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10CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2014

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. Choose the correct answers for the following : **(04 Marks)**

i) Geotechnical engineering involves the study of
A) water B) soil C) oil D) all of these

ii) A bascule bridge is a
A) arch bridge B) floating bridge C) movable bridge D) none of these

iii) Kerbs are the components of
A) dam B) bridges C) roads D) buildings

iv) Inspection gallery is a part of
A) bridge B) dam C) harbour D) airport

b. Briefly explain the scope of any three fields of civil engineering. **(09 Marks)**

c. Explain different types of roads. **(07 Marks)**

2 a. Choose the correct answers for the following : **(04 Marks)**

i) When trying to turn a key into lock, following is applied.
A) coplanar forces B) moment C) lever D) couple

ii) The vertical component of a horizontal force is
A) zero B) one C) both A and B D) two

iii) Two equal and opposite forces separated by a distance will produce.
A) translation B) rotation
C) both translation and rotation D) none of these

iv) The resultant of two concurrent forces becomes maximum and minimum, if angle between them is
A) 0° and 180° B) 0° and 90° C) 90° and 0° D) 0° and 0°

b. Define force and state its characteristics. **(06 Marks)**

c. Forces acting on the gusset plate of a joint in a bridge truss are shown in Fig.Q2(c). Determine the values of 'P' and 'θ' to maintain the equilibrium of the joint.

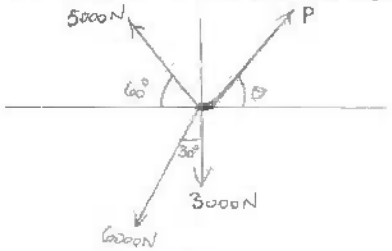

Fig.Q2(c) **(10 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**

i) The process of finding the resultant of a system of forces is called
A) resultant B) composition C) resolution D) none of these

ii) If two concurrent forces each of 'P' act at right angles to each other, their resultant is
A) 2P B) P C) $\sqrt{2}$ P D) $2\sqrt{P}$

iii) Conditions of equilibrium for a coplanar concurrent force system is
A) one B) two C) three D) four

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

b. Two forces F_1 and F_2 act upon a body. If the magnitude of their resultant is equal to that of F_1 and direction perpendicular to F_1, then find the magnitude and direction of force F_2. Take $F_1 = 20$ N. **(06 Marks)**

c. State Varignon's theorem of the moments. **(03 Marks)**

d. Determine the forces P, F and T required to keep the frame in equilibrium.

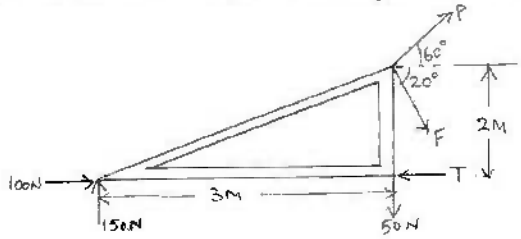

Fig.Q3(d) **(07 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**

i) Centroid of a rectangle of base width 'b' and depth 'd' is
A) $\frac{b}{3}$ and $\frac{d}{3}$ B) $\frac{b}{2}$ and $\frac{d}{2}$ C) $\frac{b}{4}$ and $\frac{d}{4}$ D) all of these

ii) An axis over which one half of plane figure is just a mirror of the other half axis is
A) bottom most axis B) axis of symmetry
C) unsymmetrical axis D) top most axis

iii) Centroid conveys some clue about
A) the orientation of a surface B) center of a body
C) shape and disposition D) area of cross section

iv) The centroid of a semicircle of radius 'r' with respect to its base is
A) $\frac{3r}{4\pi}$ B) $\frac{3r}{8\pi}$ C) $\frac{4r}{3\pi}$ D) $\frac{4r}{\pi}$

b. Determine the centroid of a right angle triangle form first principles. **(06 Marks)**

c. Find the centroid of the shaded area shown in Fig.Q4(c), obtained by cutting a semicircle of diameter 100 mm from the quadrant of a circle of radius 100 mm.

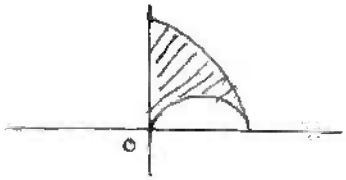

Fig.Q4(c) **(10 Marks)**

PART – B

5 a. Choose the correct answers for the following : **(04 Marks)**

i) The force equal and opposite to resultant is called as
A) resultant B) equilibriant C) similar force D) all of these

ii) Lami's equation can be applied when number of unkown forces are _____.
A) five B) two C) three D) four

iii) In a non concurrent force system, if $\Sigma H = 0$, $\Sigma V = 0$ then the resultant is
A) zero B) horizontal C) vertical D) moment

iv) A particle acted upon by two forces of equal magnitude is in equilibrium. The angle between the forces is
A) 0° B) 90° C) 180° D) 45°

b. State and prove Lami's theorem. **(06 Marks)**

c. A 100 N sphere is resting in a trough as shown in Fig.Q5(c). Find the reactions at the contact points. Assume all contact surfaces are smooth.

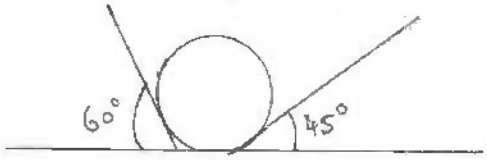

Fig.Q5(c) **(06 Marks)**

d. An electric lamp fixture weighing 10 N hangs. From a point 'C' by strings AC at angle 60° and BC at angle 45° as shown in Fig.Q5(d). Determine the forces in strings. **(04 Marks)**

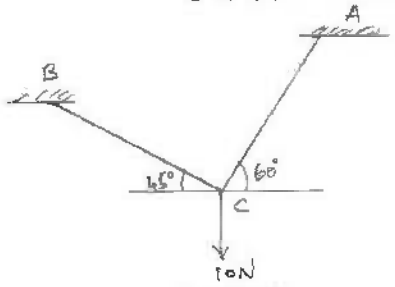

Fig.Q5(d)

6 a. Choose the correct answers for the following : **(04 Marks)**

i) Support reactions for statically determinate beams can be determined by applying
A) Varignon's theorem B) Lami's theorem
C) conditions of static equilibrium D) none of these

ii) When loads acts constant rate over given length of beam, it is called as
A) point load B) UDL C) UVL D) none of these

iii) A fixed support can have _____ reactions.
A) 1 B) 2 C) 3 D) 4

iv) The number of reactions components at a hinged end of a beam is
A) 0 B) 2 C) 3 D) 1

b. Find the reactions for a cantilever beam shown in Fig.Q6(b).

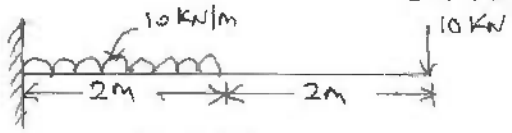

Fig.Q6(b) **(06 Marks)**

c. Determine the forces in all the members by the method of joints.

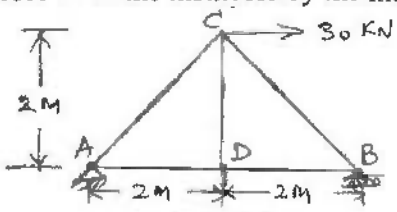

Fig.Q6(c) **(10 Marks)**

7 a. Choose the correct answers for the following : **(04 Marks)**

i) A friction force always acts _____ to the contact surface.
A) normal B) parallel C) at 45° D) both A and C

ii) _____ friction is observed in the flow of liquids and gases.
A) fluid B) static C) sliding D) kinetic

iii) Compared to static friction, kinetic friction is
A) greater B) smaller C) very large D) zero

iv) Angle of friction is _____ angle of repose.
A) = B) > C) < D) both A and B

b. A block weighing 800 N rests on an inclined plane at 12° to the horizontal. If the coefficient of friction is 0.4, find the force required to pull the body up the plane, when the line of the force is (i) parallel to the plane and (ii) horizontal. **(10 Marks)**

c. Define: i) angle of friction, ii) coefficient of friction, iii) cone of friction. **(06 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**

i) The unit of radius of gyration is
A) mm B) mm^2 C) mm^3 D) mm^4

ii) 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) $\frac{b^3h}{12}$ D) $\frac{bh^3}{12}$

iii) The moment of inertia of a square of side 'b' about its centroidal axis is
A) $\frac{b^4}{12}$ B) $\frac{b^4}{8}$ C) $\frac{b^4}{36}$ D) $\frac{b^3}{12}$

iv) The polar moment of inertia of a circular area of diameter 'd' is given by
A) $\frac{\pi d^4}{24}$ B) $\frac{\pi d^4}{64}$ C) $\frac{\pi d^4}{32}$ D) $\frac{\pi d^4}{128}$

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

c. Calculate the polar moment of inertia of the area shaded in Fig.Q8(c).

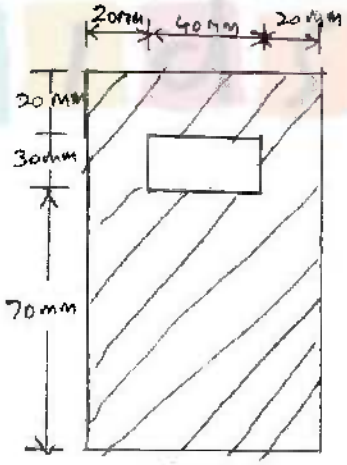

Fig.Q8(c) **(10 Marks)**

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