Mechanical Vibrations
(ME-408, DEC 2006)

Time: 3 Hrs
Max Marks: 60

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) What is meant by vibrations?
   b) Define Forced vibrations.
   c) What types of stresses are produced in case of forced vibrations of different types.
   d) What is meant by logarithmic decrement?
   e) Define transmissibility.
   f) What is dry friction damper?
   g) Mention the uses of vibrometers.
   h) What is Rayleigh's method, write its applications.
   i) What is the critical speed of shaft?
   j) Define continuous beam.

Section-B

2. Add the following harmonic motions analytically
   $X_1 = 4 \cos (\omega t + 10^o)$
   $X_2 = 6 \sin (\omega t + 60^o)$
3. A simple U-tube manometer filled with liquid is shown in fig. below. Calculate the frequency of resulting motion if the minimum length of a manometer tube is 0.15 m.
   Fig.1
4. A vibratory system in a vehicle to be designed with the following parameters K = 100N/m, C = 2N-sec/m, M = 1 kg. Calculate (a) the decrease of amplitude from its starting value after 3 complete oscillations and (b) the frequency of oscillation.
5. Determine the influence coefficients of the system in Fig
   Fig.2
6. The rotor of super charger mass 9 kg is keyed to the centre of a 25 m dia steel shaft 40 cm between bearings. Determine (a) the critical sped of the shaft (b) The amplitude of vibration of the rotor at a speed of 3200 rpm, if the eccentricity is 0.015 mm.

Section-C

7. A shaft 1.5 cm dia and 1 m long is held in long bearings. The weight of the disc at the centre of the shaft is 15 kg. The eccentricity of the centre of gravity of the disc from centre of rotor is 0.3 cm. The modulus of elasticity of the material of shaft is 2×10^7 N/cm^2. the permissible stress in the shaft material is 7000 N/cm^2. Find (a) the critical speed of the shaft (b) The range of speed over which it is safe to run the shaft. Neglect the weight of the shaft.
8. A vibratory body of mass 150 kg supported an springs of total stiffness 1050 k N/m has a rotating unbalance force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3. Determine (a) the amplitude caused by the unbalance and its phase angle (b) the transmissibility (c) the actual force transmitted (d) phase angle
9. A bar fixed at one end is pulled at the other end with a force P. The force is suddenly released. Investigate the vibration on the bar.