EXAM WAVES AND OSCILLATIONS
Time – 1 hour

[There's no order in questions with respect to "toughness"
There should be plenty of time to solve it, some are quite easy, some are rather prolonged, but not out of your reach. All question carry same value. For the problems with sections, total marks will be divided in each section.]

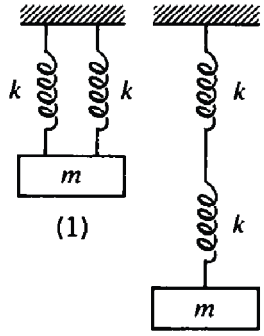
1) Two vibration along the same line are described by the equations –
Y_1 = A Cos 12πt
Y_2 = A Cos 14 πt

Find the beat period, draw a rough sketch of the resultant disturbance over one beat period.

2) Express, $z = (4\,Sin\,wt + 3\,Cos\,wt)$in the form of $z = R\,e^{[Ae^{i(wt+\alpha)}]}$

3) An object of mass m hangs from –

a) Two springs connected in parallel and
b) Two springs connected in series (watch figure)



Find the ration between the frequency of Case A and Case B. Consider the masses of both springs negligible.

4) Can you find the average Kinetic energy and average Potential energy in one complete cycle?

5) An object of mass 0.2 Kg is hung from a spring whose spring constant is 80 N/m. The body is subject to a resistive force P = -bv, where b=2 Nm^{-1} Sec, and v is the velocity at some particular moment.

a) Develop a differential equation for it, find the period.
b) The object is subjected to a sinusoidal resistive force given by F =F_0 Sin wt .
For F_0= 10 N, and w = 10 s^{-1}, find the amplitude of the oscillator in steady state.