Code No : 37148

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
IV.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOV/DEC, 2009
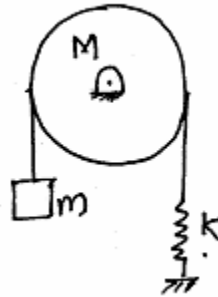**THEORY OF VIBRATIONS AND AEROELASTICITY**
(AERONAUTICAL ENGINEERING)

Time: 3hours   **Max.Marks:80**

Answer any FIVE questions
**All questions carry equal marks**
- - -

1. a)

  Determine the natural frequency of the spring-mass-pulley system shown in the   figure.
 b) Prove that acceleration is proportional to displacement in SHM.   [8+8]

2. a) Develop the characteristic equation for damped vibration and provide the solution
 b) A vibrating system in a vehicle is to designed with the following parameters.
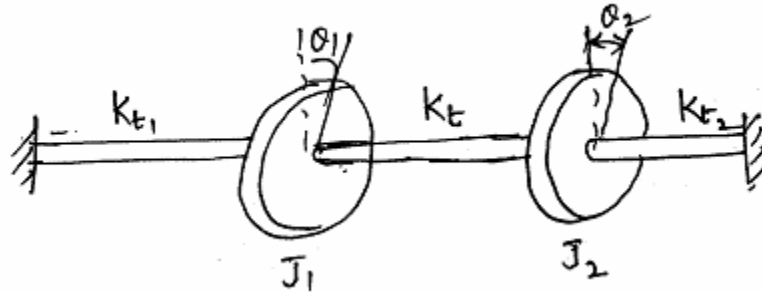   K = 100N/m, C = 2 N sec/m, m = 1 kg
    Calculate the decrease of amplitude from its starting value after '3' complete
  oscillations. Also calculate the frequency of damped oscillations.   [8+8]
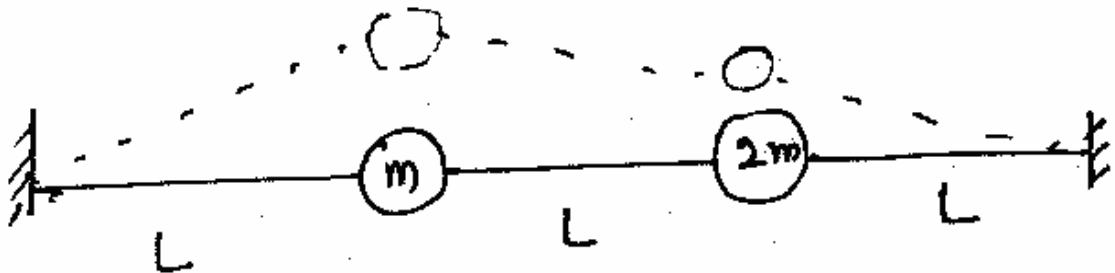
3.
Two masses are connected by equal length strings as shown. Determine the two natural
frequencies and mode shapes, assuming uniform tension in all the strings.
             [16]

4.

Determine the torsional vibrations and mode shapes for the torsional system shown in figure.
[16]

5. a) Derive the governing equation for the continuous longitudinal vibrations of a prismatic bar.
   b) Determine the frequency of vibrations of a prismatic bar with both ends free. [8+8]

6. A Rotor of a turbo super charger weighing 9 kg is keyed to the centre of a 25 mm diameter steel shaft 40 cm between bearings.
   Determine
   a) The critical speed of shaft
   b) The amplitude of vibration of the rotor at a speed of 3200 RPM, if the eccentricity is 0.015 mm
   c) The vibratory force transmitted to the bearing at this speed.
   Assume the shaft to be simply supported and the shaft material has density of 8000 kg/m^3. $E = 2.1 \times 10 N/mm^2$. [16]

7.
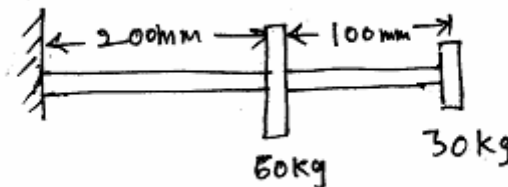
$E = 1.96 \times 10^{11} N/m^2$ $I = 6 \times 10^{-7} m^4$

Determine the lowest natural frequency of vibration of the system shown in the figure using Rayleigh's method. [16]

8. a) What is Collar's triangle?
   b) Explain the concept of flutter in aircraft wings. [6+10]
   *****