



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:I/II
Class:FY	Program:B.Tech
Branch Code:CHE/CIV/MEC	Pattern:2023
Name of Course:Engineering Mechanics	Course Code:2300113A
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 8 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome

Question No. 1 Attempt following Question

- 1 Calculate the resultant in magnitude and direction of three forces as shown in the fig. 1. (6) CO2

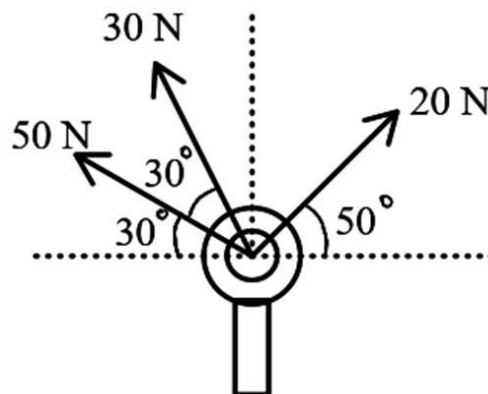


Fig.1

Question No. 2 Attempt following Question

- 2 Determine the reactions at the support A and B of the beam loaded and supported as shown in the fig. 2. (6) CO3

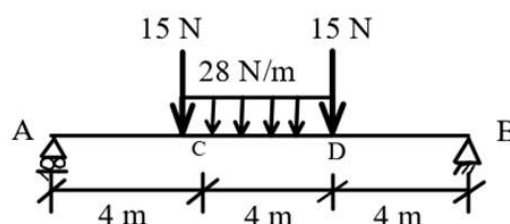


Fig. 2

Question No. 3 Attempt following Question

3.a) Determine the x and y coordinate of centroid for the angle section shown in the fig. 3a.

(6) CO4

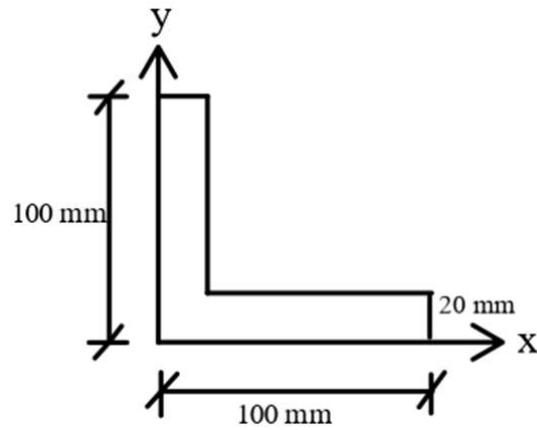


Fig. 3a

OR

3.b) Determine the x coordinate of the centroid for the shaded area shown in the fig. 3b.

(6) CO4

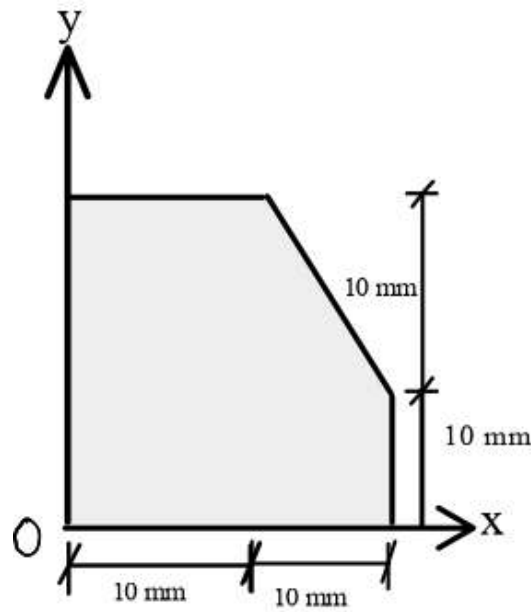


Fig. 3b

3.c) Determine the y coordinate of the centroid of the T-section shown in the fig. 3c.

(5) CO4

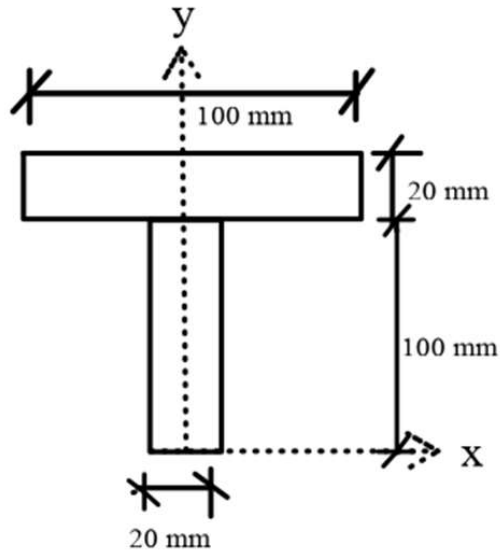


Fig. 3c

OR

3.d) Determine the y coordinate of the centroid of an unequal I – section shown in fig. 3d.

(5) CO4

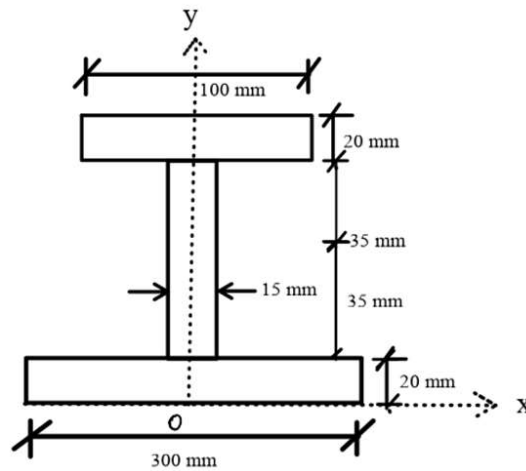


Fig. 3d

3.e) Calculate the area moment of inertia of an equal I – section shown in fig. 3e, with flange 150 mm x 10 mm and web with dimensions 400 mm x 20 mm, about its centroidal axis. The centroid of I – section is shown in the figure. (5) CO4

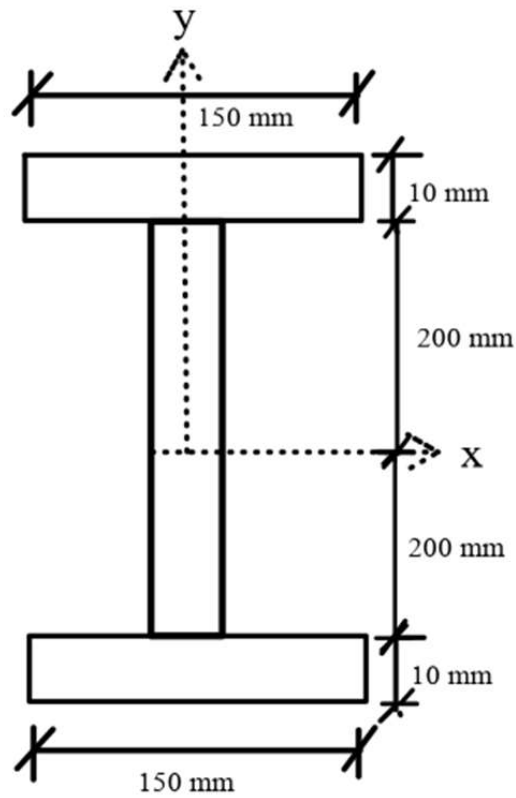


Fig. 3e

OR

- 3.f) Calculate the area moment of inertia of a hollow circular section as shown in fig. 3f, about its centroidal axis. The centroid of the area is shown in the figure

(5) CO4

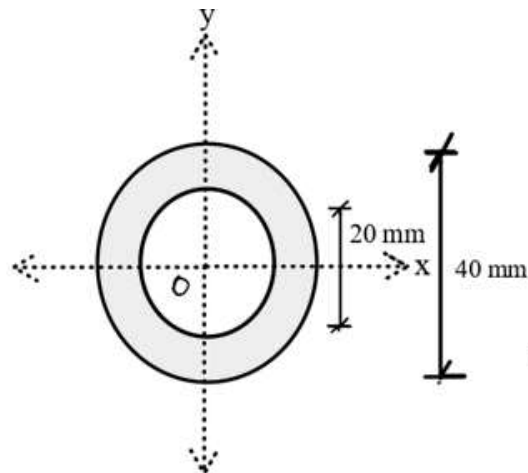


Fig. 3f

Question No. 4 Attempt following Question

- 4.a) A block of weight 500 N is placed on the rough surface with coefficient of static friction as 0.1 as shown in fig. 4a. A force P is applied to the block such that the block just starts moving in the direction of the force. Determine the value of force P.

(6) CO3

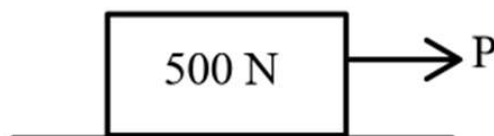


Fig. 4a

OR

- 4.b) A block of weight 600 N is kept on a rough inclined plane with coefficient of static friction as 0.25. (6) CO3
The plane makes an angle of 40° to the horizontal and a force P is applied to the block as shown in the fig. 4b. Determine the minimum value of force P so that the block just starts to move upwards.

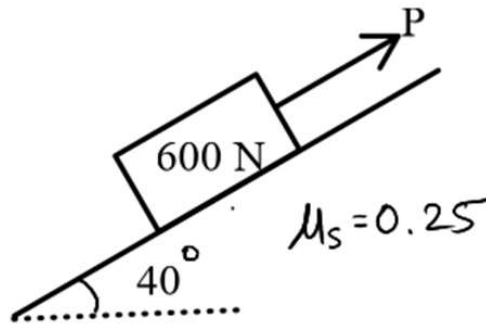


Fig. 4b

- 4.c) A ladder of length 3 m is kept inclined at 50° with the ground. The weight of the ladder is 196 N (5) CO3
and a force P is applied at 1 m from the ground surface as shown in fig. 4c. Determine the value of force P such that the ladder does not slip. Take coefficient of static friction = 0.3 for ground surface and 0.2 for wall surface.

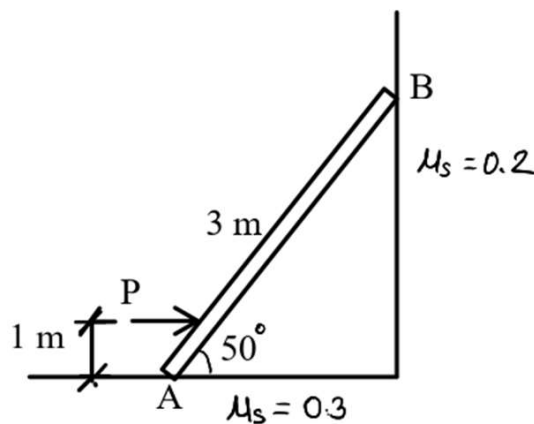


Fig. 4c

OR

- 4.d) A uniform ladder of length of 5 m and weighing 20 N is placed against a smooth vertical wall with (5) CO3
its lower end 4 m away from the wall. If the ladder is just to slip, determine the co-efficient of friction between the ladder and floor and the frictional force acting on the ladder at the point of contact between ladder and floor

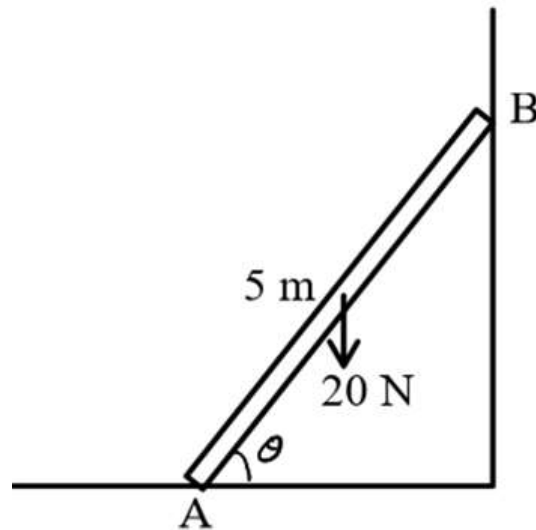


Fig. 4d

- 4.e) A cable is passing over the disc of belt friction apparatus at a lap angle of 450° as shown in fig. 4e. (5) CO3
If the weight of the block is 500 N, determine the minimum value of force P to maintain equilibrium. Take $\mu_s = 0.25$.

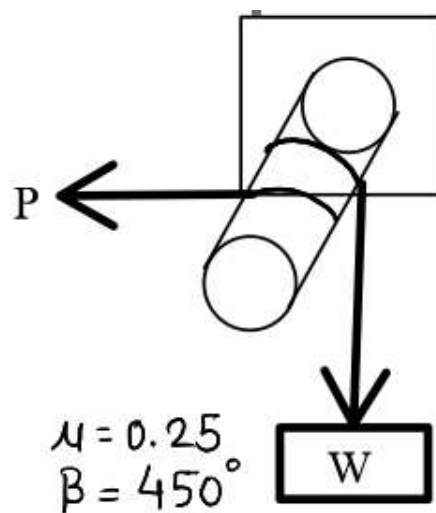


Fig. 4e

OR

- 4.f) A rope tied to a bucket is passing over a drum as shown in the fig. 4f. If the weight of the bucket is 450 N, and the angle of lap is 450° , determine the minimum value of force P so that equilibrium is maintained. Take $\mu_s = 0.2$. (5) CO3

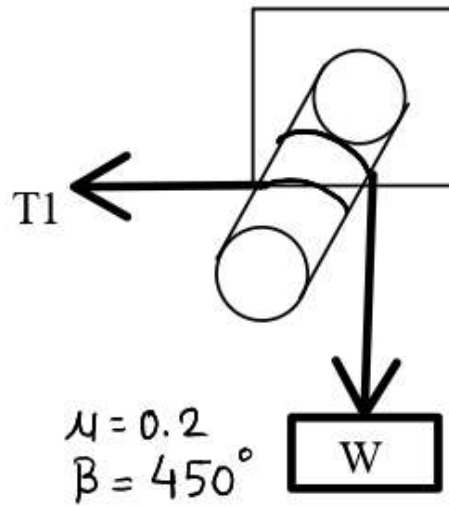


Fig. 4f

Question No. 5 Attempt following Question

- 5.a) Derive the law of conservation of momentum (6) CO5

OR

- 5.b) Differentiate between plastic and elastic impact. (6) CO5

- 5.c) A train weighing 2×10^6 N starts from rest with an acceleration of 0.8 m/s^2 and acquires a speed of 90 km/hr. Determine the kinetic energy corresponding to final speed. (5) CO5

OR

- 5.d) A glass marble whose weight is 0.2 N falls from a height of 12 m and rebounds to a height of 9 m. The marble and the floor remain in contact for 0.1 second. Determine the impulse between the marble and the floor. (5) CO5

- 5.e) A ball is dropped from a height of 4 m on a smooth floor and it rebounds twice as shown in the fig. 5e. If the coefficient of restitution between the ball and the floor is 0.8, determine the height of 2nd bounce. (5) CO5

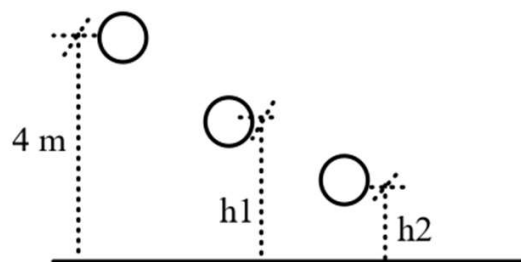


Fig. 5e

OR

- 5.f) A 20 kg wagon moving at speed of 10 m/s towards right collides with a 10 kg cylinder which is stationary as shown in the fig. 5f. If after collision, the 20 kg wagon obtains 2 m/s, determine the velocity of cylinder after collision and proceed to find coefficient of restitution between the wagon and cylinder (5) CO5

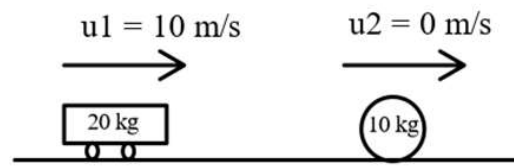


Fig. 5f

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