**Assignement-1**

1. A mass of 0.5 kg hangs on a spring. The stiffness of the spring is 100 N/m and the mechanical resistance is 1.4 kg/s. The force driving the system is f=10cos8t. (a) Calculate the maximum steady-state displacement, average power dissipation, phase angle between speed and force and the resonance frequency. (b) What is the Q value of the system and over what range of frequencies will the power loss be at least 50% of its resonance value.
2. An air-conditioning chiller unit weighing 2,000 kg is supported by four air springs with stiffness of 1000 N/m and mechanical resistance is 2.5kg/s. (a)Draw the equivalent electrical circuit of the above mechanical system and find the mechanical impedance with its corresponding unit. (b) Calculate the resonance frequency of the above system.
3. Consider a mass-spring system described by the equation (1) Give the value(s) of s for which the system is under damped over damped, and critically damped. If the system is critically damped find out the characteristic time of the system.



1. A critically damped shock absorber is to be design for a motorcycle of mass 200 kg. When the shock absorber is subjected to an initial vertical velocity due to a road bump, the resulting relaxation time is found 2 sec. Find the necessary stiffness of the shock absorber
2. The human leg has a measured natural frequency of around 20 Hz when in its rigid (knee locked) position, in the longitudinal direction (i.e., along the length of the bone) assuming no damping. What will be the maximum displacement of the leg? At t=0 the initial speed u0=0.06 m/s and displacement x0=0.