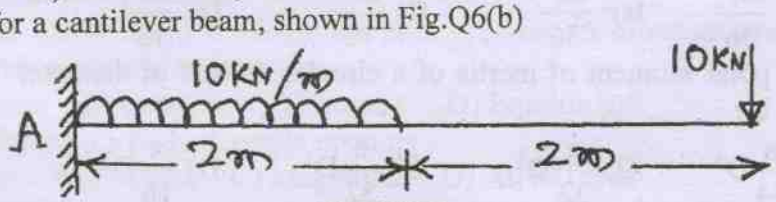

Fig.Q6(b)

c. Find reactions at A and B for beam shown in Fig.Q6(c). **(12 Marks)**

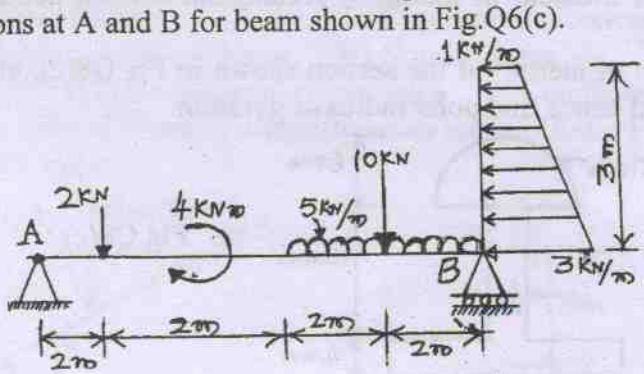

Fig.Q6(c)

7 a. i) Coefficient of friction (μ) is given by:

A) $\mu = F.R$ B) $\mu = \frac{F}{R}$ C) $\mu = \frac{R}{F}$ D) $\mu = F^2$

ii) If ϕ = angle of friction and μ = coefficient of friction, then which equation is valid?

A) $\tan\phi = \mu$ B) $\tan\phi = {}^{1}/_{\mu}$ C) $\sin\phi = \mu$ D) $\cos\phi = \mu$

iii) If ϕ = angle of friction and α = angle of repose then which relation is correct?

A) $\phi = \frac{1}{\alpha}$ B) $\phi = \alpha$ C) $\phi = \tan\alpha$ D) $\alpha = \tan\phi$

iv) Force of friction developed at contact surface is :

A) Opposite to the direction of motion B) Along the direction of motion

C) Perpendicular to plane D) All of these **(04 Marks)**

b. State the laws of friction. **(04 Marks)**

c. A small block of weight = 1000 N is placed on a 30° incline with coefficient of friction = 0.25 as shown in Fig.Q7(c). Find the horizontal force P required to be applied for :

i) Impending motion down the plane ii) Impending motion up the plane **(12 Marks)**

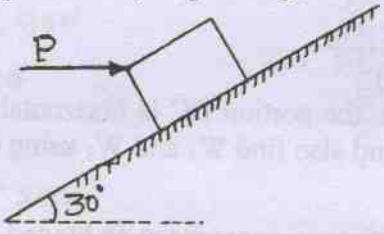

Fig.Q7(c)

8 a. i) The unit of moment of inertia of an area is :

A) m^3 B) m^2 C) m^4 D) ${}^{N}/_{m^2}$

ii) The moment of inertia of a square of side "b" about the centroidal axis is :

A) ${}^{b^4}/_{8}$ B) ${}^{b^4}/_{36}$ C) ${}^{b^4}/_{12}$ D) ${}^{b^3}/_{12}$

iii) The 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) $\frac{bh^3}{12}$

iv) The polar moment of inertia of a circular section of diameter "D" about its centroidal axis is :

A) $\frac{\pi}{64}D^4$ B) $\frac{\pi}{32}D^4$ C) $\frac{\pi}{32}D^3$ D) $\frac{\pi}{16}D^4$ **(04 Marks)**

b. Derive the equation of moment of inertia of rectangular section about its centroidal axis from the first principles. **(04 Marks)**

c. Find the polar moment of inertia of the section shown in Fig.Q8(c), about an axis passing through its centroid and hence find polar radius of gyration. **(12 Marks)**

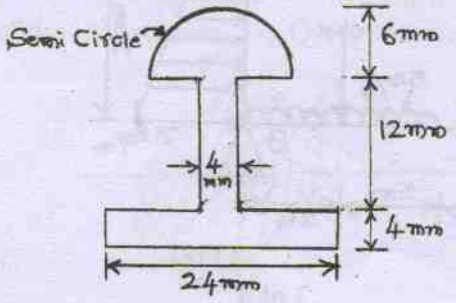

Fig.Q8(c)

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