PVP 12

Code: **MEMD2T2**

I M.Tech-II Semester-Regular Examinations-December 2013

MECHANICAL VIBRATIONS
(MACHINE DESIGN)

Duration: 3 hours　　　　　　　　　　Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1) a) Derive the equation of motion of the system shown in figure 1, using the following methods i) Newton's second law of motion ii) D'Alembert's principle and iii) Principle of virtual work

b) What is critical damping and what is its importance?

c) What is the use of logarithmic decrement?

14M

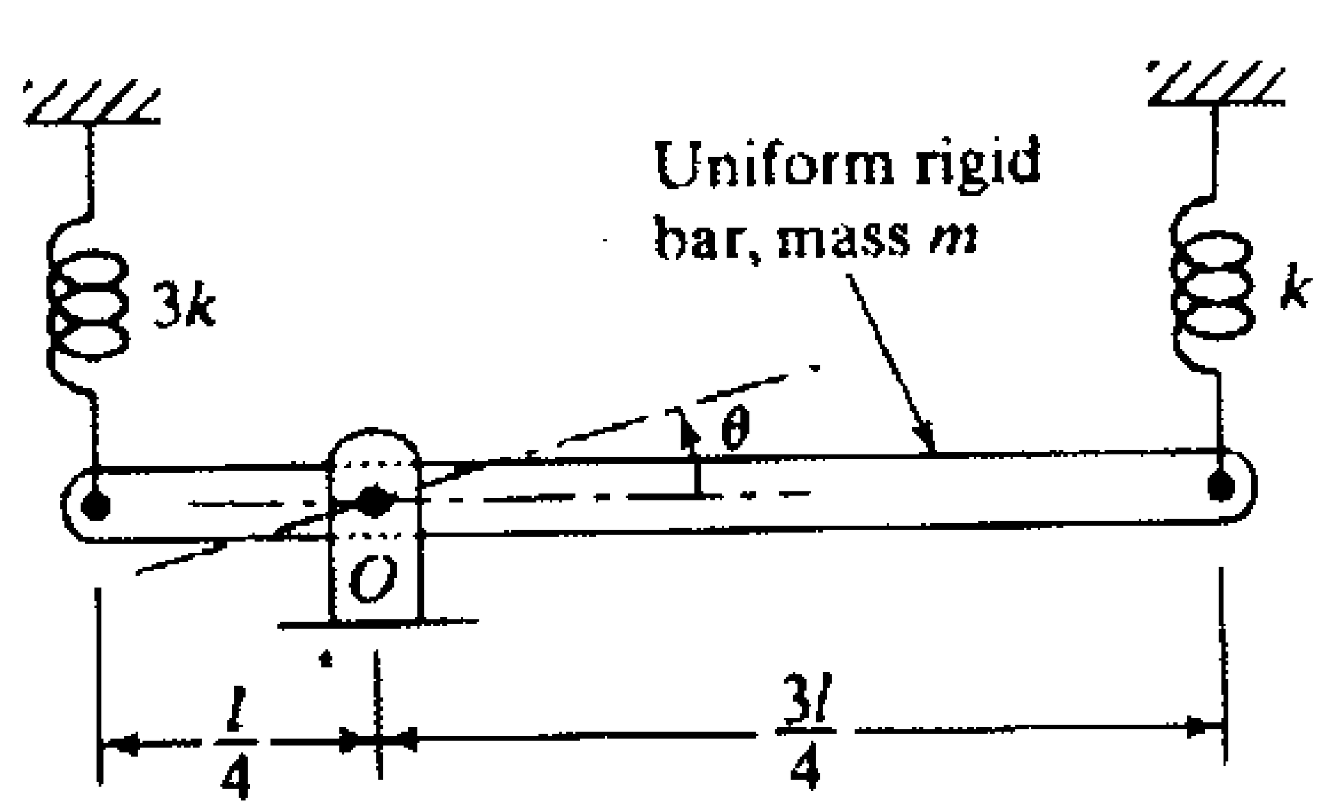

Fig 1

2) Derive the equation of motion and find the steady state response of the system shown in figure 2 for rotational motion about the hinge O for the following data: $k_1=k_2=$ 5000N/m, a=0.25m, b=0.5m, l=1m, M=50kg, m=10kg, $F_0=$ 500N, ω=100rpm.

14M

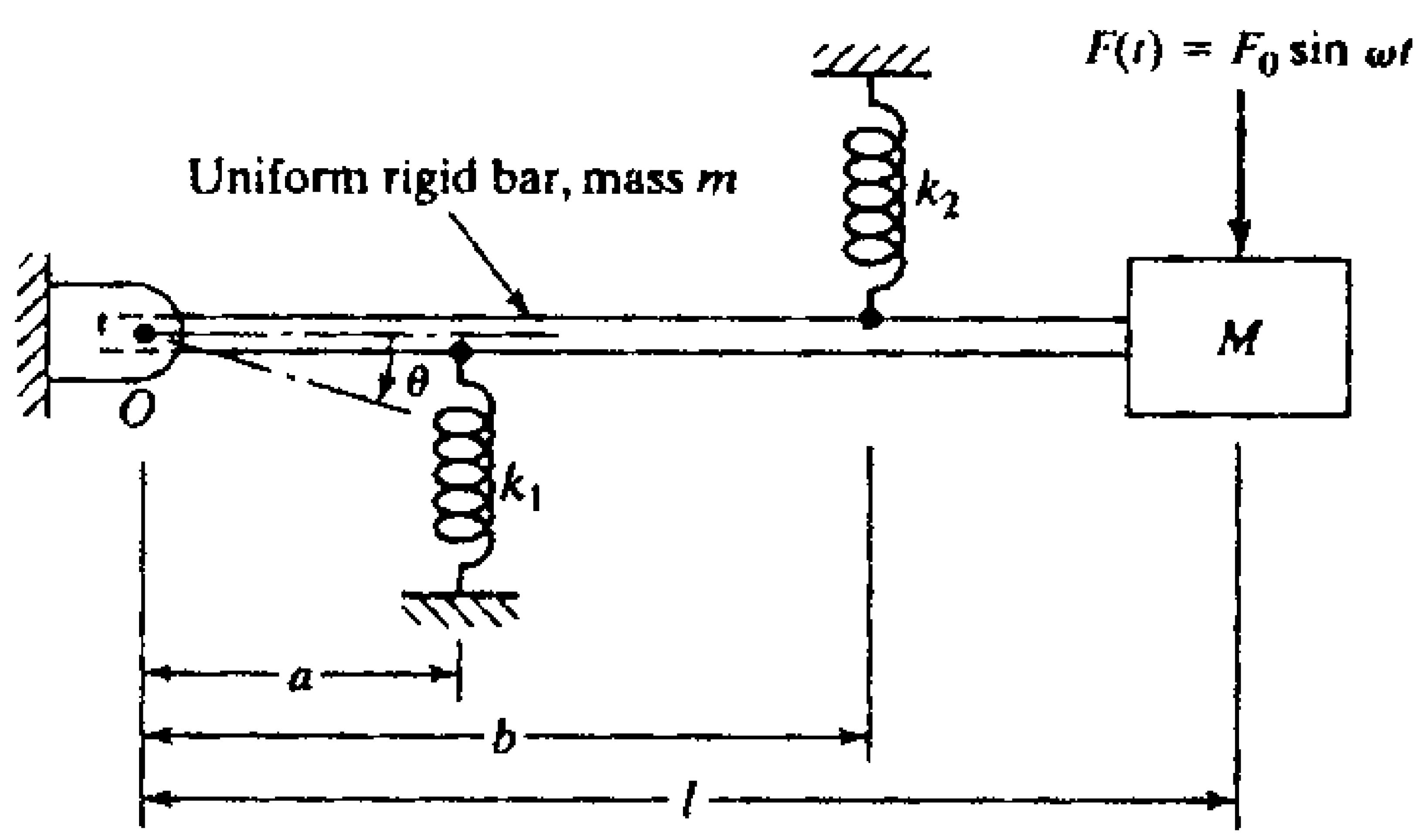

Fig 2

3) Determine the natural frequencies of the system shown in figure 3 by assuming that the rope passing over the cylinder does not slip.

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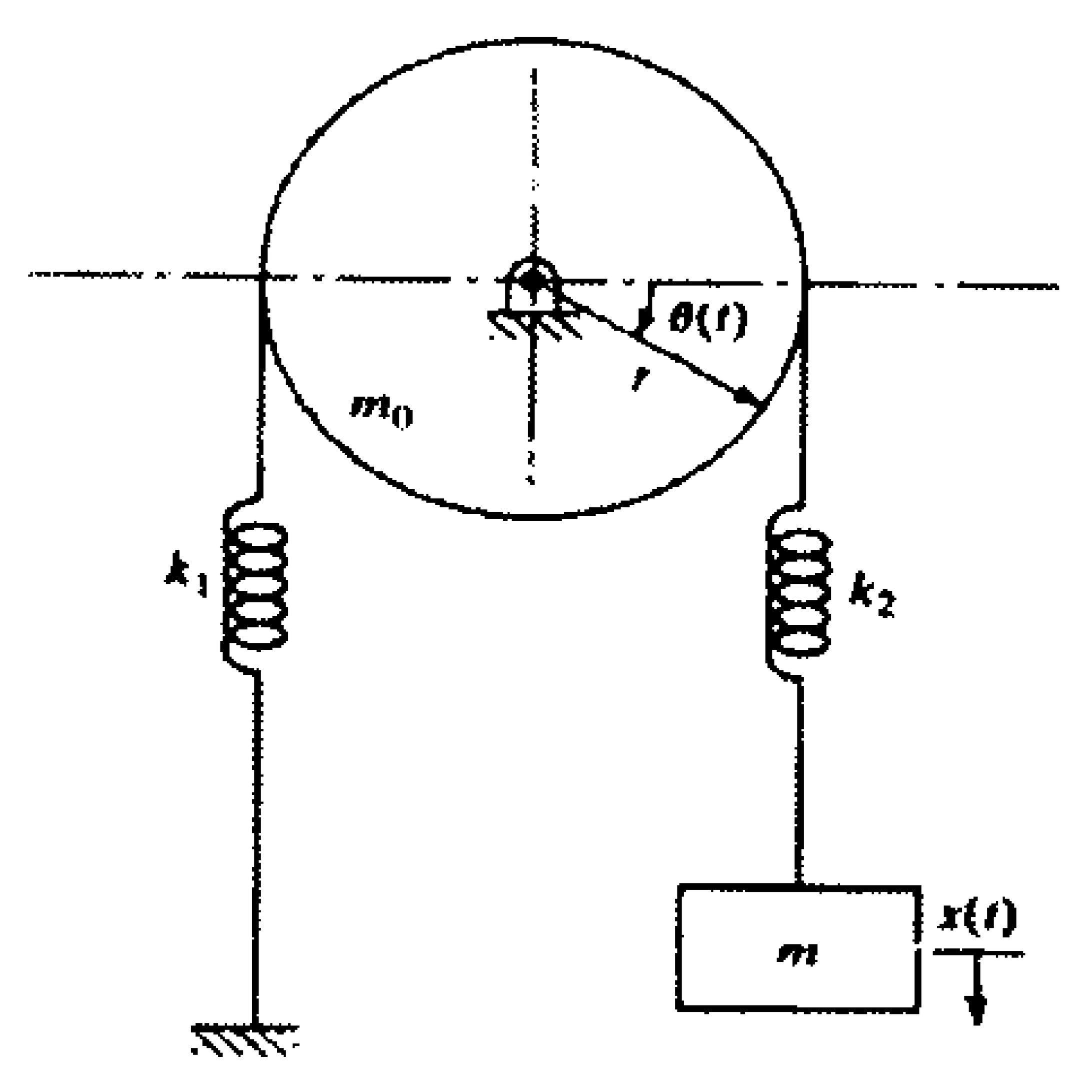

Fig 3

4) Determine the flexibility matrix of the uniform beam shown in the figure 4. Disregard the mass of the beam compared to the concentrated masses placed on the beam. Assume all l_i=l

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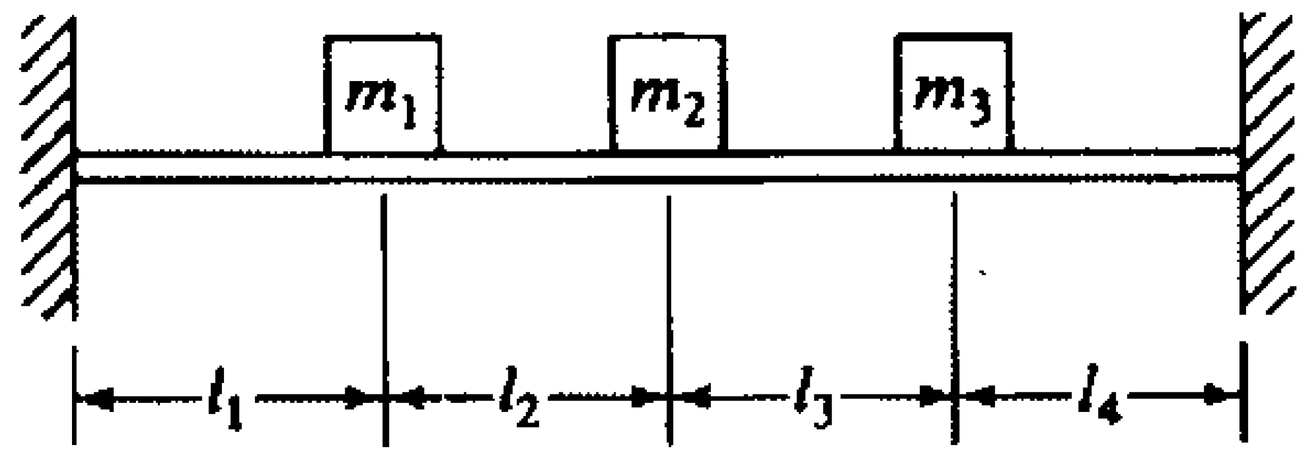

Fig 4

5) Derive the frequency equation for the transverse vibration of a uniform beam resting on springs at both ends, as shown in thefigure 5. The springs can deflect vertically only and the beam is horizontal in the equilibrium position. 14M

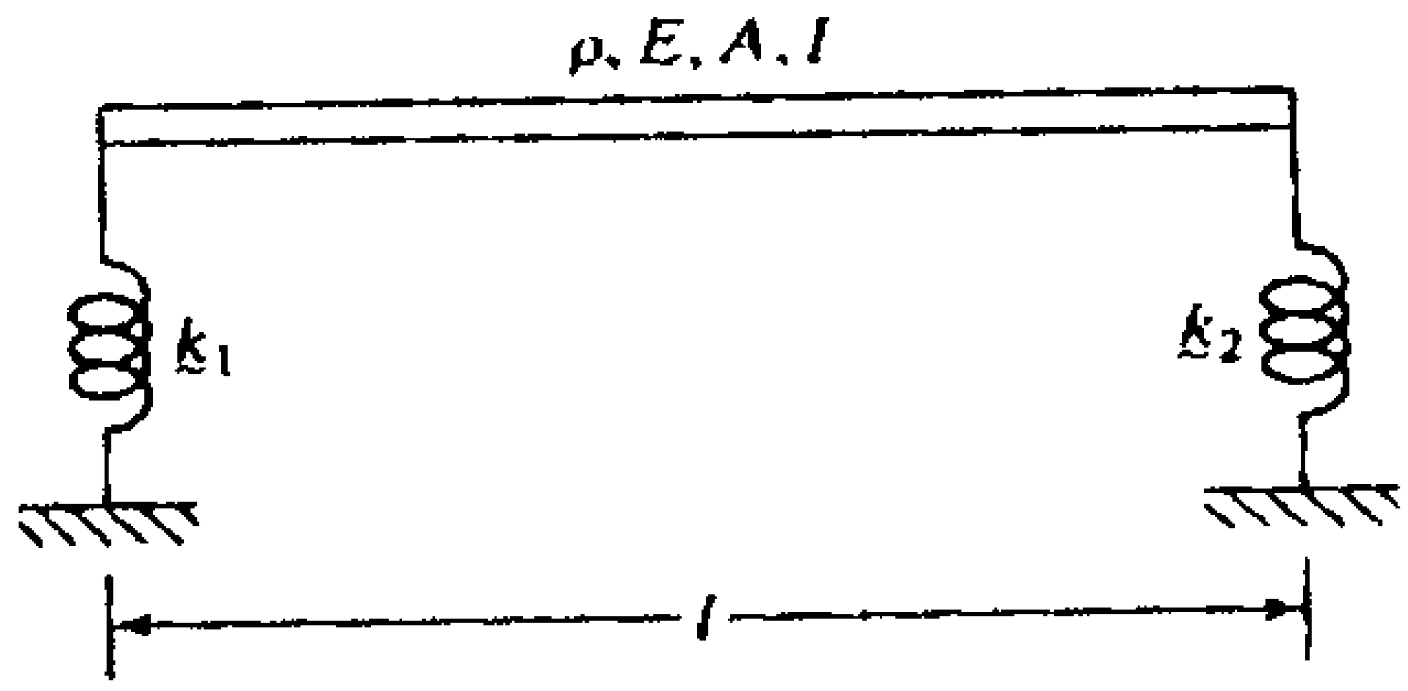

Fig 5

6) Using the matrix iteration method, find the natural frequencies and mode shapes of the system shown in figure 6 with k_1=k,k_2=2k, k_3=3k and m_1=m_2=m_3=m. 14M

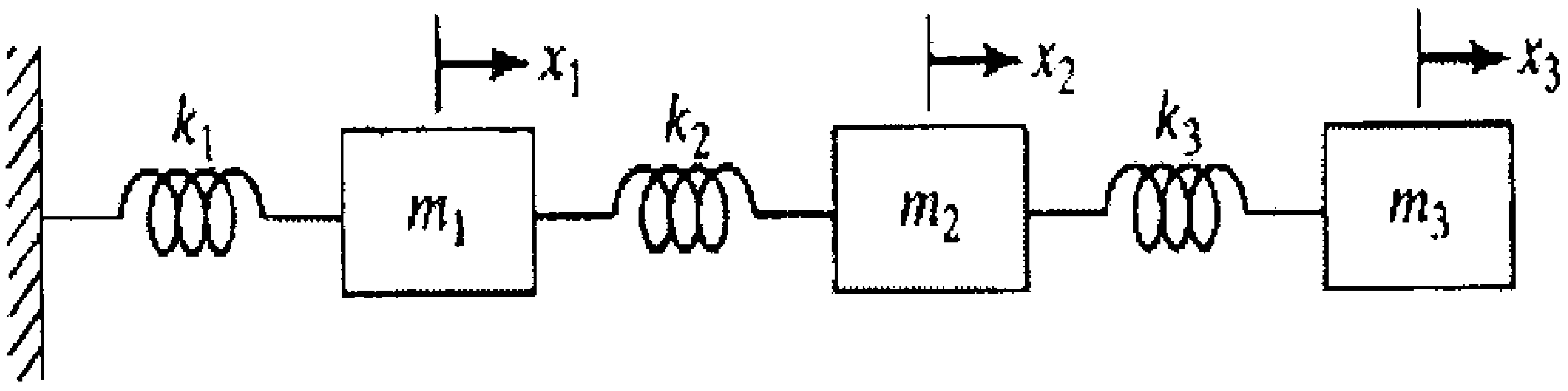

Fig 6

7) A slider crank mechanism is used to impart motion to the base of a spring mass damper system, as shown in figure 7. Approximating the base motion y(t) as a series of harmonic functions, find the response of the mass for m=1kg, c=10Ns/m k=100N/m, r=10cm, l=1m and ω=100rad/s. 14M

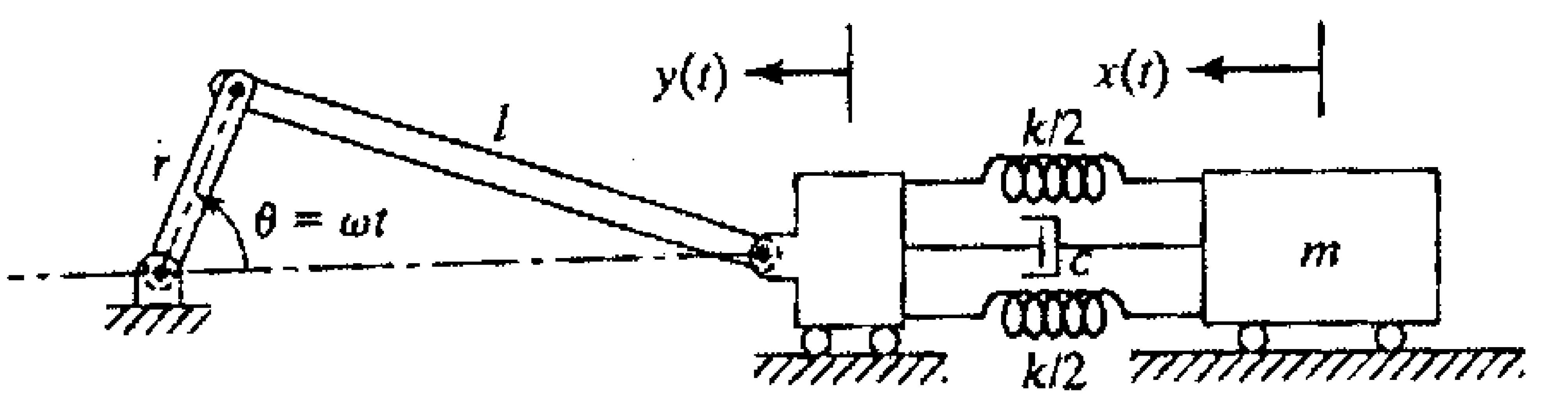

Fig 7

8) A steel shaft of diameter 2.5cm and length 1m is supported at the two ends in bearings. It carries a turbine disk, of mass 20kg and eccentricity 0.005m, at the middle and operates at 6000rpm. The damping in the system is equivalent to viscous damping with damping ratio of 0.01. Determine the whirl amplitude of the disk at a) operating speed, b) critical speed, and c) 1.5 times the critical speed. 14M