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First/Second Semester B.E. Degree Examination, Dec.2023/Jan.2024 Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1. a. Briefly explain the role of Civil engineer in the infrastructure development of a Country. (06 Marks)
- b. Explain the term force and list its characteristics. (06 Marks)
- c. A force of 500 N is applied as shown in Fig.Q1(c). Determine the moment of this force
 (i) about point A, (ii) about origin O.

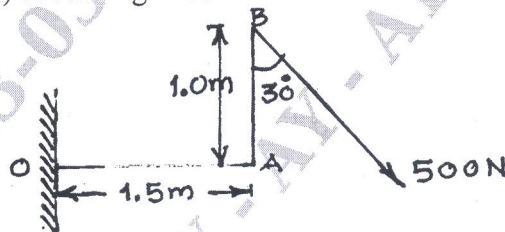


Fig. Q1(c)

(04 Marks)

OR

2. a. Define couple. Explain its characteristics. (06 Marks)
- b. Explain the terms cofferdams, detention dams diversion dams and storage dams. (04 Marks)
- c. Replace the force at A by an equivalent force and couple at 'O' shown in Fig.Q2(c).

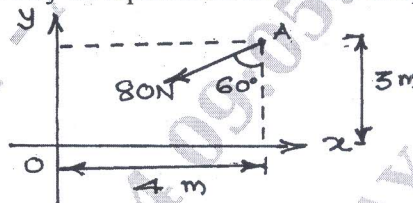


Fig. Q2(c)

(06 Marks)

Module-2

3. a. The resultant of two forces one of which is 3 times the other is 300 N when the direction of smaller force is reversed the resultant is 200 N. Determine the magnitude of the two forces and the angle between them. (06 Marks)
- b. State the laws of dry friction. (05 Marks)
- c. A roller of weight $W = 4450$ N rests on smooth inclined plane and is kept from rolling down by a string as shown in Fig.Q3(c). Find the tension T in the string and reaction R at the point of contact.

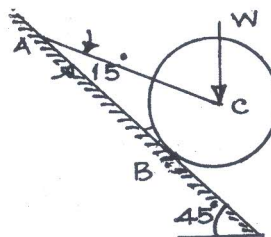


Fig. Q3(c)

(05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. State and prove Lami's theorem. (06 Marks)
 b. Differentiate between resultant and equilibrant. (02 Marks)
 c. The block shown in Fig.Q4(c) weighs 2000 N. The chord attached to it passes over a frictionless pulley and supports a weight equal to 800 N. The coefficient of friction between block and horizontal plane is 0.35. Solve for the horizontal force P. (i) If the motion is impending towards the left, (ii) If the motion is impending towards the right.

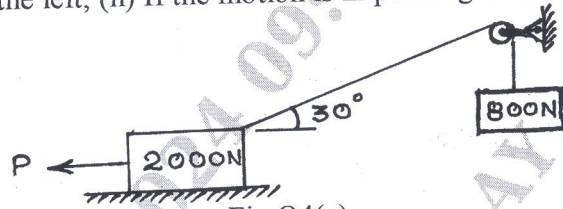


Fig.Q4(c)

(08 Marks)

Module-3

- 5 a. Determine the magnitude, direction and position of the resultant force with reference to point A for the non concurrent force system shown in Fig.Q5(a).

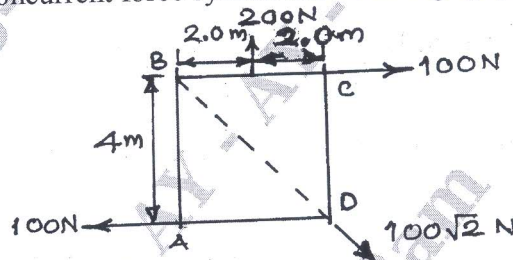


Fig.Q5(a)

(08 Marks)

- b. Define statically determinate beams, and with neat sketch explain the different types of supports and mark the reaction line. (08 Marks)

OR

- 6 a. State and prove Varignon's theorem of moments. (05 Marks)
 b. Determine the reactions developed at the supports in the beam shown in Fig.Q6(b).

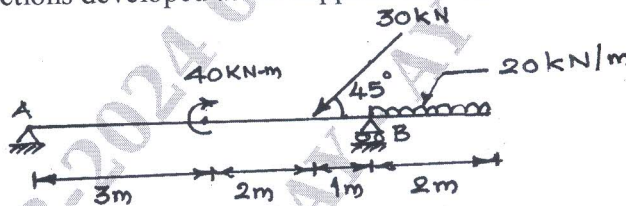


Fig.Q6(b)

(08 Marks)

- c. Explain the different types of loads in the analysis of beams. (03 Marks)

Module-4

- 7 a. Locate the centroid of an area shown in Fig.Q7(a) by the method of integration with respect to the axis shown.

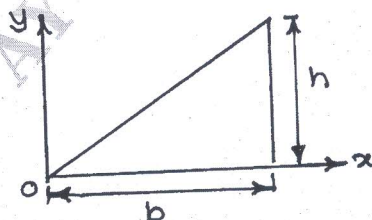


Fig.Q7(a)

(08 Marks)

- b. A semicircular cut is made in a rectangular wooden beam as shown in Fig.Q7(b). Determine the centroidal polar moment of inertia of the section.

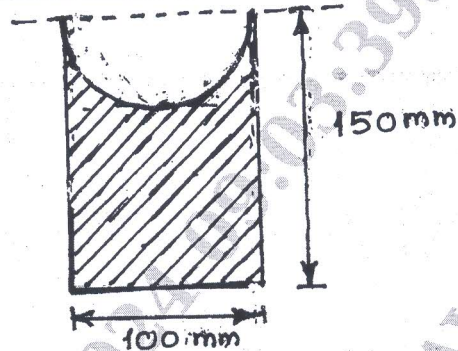


Fig.Q7(b)

(08 Marks)

OR

- 8 a. State and prove parallel axis theorem. (05 Marks)
 b. Derive an expression for MI of a circle about centroidal axis by the method of integration. (05 Marks)
 c. Find the centroid of shaded area shown in Fig.Q8(b) with reference to axis shown.

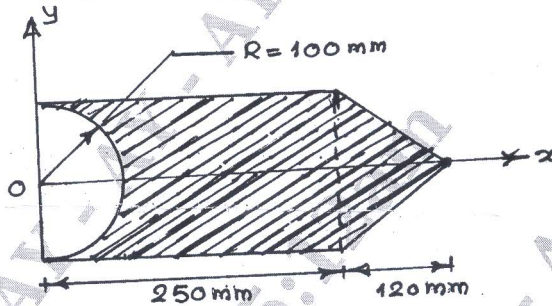


Fig.Q8(b)

(06 Marks)

Module-5

- 9 a. Define Velocity, Acceleration, Speed, Displacement. (04 Marks)
 b. From the top of a tower of height $h = 36$ m a ball is dropped at the same instant that another ball is projected vertically upward from the ground with an initial velocity of 18 m/s. How far from the top do they pass and with what relative velocity? (08 Marks)
 c. Define super-elevation and what is its necessity? (04 Marks)

OR

- 10 a. A projectile is fired with an initial velocity of 40 m/s at an angle of 25° with the horizontal. Determine: (i) The horizontal range, (ii) Maximum height attained by the particle, (iii) The time of flight. (06 Marks)
 b. The motion of a particle in rectilinear motion is defined by the relation $x = t^4 - 3t^3 + t^2 + 6$. Determine the position, velocity and acceleration of the particle at time $t = 2$ seconds. (05 Marks)
 c. A stone is dropped into a well and sound of splash is heard after 4 seconds. Find the depth of well. If the velocity of sound is 350 m/s. (05 Marks)

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