

Answer all the following questions:

Question No.1 (12 marks)

Draw the shear force and bending moment diagrams for the beam shown in Fig.(1).

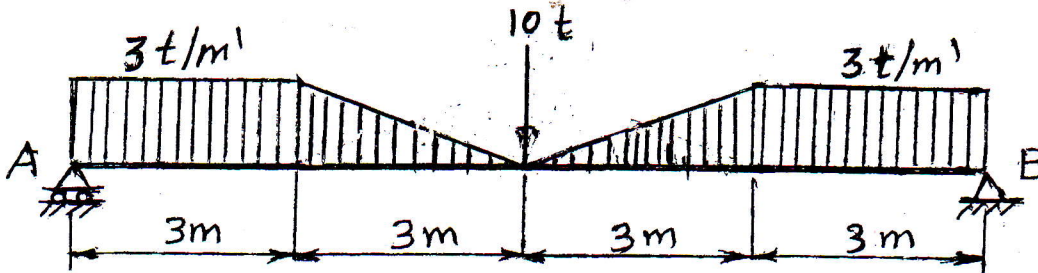


Fig. 1

Question No.2 (10 marks)

A partical of mass 10 kg is moving in a horizontal straight line with a initial velocity  $v_0 = 20$  m/s. An upward force  $F_v$  functioning in time is applied to it in a direction normal to the initial direction of motion. If the force  $F_v$  varies according to the graphical representation shown in Fig.(2). Determine the velocity of the partical when  $t=4$  sec and its direction with respect to the force  $F_v$ . Suppose that the force does not change its directin .

Question No.3 (8 marks)

A rigid bar of neglected mass is mounted on three similar springs of length  $L = 0.5$  m and stiffness  $K$  as shown in Fig.(3). A block of mass  $m = 30$  Kg is dropped on the bar from a hight of  $h = 0.6$  m so that the springs deform identically. Determine the stiffness  $K$  of each spring required for the bar to reach its lowest position at  $y = 0.3$  m. Assume that the block is not to rebound after hitting the bar.

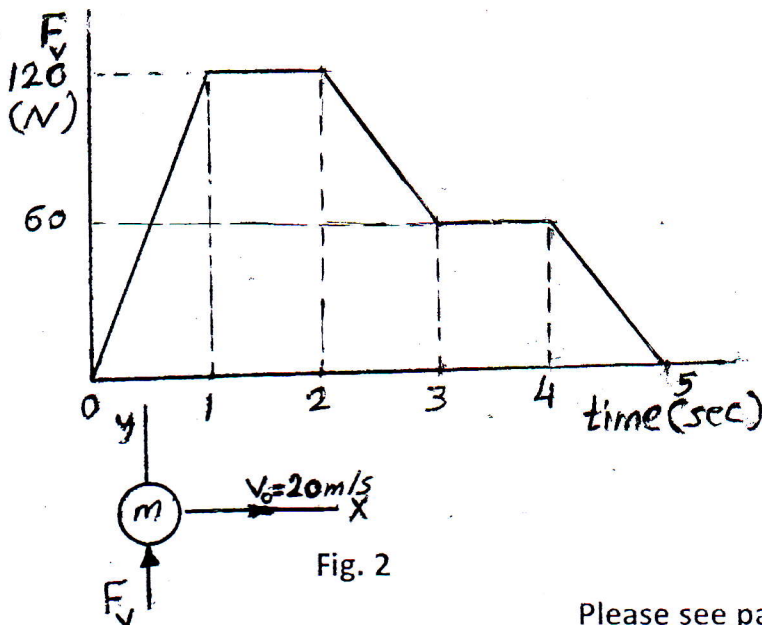


Fig. 2

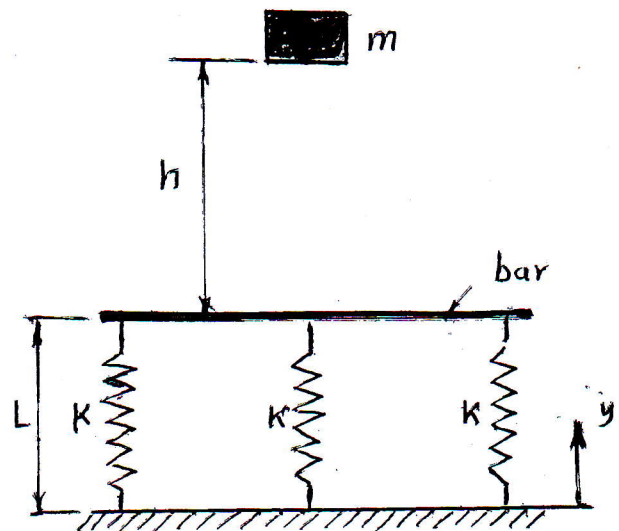


Fig. 3

Please see page no. 2

Question No. 4 (10 marks)

Two smooth spheres A and B have initial velocities just before they collide as shown in Fig.(4). If they have masses  $m_A=10$  kg and  $m_B=5$  kg, determine their velocities just after impact, and Also find the loss in kinetic energy due to the impact if the coefficient of restitution  $e=0.8$ .

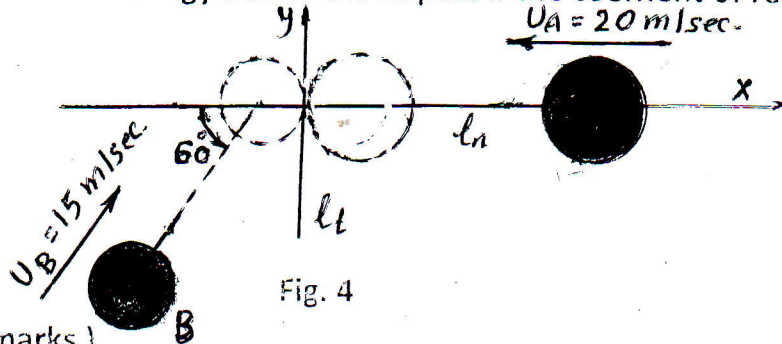


Fig. 4

Question No. 5 (12 marks)

For the mechanism shown in Fig.(5), the crank OA rotates about a pin (O) with a constant angular speed of  $\omega=30$  rad/s ( in clockwise direction ). If the length of the crank OA=6 cm and the connecting rod AB= 18 cm and the rod BC= 12 cm, calculate the velocities of the block B and the block C. Also, determine the acceleration of the block B.

Question No. 6 ( 8 marks )

A vibrating system consists of three masses  $m_1=m_2=m_3= 2$  Kg connected to a massless beam and a set of springs and dampers as shown in Fig.(6) . If the coefficients  $K_1= K_2=100$  N/m and  $c_1=c_2= 0.5$  N.s/m and  $L_1=L_2=L_3= 0.4$  m. write dow the equation of motion and hence calculate the natural frequency of the system.

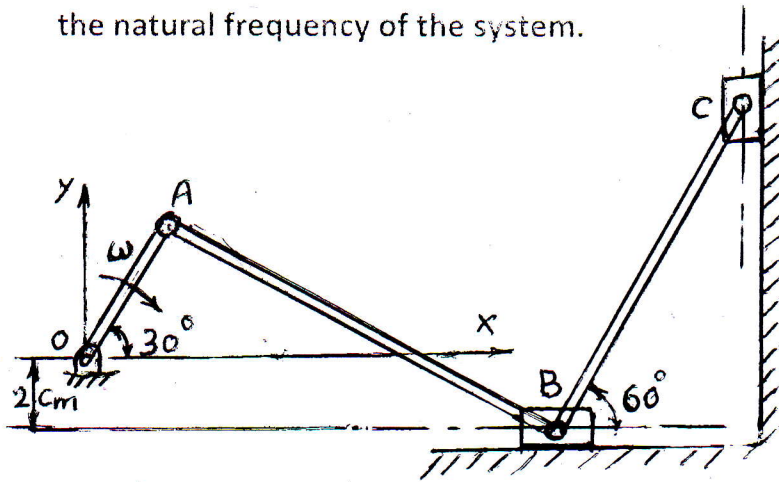


Fig. 5

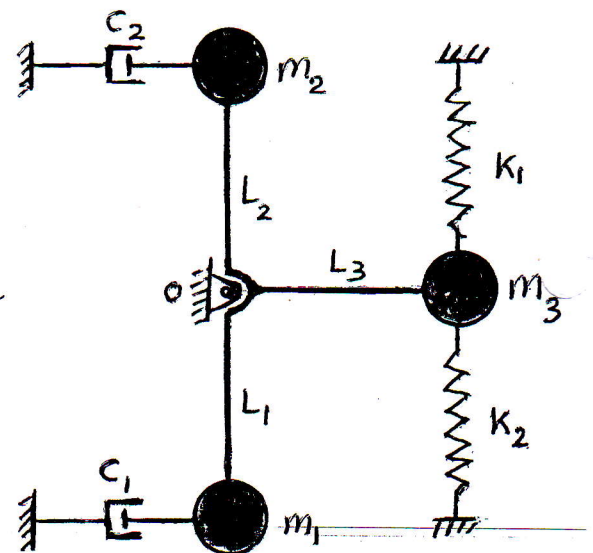


Fig. 6

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This exam measures the following H.Os									
Question Number	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>		Q <sub>1</sub>			Q <sub>5</sub>	Q <sub>6</sub>
Skills	a 15-2	a 1-1	a 15-2		b 17-1			C 13-1	C 13-1
	Knowledge & Understanding Skills				Intellectual Skills			Professional Skills	