MCL 314: Acoustics and noise control

Minor I (July-Nov 2017)

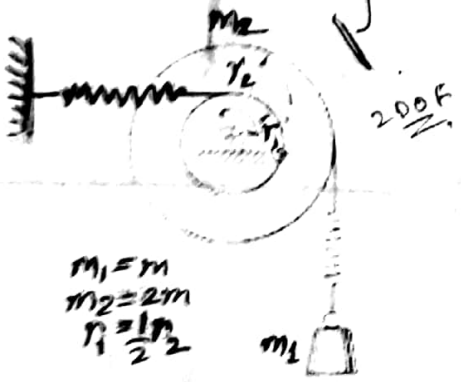
Max Time: One hour | Max. Marks: 4*10= 40

Note: Make suitable assumptions, if necessary, giving justification.

Q1. A beam simply supported at both the ends supports an electric motor at its mid-point. Approximate the system as a single degree of freedom model. The dimensions of the beam: Length = 0.5m, width= 5cm and thickness= 5mm. The material of the beam is steel. The mass of the motor is 8 Kg.

a) Find an estimate of undamped natural frequency of the system
b) Find the amplitude of the transverse displacement of the beam vibration if the motor has an unbalance (i.e. mass*eccentricity) of 0.015 Kg-m and is rotating at 2000 RPM. The damping factor of the motor-beam system is 0.01.

Q2. Derive equations of motion for the system shown in figure below. Find natural frequencies and mode shapes. The stiffness of the springs is k.



Q3. A string with tension T is fixed at one end and extends to infinity at the other end. It is driven by a harmonic force at a distance L from the fixed end. Starting from the fundamental equations find the input mechanical impedance of the string. Give interpretation of the result.

Q4. If a transient acoustic disturbance is created at time t=0 in a cylindrical pipe of length L that is open at both ends, can there exist natural acoustic waves in this pipe? If yes, find characteristics of these waves in terms of their frequencies and pressure and velocity distribution in the pipe.