Kafrelsheikh University
Faculty Of Engineering
Department Of Civil Engineering
Third Year, Structural Analysis

Date 16/1/2019
Time Allowed: 4 Hours
Full Mark: 125
2 pages

ANSWER AS MUCH AS YOU CAN

Q1) 1- Mention shortly about the difference between static and dynamic analysis of structure. 2- The assumptions taken into account to consider the shear buildings. 3- Give a short definitions with net sketches (If possible) for : Free vibration – Forced vibration - Natural period – Natural frequency – Damping natural frequency - Angular frequency – Damping - Damping coefficient - Critical damping - Damping ratio - Logarithmic decrement – Frequency ratio – Resonance - Simple harmonic motion - Modal shapes - Periodic and no periodic dynamic loads – Impulsive loads - Tuned mass dampers – Tuned liquid dampers – Smart structures. 4- For one story un-damped and damped building in free vibration. Sketch the mathematical models and the free body diagrams, and then write the equation of motions in each case. (15 Marks) (ILOS a-3, b-1, c-2)

Q2) Find the period of vibration for the following structures shown in Fig. (1) and then with initial displacement of 2 cm and initial velocity of 20 cm/sec. Find the displacements, velocities and accelerations at t = 1.5 seconds. (E = 2000 t/cm^2, I = 0.005 m^4, K_s = 2000 t/m). (15 Marks) (ILOS a-3, b-1, c-2)

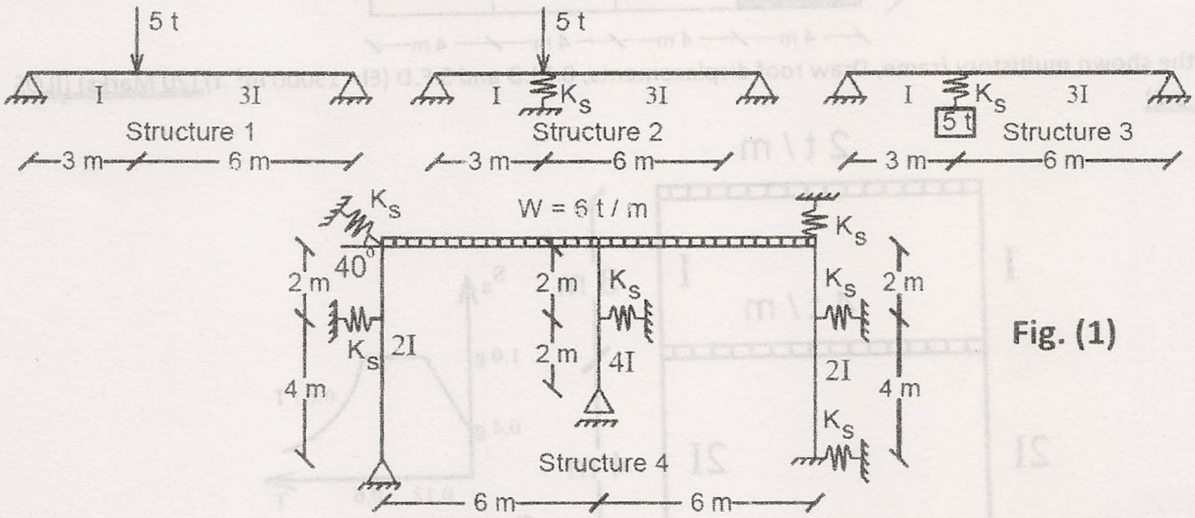


Fig. (1)

Q3) For frame shown in Fig. (2), considering 8 % damping, compute: 1- The steady state amplitude. 2- The transmissibility and the maximum force transmitted to the foundation 3- The bending moment in each column. 4 - If the frame oscillates in free vibration and the first cycle displacement = 3 cm at the roof level, draw four loops of the roof displacement. (E = 2000 t/cm^2, I = 0.005 m^4, Ks = 2000 t/m). (15 Marks) (ILOS a-3, b-1, c-2)

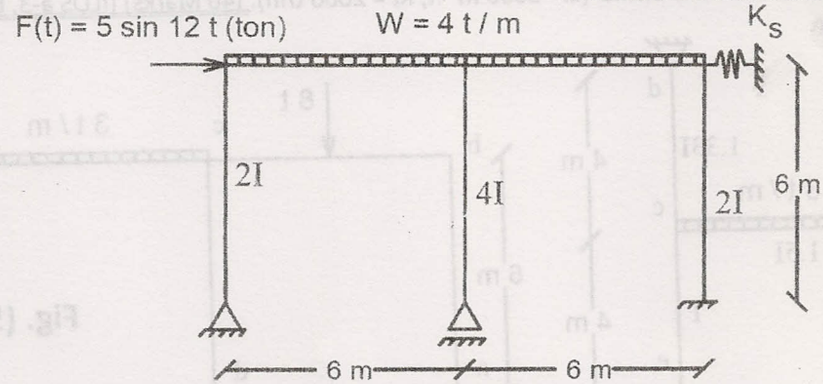


Fig. (2)

Q4) For the structural plane shown in Fig. (3) and **for Y direction only**, If number of stories = 12 , Height of each story = 3 m, Type of slab is flat slab with 24 cm thickness , Live load = 400 kg/m^2 , Flooring cover 200 kg/m^2 , Equivalent weight of walls = 200 kg/m$_2$. Using **ELASTIC RESPONSE SPECTRUM** and considering: Second zone for republic of Egypt a= 0.125g (where g= 9.81 m/s^2) – Soil class type **D – (S = 1.8)** - **(T_B = 0.1)** - **(T_C = 0.3)** - **(T_D = 1.2)** – **(R = 4.5)** – **(η = 0.95)** – **(γ_I = 1)** – **(α = 0.25)** – R.C wall dimensions 0.3m *4.0m - Neglecting own weights of R.C walls.

Take $$S_d(T) = a_g \gamma_1 S \frac{2.5}{R}\left[\frac{T_C}{T}\right]\eta \geq 0.20\, a_g \gamma_1$$

1- Compute the **TOTAL BASE SHEAR** due to the seismic loads (**Not distribute it along the height**). 2- If the raft foundation with area equal to the area of the typical floor, Check against sliding if friction coefficient $\mu = 0.25$. 3- Assuming that the redundant of lateral forces influences on a height = 2/3 of the building height from the base, Find the overall moment and check against overturning. - What is the bending moment and axial load resisted by each shear wall? (20 Marks) (ILOS a-3, b-1, c-2)

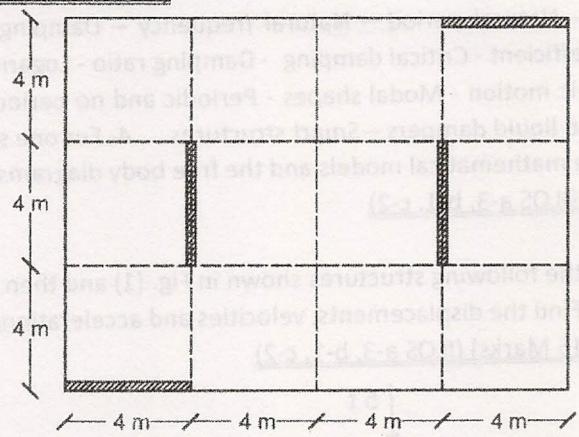
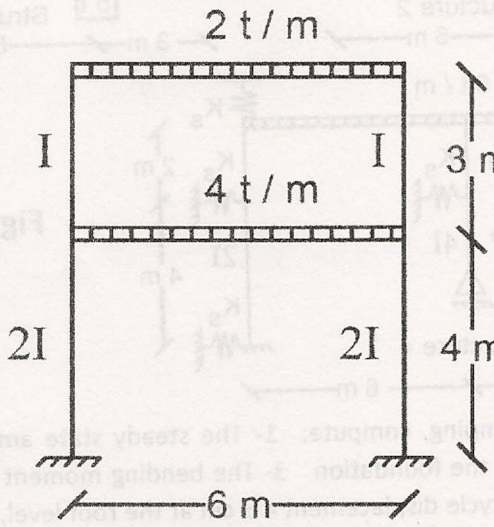
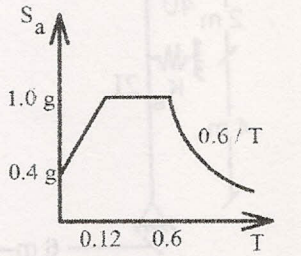


Fig. (3)

Q5) For the shown multistory frame, Draw roof displacements, B.M.D and S.F.D (EI= 15000 m^2 .t) (20 Marks) (ILOS a-3, b-1, c-2)

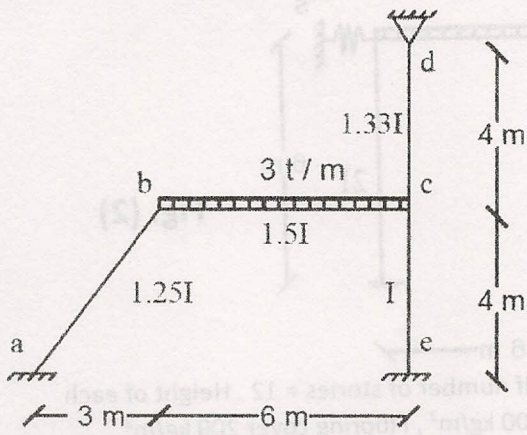




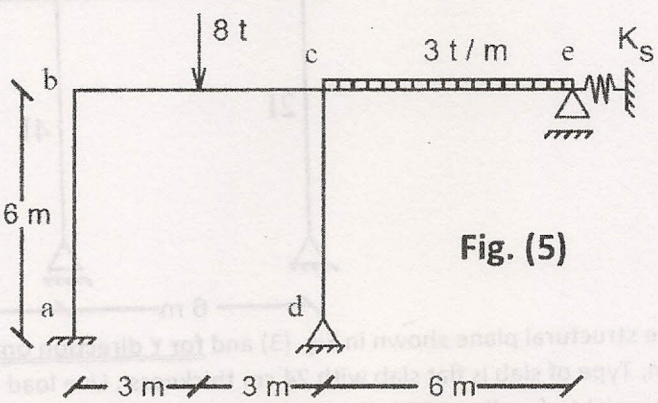
The spectrum acceleration curve

Fig. (4)

Q6) For the shown frame, Draw the final B.M.D (EI= 5000 m^2 .t, K_s = 2000 t/m). (40 Marks) (ILOS a-3, b-1, c-2)



Using Moment Distribution Method



Using Slope Deflection Method

Fig. (5)

& With my best wishes &

DR. GALAL ELSAMAK