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14CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2015
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE questions, selecting ONE full question from each part*

PART —A

1 a. Explain in brief the scope of the following civil engineering fields:
   i) Structural engineering
   ii) Water resources engineering. (06 Marks)

   b. State and explain the basic idealizations in mechanics. (06 Marks)

   c. A system of forces are acting on a rigid bar as shown in Fig.Q.1 .fReduce this system to
   l) A single force
   ii) A single force and a couple at 'A'
   iii) A single force and a couple at 'IV. (08 Marks)

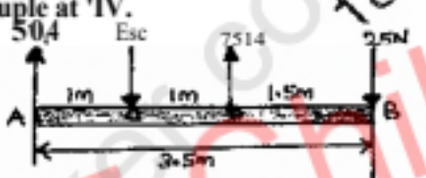


Fig.Q.1(c)

2 a. Define couple moment and list the chareteristics of a couple. (06 Marks)

   b. With the help of the neat sketzflw)xplain the cross-section of road and its structural components. (08 Marks)

   c. Replace the force and couple system by an equivalent force and moment at '0' for the Fig.Q.2(c). (06 Marks)

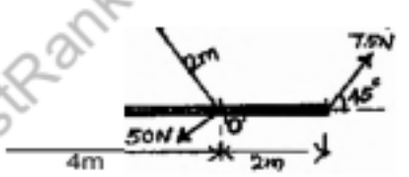


Fig.Q.2(c)

PART—B

3 a. Define the following: i) Resultant force; ii) Composition of force; iii) Resolution of force. (06 Marks)

   b Two cables attached at the top of tower carries a guy cable AB. Determine the tension in guy cable such that the resultant of the forces in all three cables acts vertically down. Also find the resultant force [refer Fig.Q.3(b)]. (10 Marks)

   c. Find the moment of a force about `1[3]' [Fig.Q.3(c)]. (04 Marks)

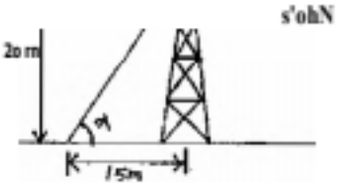


Fig.Q.3(b)

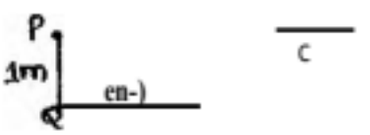


Fig.Q.3(c)

4 a. State and prove parallelogram law of forces. (05 Marks)

b. Four forces are acting on a vertical bar AB as shown in Fig.Q.4(b). Determine the resultant and its point of intersection from 'A'. (05 Marks)

c. Find the resultant magnitude, direction and its point of application from 'A' for the square subjected to load as shown in Fig.Q.4(c). (10 Marks)

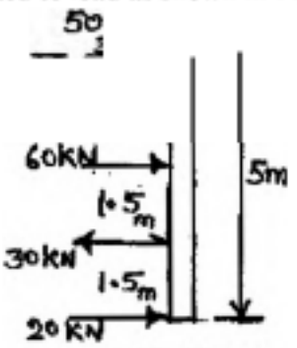


Fig.Q.4(b)

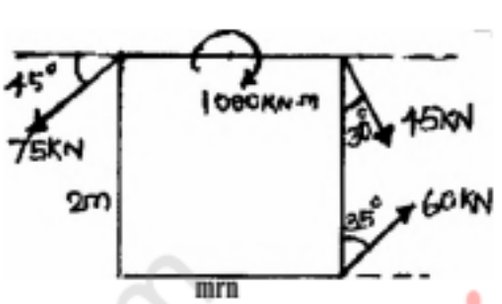


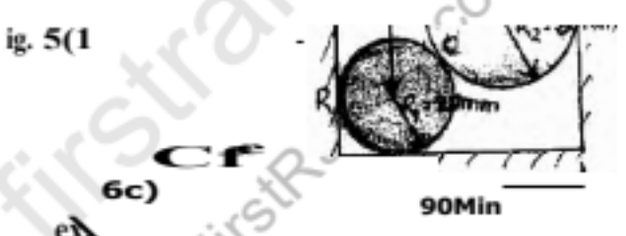
Fig.Q.4(c)

PART — C

5 a. State and prove Lami's theorem. (04 Marks)

b. State the laws of dry friction. (06 Marks)

c. Determine the reactions at contact points shown in Fig.Q.5 (10 Marks)



6 a. For the lSokelt shown in Fig.Q.6(a), find the minimum value of `P' which will just disturb the equililikOn of the system (p. = 0.5). (05 Marks)

b. KikAvihg that WA = 100N and 0 = 30°, determine the smallest and largest value of WB for Which the system is in equilibrium [Refer Fig.Q.6(b)]. (10 Marks)

c. A ladder weighing 200N is to be kept in position as shown in Fig.Q.6(c) resting on a smooth floor and leaning against a small wall. Determine the horizontal force required to prevent it from slipping when a man weighing 700N is at a height of 2m above the floor level. (05 Marks)

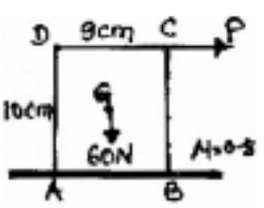


Fig.Q.6(a)

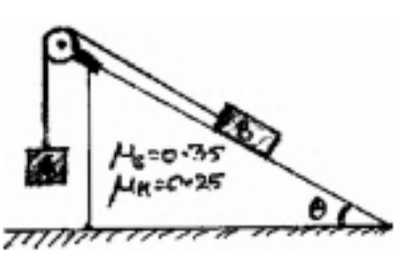


Fig.Q.6(b)

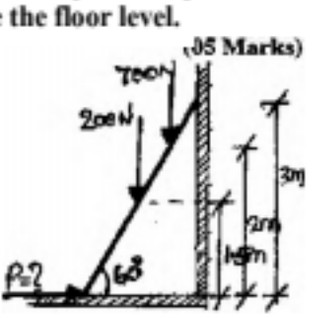


Fig.Q.6(c)

PART —D

7 a. Derive an expression for the moment of inertia of a rectangle from first principles about its vertical centroidal axis. **(06 Marks)**

b. A thin homogeneous wire is bent into a triangle shape ABC such that AB = 240mm, BC = 260mm and AC = 100mm. Locate the C.G of wire with respect to coordinate axes. Angle at 'A' is a right angle. [Refer Fig.Q.7(b)]. **(08 Marks)**

c. Calculate the MOI of the lamina shown in Fig.Q.7(c) about 'AB'. **(06 Maw)**

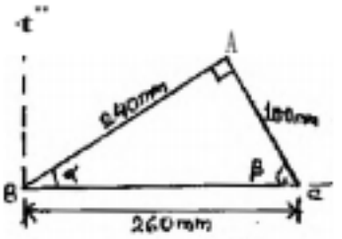


Fig.Q.7(b)

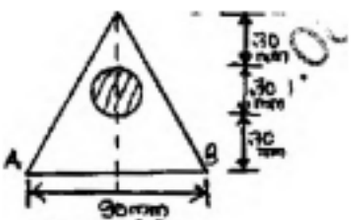


Fig.Q.7(c)

8 a. Derive an expression for the centroid of a quarter circle on &metrical axis. **(08 Marks)**

b. Find the moment of inertia of the lamina shown in Ftg.,, .8(b) about its horizontal (xx) centroidal axis. [Unshaded area] **(12 Marks)**

Fig.Q.8(b)

PART —E

a. Define the foil i) Displacement ; ii) Velocity; iii) Acceleration ; iv) Speed; v) Decelerati **(05 Marks)**

b. Derive eq **ftas** of motion:
I) With_14Wrm acceleration ii) Distance travelled. **(05 Marks)**

c. A poliee officer observes a car approaching at the unlawful speed of 60 kmph. He gets on his motor cycle and starts chasing the car, just as it passes in front of him. After accelerating for 10 secs, at a constant rate, the officer reaches his top speed of 75 kmph. How long does it take the officer to overtake the car from the time he started? **(10 Marks)**

9- a. A flywheel starts rotating from rest and is given an angular acceleration of 1 rad/sec ^{2}. Determine the angular velocity and speed in rpm after 90 seconds.
If the flywheel is brought to rest with an uniform angular retardation of 0.5 rad/sec ^{2}. Find the time required by the flywheel to come to rest. **(06 Marks)**

b. What is super elevation and why it is provided? **(04 Marks)**

c. A projectile is fired from the top of cliff 150m height with an initial velocity of 180 m/sec at an angle of elevation of 30° to horizontal. Neglecting air resistance; determine: i) the greatest elevation above the cliff; ii) the great elevation above the ground reached by the particle; iii) The horizontal distance from the gun to the point where the projectile strikes the ground. **(10 Marks)**