1.(10%)

Write down the equations of motion for a particle in a central field, and prove that the time rate at which area is swept out by the position vector is a constant.

2.(18%)

The truss which is pin supported at A and roller supported at D is inclined 40 deg. with the vertical as shown in Fig. 1. The members AC and CD are cables which are designed for a maximum load of 2000 lb. What is the maximum value which W may have? Also, determine the reactions on A and D.

3.(20%)

For the system shown in Fig. 2, determine

(a)(6%) The difference equations of the motion.

(b)(8%) The frequency equation and natural frequencies.

(c)(6%) The natural modes of vibration.

(Assume small θ)

4.(20%)

A flexible chain of length ℓ rests on a smooth table with length C overhanging the edge as shown in Fig. 3. The system originally as rest is released. Solve the motion of the chain. The chain weights W lb per ft. If the friction exists, what will the motion be?

5.(15%)

Determine the number of degrees of freedom in each of the following cases:

(a) a particle moving on a given space curve;

(b) five particles moving freely in a plane;

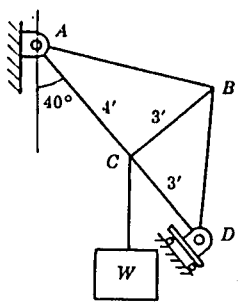
(c) five particles moving freely in space;

(d) two particles connected by a rigid rod moving freely in a plane.

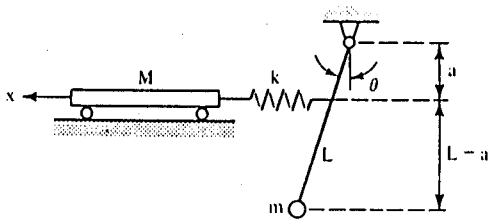
(e) three particles moving in space so that the distance between any two of them is always constant.

6. (17%)

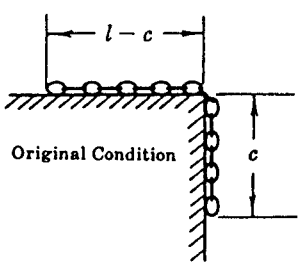
Refer to Fig. 4. Block A weighing 60 lb rests on block B weighs 80 lb. Block A is restrained from moving by a horizontal rope tied to the wall C. What force P parallel to the plane inclined 30 deg. with the horizontal is necessary to start B down the plane? Assume μ for all surfaces to be 1/3.



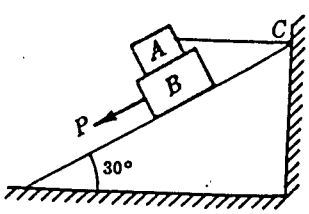
< Fig. 1 >



< Fig. 2 >



< Fig. 3 >



< Fig. 4 >