Course No: CE F432   **Date: 16. 03. 2023 (Room: 5105)**
Duration: 9:00 - 10:30 A.M.   **Max. Marks: 30**

(Attempt all questions)

1. Answer the following questions:

   a. what is the difference between vibration and oscillation?
   b. what is the significance of half-power bandwidth?
   c. what is the difference between transmissibility and magnification factor?
   d. is there any difference in defining degrees of freedom in dynamics with statics?
   e. a cylinder of diameter D and mass in floats vertically in a liquid of mass density ρ. Find the period of oscillation if it is depressed by 'x' from top surface slightly and released.
   f. the natural frequency of a spring-mass system is 20 Hz and when extra 3 kg mass is attached to its mass the natural frequency reduces by 4 Hz. Determine the mass and stiffness of the system.
   g. Explain the relationship among central difference, linear acceleration and newmark-β methods. $[0.5+0.5+0.5+0.5+1+1+1 = 05]$

2. A tower modeled as a SDOF system has stiffness of 1.2×10^6 N/m and its weight (without water) is 2000 kN. It is subjected to ground acceleration of $0.98t^2$ m/s^2. Determine the relative displacement at the top of the tower at t = 1s. Neglect damping.   [10]

3. A sinusoidal force excites an SDOF system. At resonance, the amplitude of displacement was measured to be 50 mm. At an exciting frequency of one-tenth the natural frequency of the system, the displacement amplitude was measured to be 5 mm. Estimate the damping ratio of the system.   [5]

4. The cantilever beam shown in Fig. 1(a) carries a concentrated weight at its free end and it is subjected to a periodic acceleration at its support (Fig. 1(b)) which is the rectified sine function ($\ddot{y}_0 \sin \omega t$) of period T = 0.4 sec and amplitude $\ddot{y}_0 = 4.572$ m/sec^2. Determine (a) the Fourier series expansion of the forcing function, and (b) the steady state response considering only three terms of the series. Neglect damping in the system and assume the beam massless. [5+5]
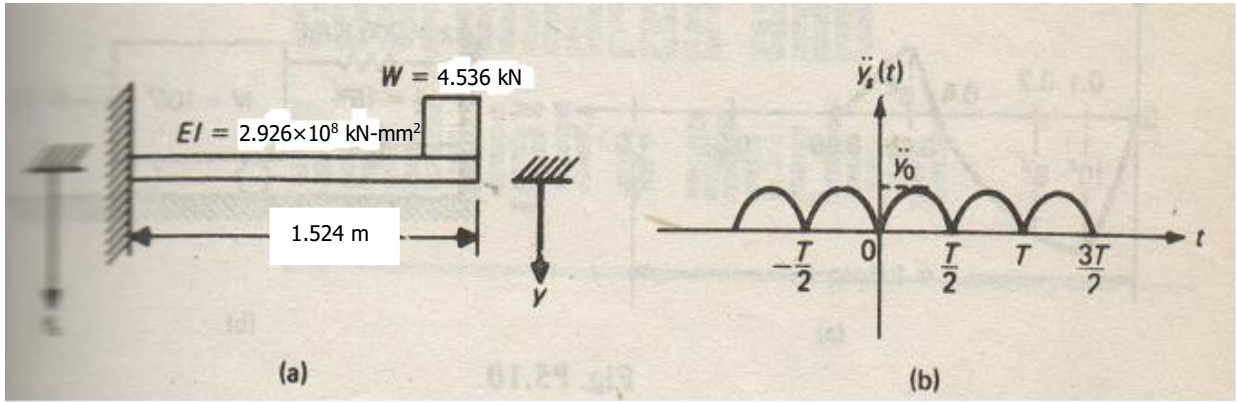
Fig. 1