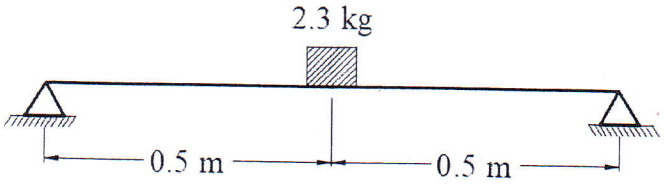
Menoufeya University
College of Engineering
Civil Engineering Dept.

Minufiya University

CVE (503) Dynamics
May, 2018
Time Allowed 3 hrs

Question (1)(10%)

A simply supported beam of square cross section 5 mm x 5 mm and length 1.0 m, carrying a mass of 2.3 kg at the middle, is found to have a natural frequency of transverse vibration of 30 rad/s. Determine the Young's modulus of elasticity of the beam.



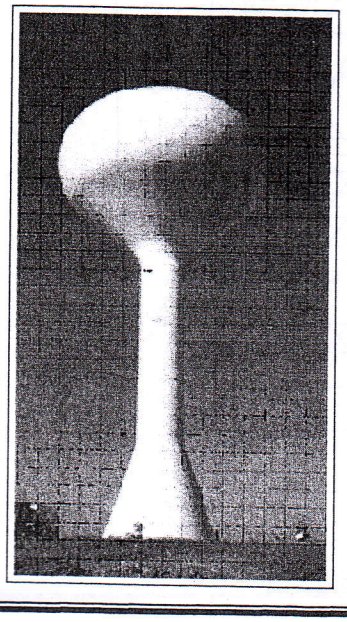
Question (2) (15 %)

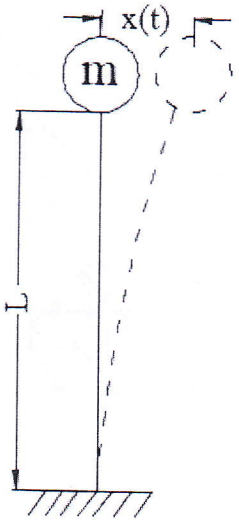
The column of the water tank shown is 90 m high and is made of reinforced concrete with a tubular cross section of inner diameter 2.4 m and outer diameter 3.0 m The tank weighs 2700.0 kN with water. By neglecting the mass of the column assuming the Young's modulus of reinforce concrete as 2.76 x 10^4 MPa, determine the following:

(a) the natural frequency and the natural time period of transverse vibration of the water tank

(b) the vibration response of the water tank due to an initial transverse displacement of 25 cm.

(c) the maximum values of the velocity and acceleration experienced by the water tank

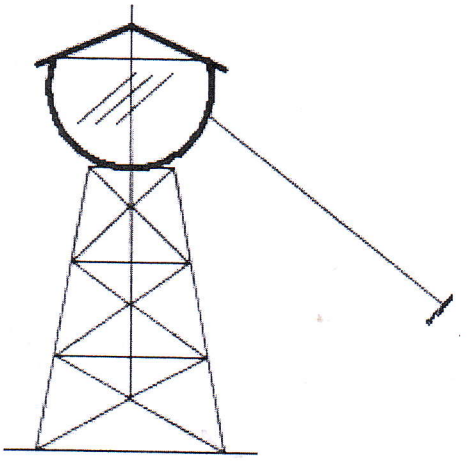




Question (3) (15 %)

A free vibration test is carried out on an empty elevated water tank shown in Figure cable attached to the tank applies a lateral force 144 kN and pulls the tank by 0.050 m. Suddenly the cable is cut and the resulting vibration is recorded. At the end of five complete cycles, the time is 2 seconds and the amplitude is 0.035 m. Compute :

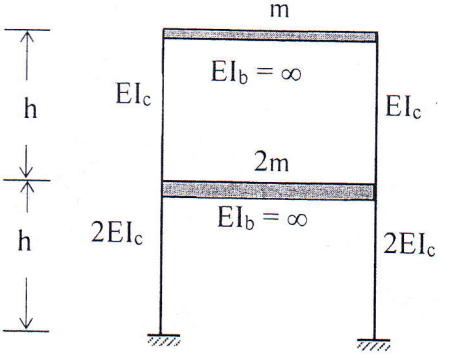
(a) stiffness, (b) damping factor, (c) undamped natural frequency,
(d) weight of the tank, (e) damping coefficient. (f) number of cycles when the amplitude becomes 0.005 m.



Question (4) (15 %)

A two story building as shown in figure is subjected a lateral acceleration, calculate :

a- The natural frequencies.
b- The mode shapes of vibrations.



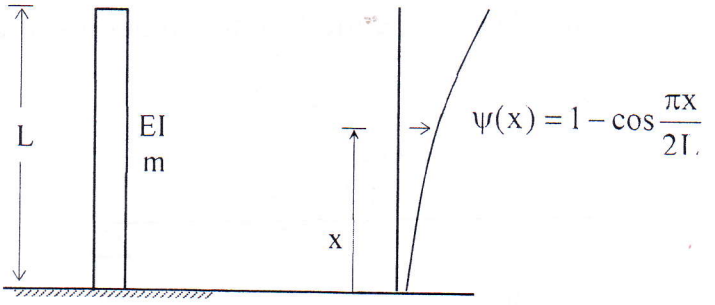
Question (5) (15 %)

A SDOF system has a total weight of 5 kN and a spring stiffness of 360 kN/m. The system is excited at resonance by harmonic force of 3.0 kN. Determine the displacement amplitude of the forced response after

(a) 1.25 cycles .
(b) 10.25 cycles.

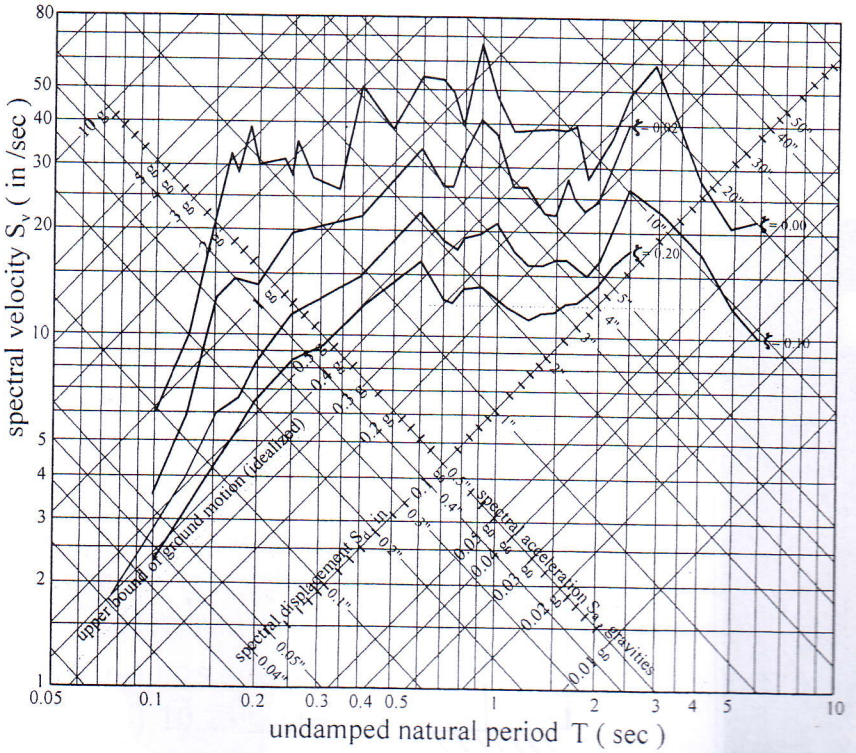
Question (6) (15 %)

A tall building as a cantilever shape has a uniform mass and stiffness with length L and mas m per unit length and stiffness EI as shown in figure, assume a shape function $\psi(x) = 1 - \cos(\pi x / 2L)$. Calculate the equation of motion of the building under its natural vibration.



Question (7) (15 %)

The frame shown in Fig. is for use in a building to be located on sloping ground. The beams are made much stiffer than columns and can be assumed to be rigid. The cross-section of the columns is 250 mm square but their lengths are 4 m and 8 m respectively. Determine the base shear in the two columns, at the instant of peak response due to El Centro ground motion. Assume damping as 10% of critical damping.



Elastic Log Tripartite Plot (1940 Elcentro Earthquake)