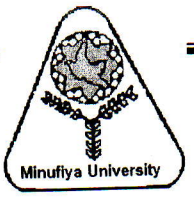
Menoufeya University
College of Engineering
Civil Engineering Dept.



Earthquake Enging
Diploma Jan. 2017
Time Allowed 3 hrs

OPEN BBOK , NOTES, AND HOMEWORK EXAM

Question (1) (20 %)

a- Define the following terms :
1-Body waves . 2- S- wave . 3- Ductility factor. 4- Epicenter. 5- fault. 6- Intensity . 7- Liquefaction. 8- Magnitude. 9- pounding. 10- Response spectra.

b - Distinguish between :
i- Earth's crust and earth's mantle.
ii- Body waves and surface waves.
iii- Lithosphere and asthenosphere.
iv- Epicenter and hypocenter.
v- Free vibrations and forced vibrations.

c – Derive an expression for the condition under which a structure will sink during an earthquake.

Question (2) (20 %)

a -Both systems in fig.(1) have the same mass, and all springs have the same stiffness k , Calculate the ratio of the two systems periods (T_1/T_2) when they vibrate freely.

b- A vibrating system consists of a mass of 4.0 kg and a spring of stiffness of 150 N/m and a damper of coefficient of 5 N-s/m. Find out:
1- Damping factor.
2- Natural frequency of damped vibration.
3- Logarithmic decrement.
4- Ratio of two successive amplitudes.
5- Number of cycles after which the initial amplitude is reduced to 25%.

c- What are the important considerations from the viewpoint of soil to be taken to ensure the safety of structure during an earthquake ?

Question (3) (20 %)

a- Calculate the ratio of energy released from an earthquake of Magnitude of 7.0 and that released from an earthquake of Magnitude of 5.0 on Richter scale.

b- What are the factors that influence the amount of structural damage caused by an earthquake ?

c- A water tank of 200 mm^3 capacity is supported on a circular shaft 0f 24 m height. The stiffness of the system is 800 kN/m and the tank period is estimated to be 1.5 sc. Calculate the maximum tank displacement and the maximum bending moment in the tank's shaft due to 1940 El Centro Earthquake assuming 10% damping ratio. Calculate the maximum displacements in case of damping ratios 0.0 %, 20.0 %. Use the given Response Spectra.

Question (4) (20 %)

a- Write short notes on:
   i- Strength and stiffness.
   ii- Simplicity and symmetry.
   iii- Stiff and flexible buildings.

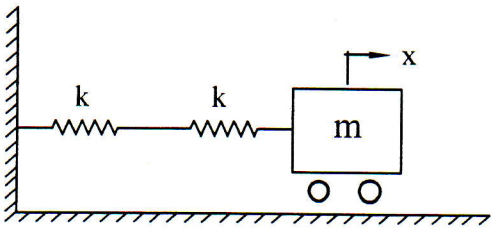
b- Irregularities of mass, stiffness, and strength are not desirable in buildings situated in earthquake prone areas. Describe using diagrams how these occur and affect the building.

c- Why lighter buildings sustain the earthquake shaking better ?

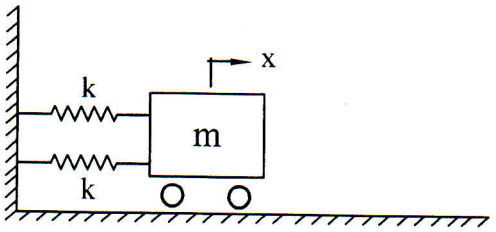
Question (5) (20 %)

a- The plan and elevation of a three-storey reinforced concrete hospital building I s shown in figure. The building is located in seismic zone IV. The type of soil encountered is medium and it is proposed to design the building with ductile shear walls. The intensity of dead load is 15 kN/m^2 and the live load is 6 kN/m^2. Determine :
   i- The force at each floor due to earthquake.
   ii- The drift of the second floor.
   iii- The base shear.
   iv- The overturning moment.

b- simple one-storey building has two shear walls in each direction as shown in figure. It has some gravity columns that are not shown. All four walls have characteristic strength of 25 N/mm^2, 25 cm thick, and 5.0 m long. The storey height is 4.0 m . The floor consists of cast in-situ reinforced concrete. Design shear force on building is 300 kN in either direction. Compute design lateral forces on all shear walls



(1)



(2)

Question 2-a

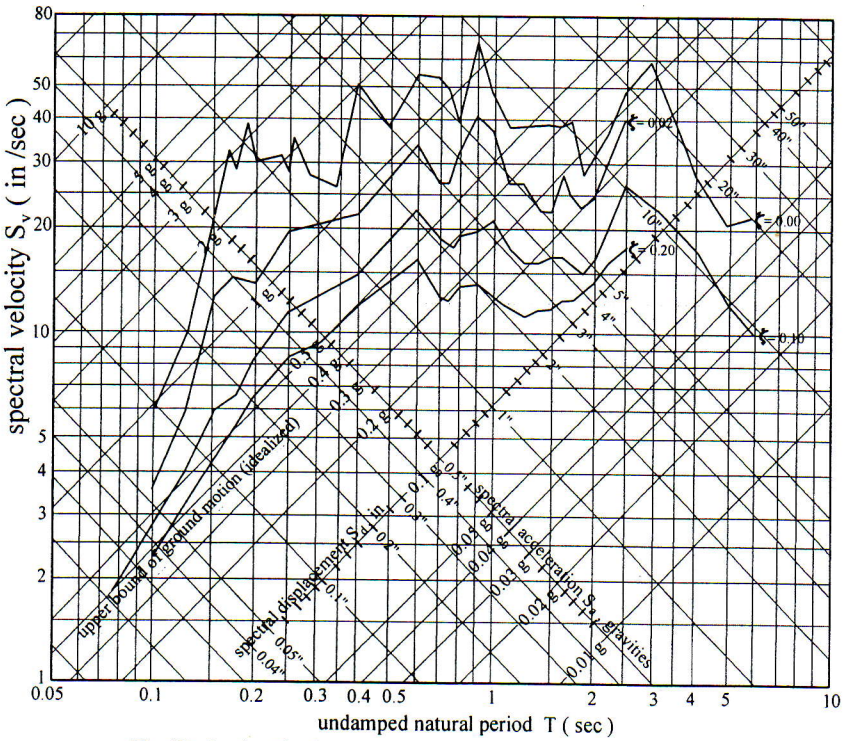
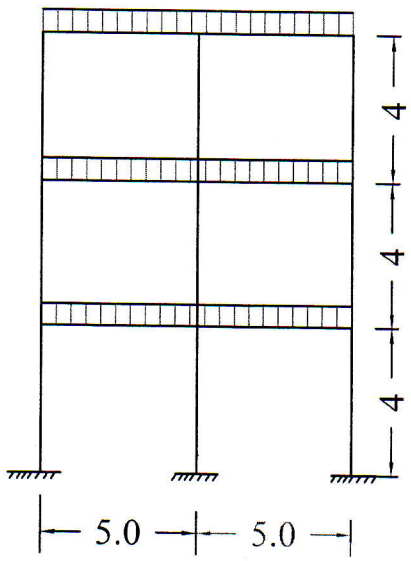
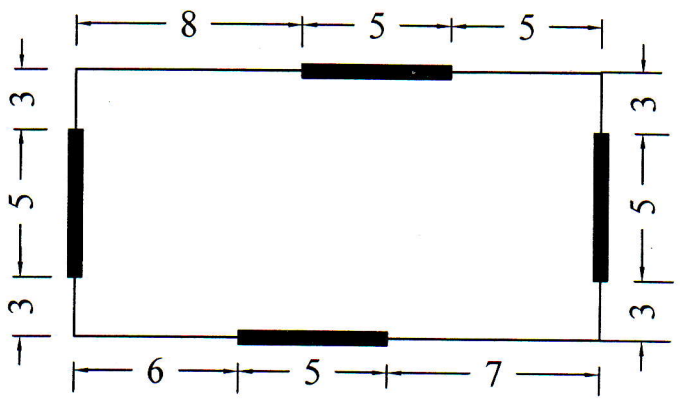


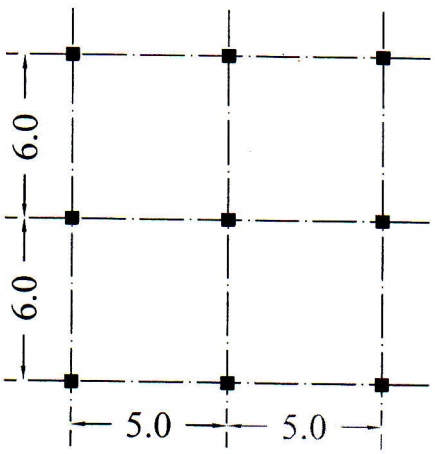
Fig (3) 3 - d Elastic Log Tripartite Plot (1940 Elcentro Earthquake)



Question 3-c



Question 5-b



Question 5-a