



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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain briefly the scope of civil engineering in the specification of,
 - (i) Geo-technical engineering (08 Marks)
 - (ii) Structural engineering (08 Marks)
- b. Briefly explain the role of civil engineers in infrastructural development of the nation. (04 Marks)
- c. Define force and mention its characteristics. (04 Marks)

OR

- 2 a. State and prove Varignon's theorem of moments. (08 Marks)
- b. For the five force concurrent system acting on a bolt shown in Fig. Q2 (b), obtain the resultant force.

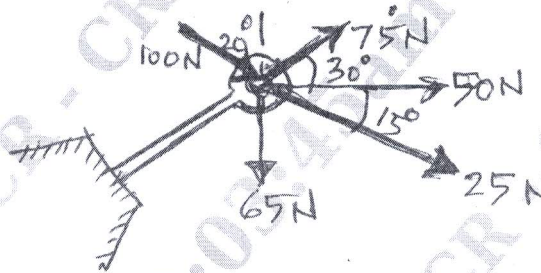


Fig. Q2 (b)

- c. What is moment of a force? Explain. (04 Marks)

Module-2

- 3 a. Draw the FBD (Free Body Diagram) for a cylinder held between a smooth wall and a smooth rod. The bottom of the rod is hinged to the wall and top end is held by a string at an angle of 90° to the rod. The angle between the rod and wall is 30° .
 Weight of cylinder = W_C ; Weight of rod = W_R , Length of rod = L , Radius of cylinder = r . (04 Marks)
- b. Determine the magnitude of W and tension induced in each segment of string for the Fig. Q3 (b) shown.

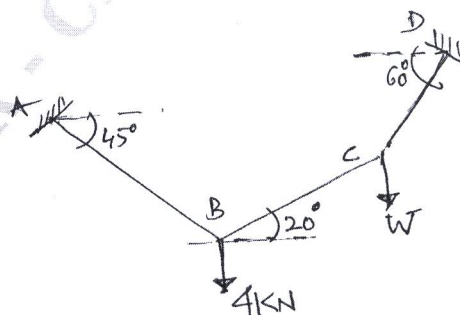


Fig. Q3 (b)

1 of 4

(08 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.

- c. Two smooth rollers of same radius and weight each equal to 200 N are placed in a trough as shown in Fig. Q3 (c). Find the contact reactions R_A , R_B , R_C and R_D assuming all surfaces are smooth.

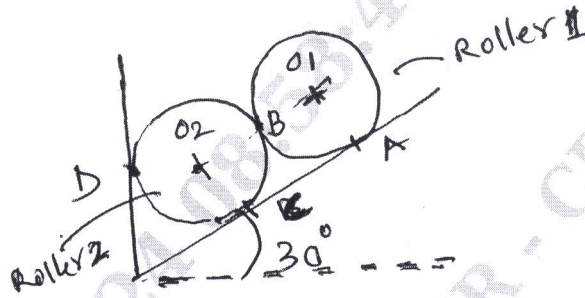


Fig. Q3 (c)

(08 Marks)

OR

- 4 a. Define Friction and explain the different types of friction. (06 Marks)
 b. A 1000 N block is placed on an inclined plane as shown in Fig. Q4 (b). Take co-efficient of friction of surfaces = 0.25.
 Determine the horizontal force to be applied for,
 (i) Impending motion down the plane.
 (ii) Impending motion up the plane.

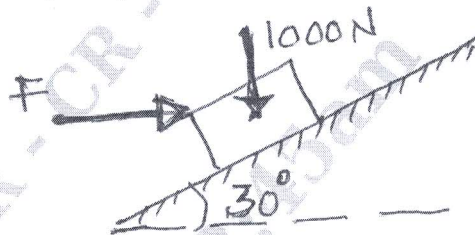


Fig. Q4 (b)

(08 Marks)

- c. A 100 N block resting on a rough horizontal surface is pulled by a 30 N force inclined at 15° with horizontal as shown in Fig. Q4 (c). Find the co-efficient of friction.

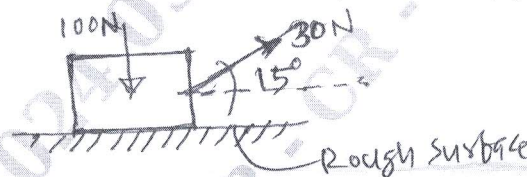


Fig. Q4 (c)

(06 Marks)

Module-3

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- 5 a. Define a beam and explain the different types of beams and supports. (08 Marks)
 b. Obtain the distance X for the beam loaded as shown in Fig. Q5 (b) such that reactions R_A and R_B are equal.

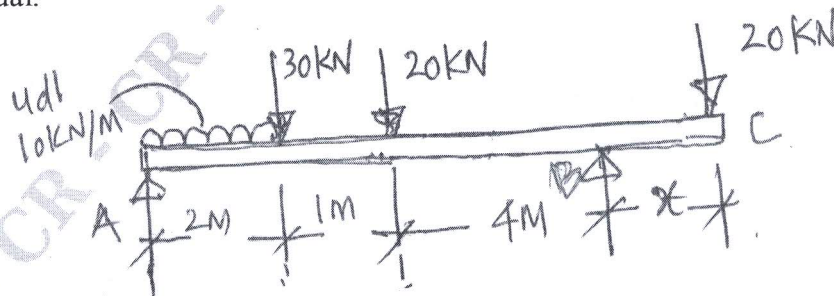


Fig. Q5 (b)

(12 Marks)

OR

- 6 a. Give the step by step analysis of a plane truss using the method of sections. (06 Marks)
 b. Analyze the forces in the members of the plane truss shown in Fig. Q6 (b) using method of joints.

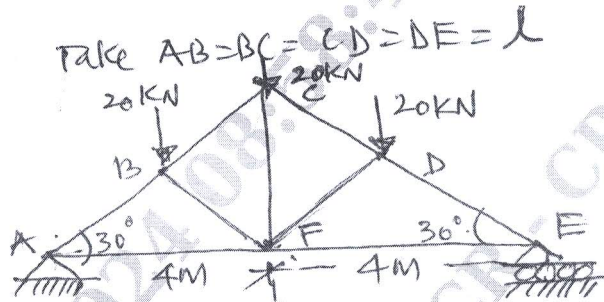


Fig. Q6 (b)

(14 Marks)

Module-4

- 7 a. Obtain the location of the centroid for a semi circular area when the diameter AB is horizontal as in Fig. Q7 (a).



Fig. Q7 (a)

(08 Marks)

- b. Locate the centroid of the composite area shown in Fig. Q7 (b) with respect to point 'O'.

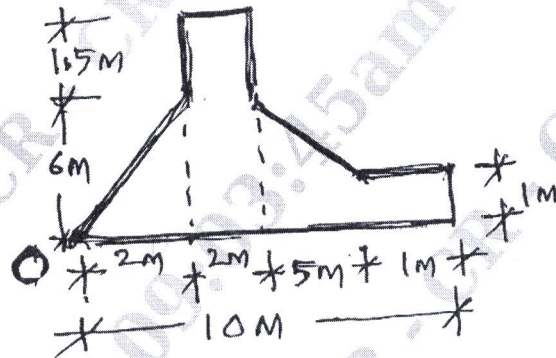


Fig. Q7 (b)

(12 Marks)

OR

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- 8 a. State and prove the transfer theorem. (06 Marks)
 b. Compute the second moment of area for the composite Fig. Q8 (b) about the centroidal horizontal axis. Also find the radius of gyration.

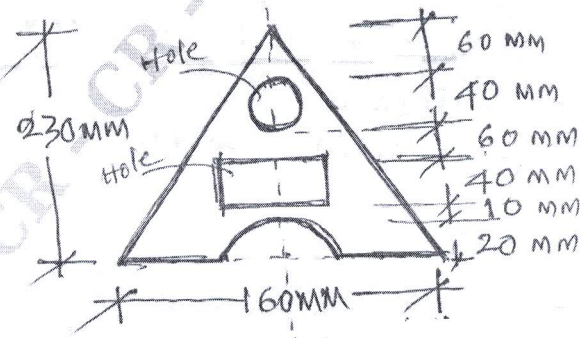


Fig. Q8 (b)

(14 Marks)

Module-5

- 9 a. Define the following :
- (i) Displacement
 - (ii) Speed.
 - (iii) Velocity
 - (iv) Acceleration. (08 Marks)
- b. A burglar's car starts with an acceleration of 2 m/sec^2 . A police van reached after 10 seconds and continued to chase the burglar's car with a uniform velocity of 40 m/s . Find the time taken by the police van to overtake the burglar's car. (08 Marks)
- c. State the Newton's Laws of motion. (04 Marks)

OR

- 10 a. What is super elevation? Derive the expression for super elevation. (08 Marks)
- b. A stone is dropped down a well with no initial velocity and after 4.5 seconds the splash is heard. Then a second stone is thrown downward with an initial velocity of V_0 and the splash is heard in 4 seconds. If the velocity of sound is constant at 336 m/sec determine the initial velocity of the second stone. (08 Marks)
- c. A Lift carries a weight of 4000 kN and is moving with a uniform acceleration of 3.5 m/sec^2 . Determine the tension in the cable when lift is moving upward. (04 Marks)
