

Part I: Statics (35 marks)

Answer the following questions

(Question 1): (10 marks)

- a) Define the following:
 The area moment of inertia, the mass moment of inertia and the radius of gyration.
 b) Determine the moment of inertia of the shaded area shown in Fig. 1 with respect to the X-axis.

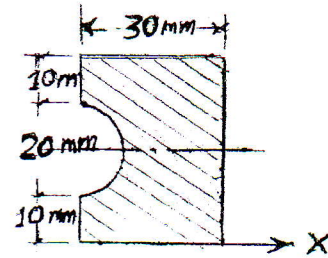


Fig. 1

(Question 2): (10 marks)

- a) For the structure shown in Fig. 2-a, determine the components of reactions at supports A and B and the value of P, ω and q with the aid of shear force diagram shown in Fig. 2-b.
 b) Draw the bending moment diagram indicating the location and magnitude of the maximum positive and maximum negative bending moments. Also, the location of points of contraflexure.

(Question 3): (15 marks)

Determine the components of reactions at supports A and B for the simple frame shown in Fig. 3 and draw the normal force, shear force and bending moment diagrams.

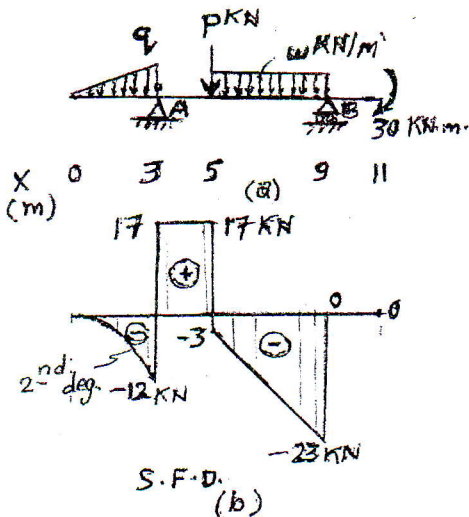


Fig. 2

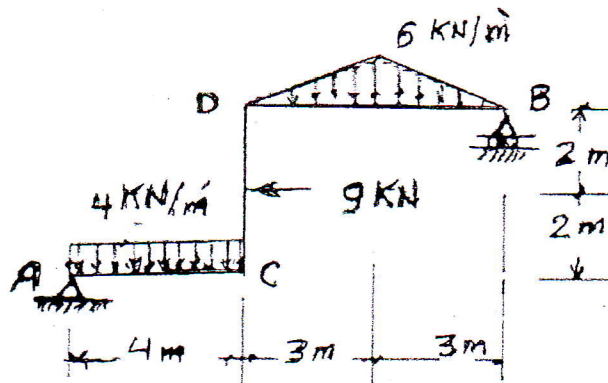


Fig. 3

This exam contributes "by measuring ILOs" in achieving Programme Academic Standards according to NARS

Question Number	Q1-a	Q2-a	Q3		Q2-a	Q2-b	Q3			Q2-b	Q2-b	Q3		
	a5-1,2		a15-2		b1-1	b1-1	b1-1			c1-1	c1-1	c1-1		
Skills	Knowledge & Understanding Skills				Intellectual Skills				Professional Skills					

PART 2 (Dynamics):

Question (1):- (10 marks)

- a- What are the three type of rigid body planner motion, (3 Marks)
Give a short description of each. ?
- b- A smooth- 5kg collar c, shown in Fig. (1) is attached to a spring having a stiffness $k=3 \text{ N/m}$ and unstretched length of 0.75 m . If the collar is released from rest at A, Determine its acceleration and the normal force of the rod on the collar at the instant $y = 1 \text{ m}$. (7 Marks)

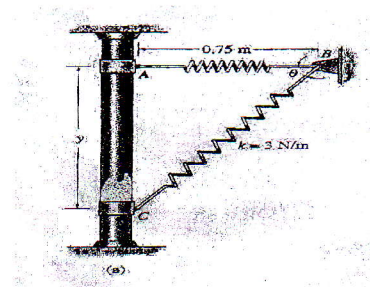


fig. (1)

Question (2):- (12 marks)

- a- what is the principle of work and energy used to solve kinetic problems .? (2 Marks)
- b- Two disks A and B having a mass of 2 kg and 5kg ,respectively. If they are sliding on smooth horizontal plane with the velocities Shown in Fig. (2) , determine their velocities just after impact The coefficient of restitution between the disks is $e = 0.6$ (8 Marks)

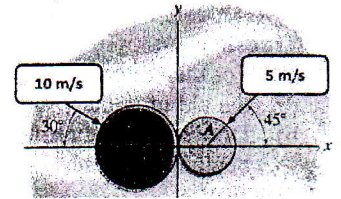


fig. (2)

Question (3):- (10 marks)

- a- Can a point have an angular velocity, (2 Marks)
and what does it means by the term $(V_{C/A})_{xyz}$ is zero.
- b- The link shown in Fig. (3) is guided by two blocks at A and B , which move in fixed slots . If the velocity of A is 2 m/s downward, Determine **by two methods** the velocity of B at the instant $\Theta = 45^\circ$. (8 Marks)

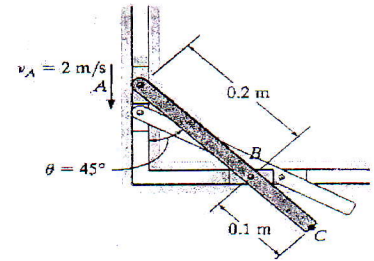


fig. (3)

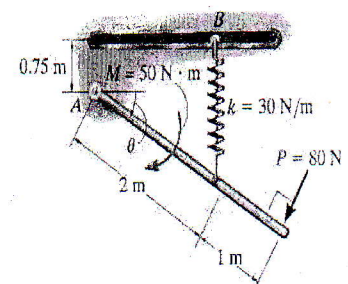
Question (4):- (10 marks)

- a- What are the equations of motion for a particle moves in tangential and normal coordinates.? (2 Marks)
- b- The bar shown in Fig. (4) has a mass of 20 kg is subjected (8 Marks)
to a couple moment of $M = 50 \text{ N.m}$ and a force of $P=80 \text{ N}$, which is always applied perpendicular to the end of the bar . Also the spring has an unstretched length of 0.5 m and remains in the vertical position due to the roller guide at B .

Determine :-

The total work done by all the forces acting on the bar when it has rotated from $\Theta = 0^\circ$ to $\Theta = 90^\circ$

fig. (4)



With our best wishes

This exam contributes "by measuring" in achieving Programme Academic Standards according to NARS												
Question Number	Q1-a	Q2-a	Q3-a	Q4-a	Q1-b	Q2-b	Q3-b	Q4-b	Q1-b	Q3-b	Q4-b	
	a1-1	a19-1	a15-2	a5-1	b16-1	b17-1	b1-1	b16-1	c13-1	c14-1	c13-1	
Skills	Knowledge & Understanding Skills				Intellectual Skills				Professional Skills			