Menoufia University
Faculty of Engineering-Shebin Elkom
Prod. Eng. & Mech. Design Department
First Semester Examination-2018/2019
Date of Exam: 21/1/2019

Subject: Applied Mechanics
Code : PRE 113
Year : First Prod. Department
Time Allowed : 3 hours
Total Marks : 120 marks

Answer all the following questions:

Question No.1 (45 marks) (Marks)

a - Draw the normal force, shear force and bending moment diagrams for the beam shown in Fig.(1-a). (20)

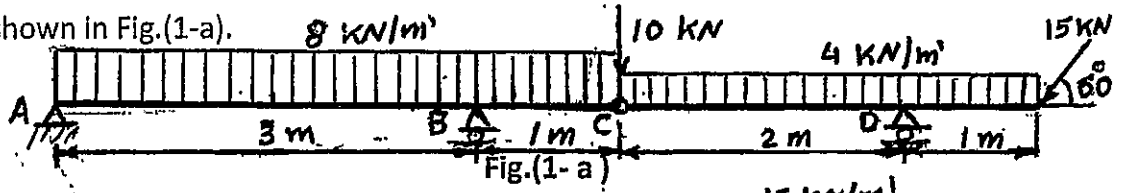

Fig.(1- a)

b- Determine the support reactions and then draw the axial force, shear force and bending moment for the frame shown in Fig.(1-b). (25)

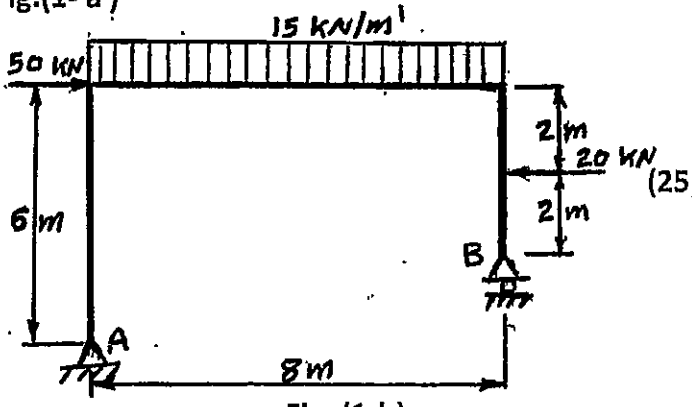

Fig. (1-b)

Question No. 2 (15 marks)

A satellite of mass m= 10 kg approaches a planet along a parabolic orbit (e=1). At the near point A retrorockets are fired to slow the satellite and place it in an elliptic orbit (e=1/3). If r_o=10 Mm as shown in Fig.2, the earth's mass m_o=5.976 x 10^{24} kg and its radius R=6378 km and the universal gravitational constant G= 66.73 x 10^{-12} m^3/kg.sec^2, calculate :-

a -the velocity v_p of the satellite in the parabolic bath ,

b -the velocity v_o in the elliptical orbit, and

c - the work done by the retrorockets at the point A.

Question No.3 (15 marks)

The magnitude and direction of the velocities of two identical frictionless balls before they strike each other as shown in Fig.3. Assume that the coefficient of restitution e= 0.85 , determine the magnitude and direction of the velocity for each ball just after the impact. Also find the loss of kinetic energy due to the impact.

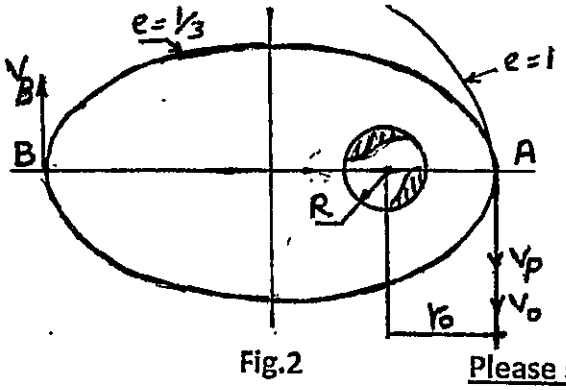

Fig.2

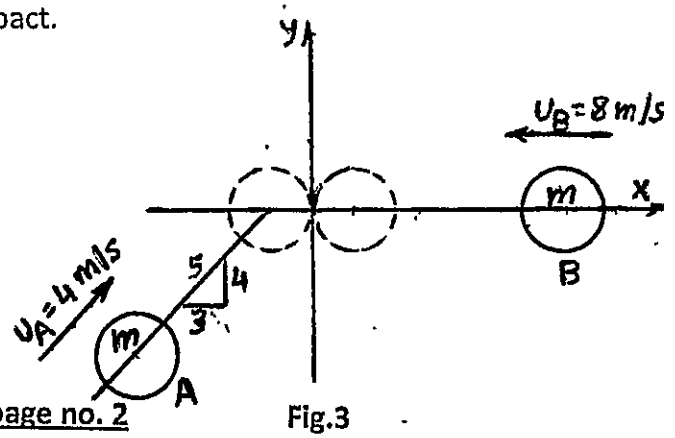

Fig.3

Please see page no. 2

Question No. 4 (15 marks)

The water static pressure at A is P= 6000 N/m^2. If the water flows out of the pipe at B and C, as shown in Fig.4, with velocities v_B= 9 m/s and v_C= 5 m/s, calculate the horizontal and vertical components of forces exerted on the elbow at A necessary to hold the pipe assembly in equilibrium. Neglect weight of the water within the pipe and weight of the pipe. The pipe has diameters of d_A= 0.85 m and d_B=d_C= 0.5 m, where the density of the water ρ_W= 1000 kg/m^3.

Question No. 5 (15 marks)

Both ends of the bar AB are constrained to move along the paths as shown in Fig.5. At a certain moment, the velocity of the collar A is 10 m/s and its acceleration is 5 m/s^2. Determine the angular velocity and angular acceleration of the bar AB at this moment.

Question No. 6 (15 marks)

For the free vibratory system shown in Fig.6, drive the equation of motion and then compute the natural frequency of the system. Given:-

m=5 kg, K=500 N/m, C=20 N.s/m, M=20 kg, I=3.6 kg.m2, R= 0.6 m, and a= 0.4 m.

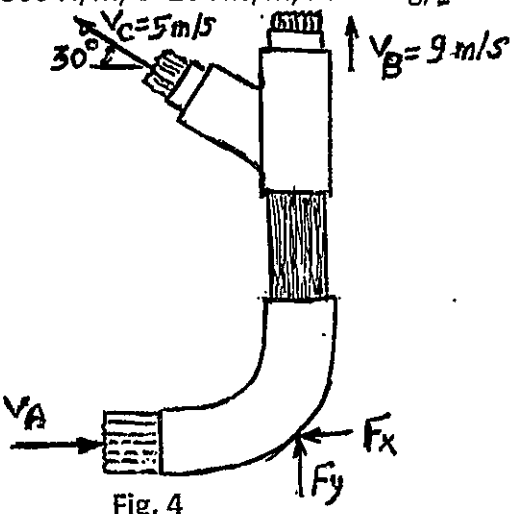

Fig. 4

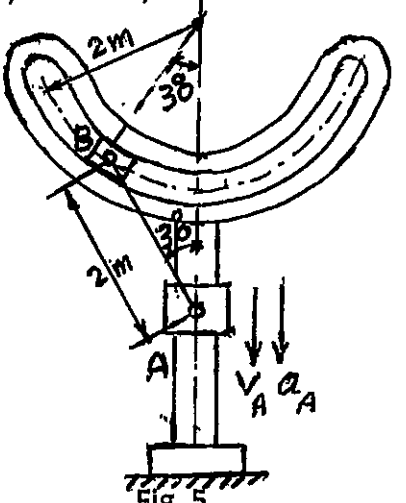

Fig. 5

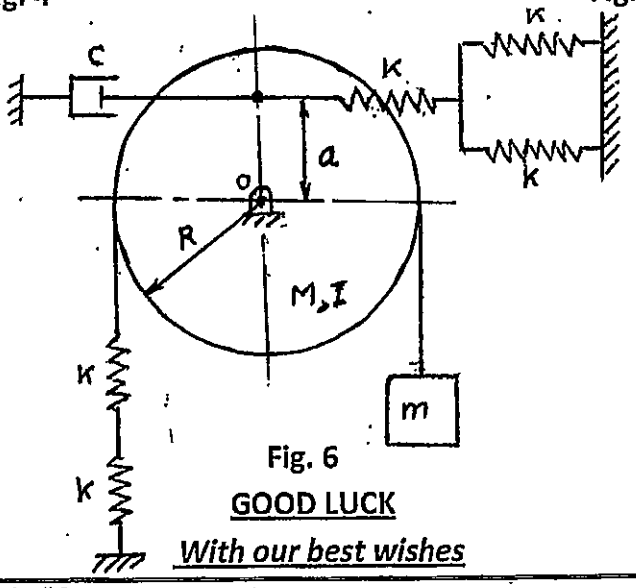

Fig. 6

GOOD LUCK

With our best wishes

This exam measures the following ILOs															
Question Number	Q_4	Q_6	Q_1			Q_1	Q_2	Q_5			Q_3	Q_2	Q_4		
Skills	a1-1	a19-1	a15-2			b16-1	b17-1	b1-1			c13-1	c14-1	c6-1		
	Knowledge &Understanding Skills					Intellectual Skills					Professional Skills				