Assignment 3 (Unit 3)

1. Find the stiffness and flexibility influence coefficients of the system shown in figure below

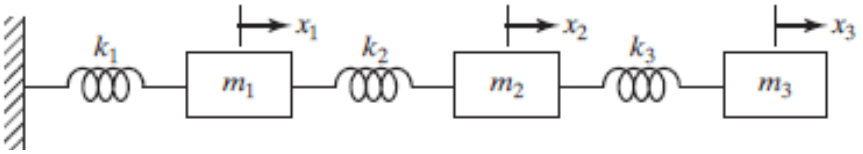

Figure 1

2. Derive the flexibility matrix of the weightless beam shown in Figure below. The beam is simply supportedat both ends, and the three masses are placed at equal intervals. Assume the beam to be uniformwith stiffness *EI*.

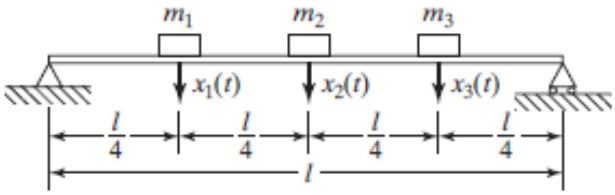

Figure 2

3. State the free-vibration equations of motion of the system and alsoFind the natural frequencies and mode shapes of the system shown below fork_1 = k_2 = k_3 = k and m_1=m_2=m_3=m

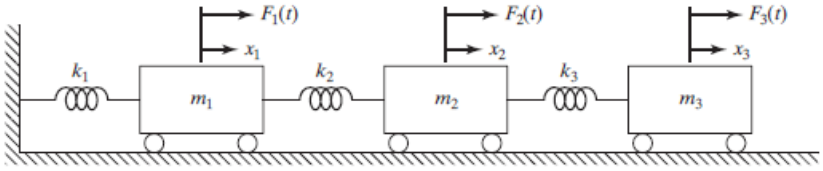

Figure 3

4. Show how flexibility influence co-efficient are used to obtain fundamental natural frequency of a system shown in **figure 4** below by stodola method.

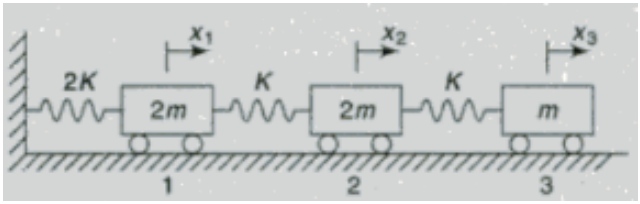

Figure 4

5. Find the lowest natural frequency and modal vector of the system shown in **figure 4** by matrix iteration method. Draw mode shape.

6. Find the natural frequencies of a unrestrained system shown in figure 5. J_1=J_2=J_3=J; K_{t1}=K_{t2}=K_{t3}
   Use Langranges equation to get differential equations of motion.
   T= $\frac{1}{2}(J\dot{\theta_1^2} + J\dot{\theta_2^2} + J\dot{\theta_3^2})$

V= $\frac{1}{2}k[(\theta_2 - \theta_1)^2 + (\theta_3 - \theta_2)^2]$

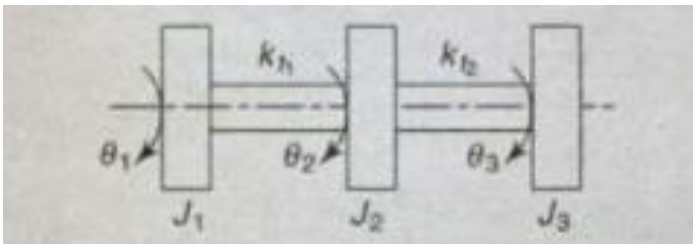

Figure 5

7. Rotor of a turbocharger of 9 kg mass is keyed centrally to a shaft of 25 mm diameter, 40 cm length between bearings. Shaft material density = 8 gm/cm^3; and shaft may be treated as simply supported. Find (i). critical speed (ii) Amplitude of rotation of rotor at 3200 rpm if eccentricity of rotor CG = 0.015 mm (iii) vibratory force transmitted to base

Reference books:

1. Dynamics of Machinery by FarazdakHaideri, 5th Edition, NiraliPrakashan
2. Mechanical Vibrations by S.S.Rao, Fifth Edition, Pearson Publicaton