INTRO TO STRUCTURAL DYNAMICS & EARTHQUAKE ENGG

Instructor: Engr. Yaseen Mahmood Duration: 6 Hours

Note: Assume any missing data. Put your ID (****) in the data, if it is required. Check all the units for solving problems, which should be consistent.

Question: 1

A beam shown in Figure 1 is pulled for 1/2 inch in the downward direction and then suddenly released to vibrate freely. Determine natural time Period of the system and develop and solve the equation of motion for vibrations resulting at free end. Also develop the equation showing variation in the Equivalent static forces with time. What will be the amplitude of equivalent static force? Ignore the self-weight of beam as well as damping effect. Take E = 29,000 ksi and I = 150 in^4. δ st = Deflection due to (ID) lb static load. Also draw the graph to show the variation of displacement with time, and the variation of equivalent static forces with time. (CLO-2) **15 marks**

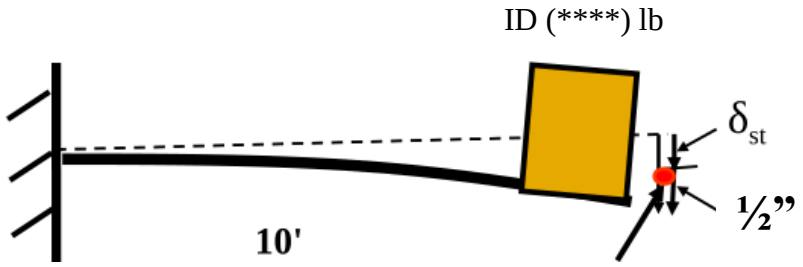

Figure 1

Question: 2

For the beam's data given in question no. 1, develop and solve the equation of motion for vibrations resulting at free end. Also develop an equation showing variation in the Equivalent static forces with time. Take ζ (Damping Ratio) of Reinforced concrete with considerable cracking. Also draw the graph to show the variation of displacement with time, and the variation of equivalent static forces with time.

(CLO-1) **15 marks**

Questions 3:

A free vibration test was conducted on an empty water tank shown in figure. A force of 60 kips, applied through a cable attached to the tank, displace the tank by (ID/1000)" in horizontal direction. The cable is suddenly cut and the resulting vibration is recorded. At the end of 7 cycles, which complete in 3.57 sec., the amplitude of displacement is 2.286 cm. (CLO-3) **20 marks**

Ignore the vertical vibration of tank and compute the following:

a. Damping ratios
b. Natural period of un-damped vibration
c. Stiffness of structures
d. Weight of tank
e. Damping coefficient
f. Number of cycles to reduce the displacement amplitude to 0.5 ″

(ID/1000) inches

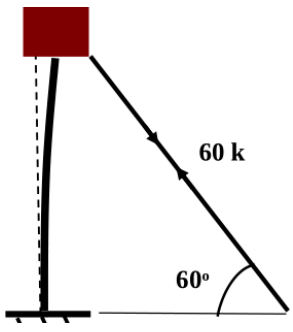

Figure 2