Menoufeya University
College of Engineering
Civil Engineering Dept.

Minufiya University

Earthquake Enging
Diploma Jan. 2015
Time Allowed 3 hrs

OPEN BBOK , NOTES, AND HOMEWORK EXAM

Question (1) (16 %)

a- What are the three main kinds of earthquakes ?
b- Define the seismograph. What are the main kinds of seismograph ?
c- Draw a sketch for Dip-Slip faults and Strike –Slip faults.
d- Three earthquakes of magnitude 2, 3, and 6 on Richter scale. If the first has an amplitude of 0.02 mm , and the energy released is 3.0×10^{14} Erg. Calculate the amplitude and the released energy for the other two earthquakes.

Question (2) (18 %)

a- What are the main four types of vibrations regarding the stiffness? Draw a sketch for each kind.
b- What is the main difference between Richter magnitude and the moment magnitude ?
c- Draw a sketch for vibrating single degree of freedom system in all possible cases of damping.
d- Calculate the natural period of vibration, and the natural frequency of a weight shown in figure. $E=2.4 \times 10^{4}$ MPa, $I=1.2 \times 10^{-4}$ m^4, k= 40 kN/m, and W=32 kN. Neglect the beam weight.

Question (3) (20 %)

a- Define liquefaction. What are the measures to be taken to reduce possibility of soil liquefaction ?

b- What is the minimum value of hydraulic gradient that cause liquefaction ?

c- State the common causes of structure failure during an earthquake.

d- The plan and elevation of a three-storey reinforced concrete factory building is shown in figure. The building is supported by three frames on axes A,B, and C, and is located in seismic zone II. The type of soil encountered is medium and it is proposed to design the building with ductile shear walls.
   i- Determine the design seismic lateral loads at each floor according to the Egyptian Code.
   ii- Calculate the shearing forces in the shear walls due to the base shear.

Question (4) (15 %)

a- Write short notes on:
   i- Strength and stiffness.
   ii- Dynamic isolation devices.
   iii- Energy dissipation devices
   iv- Properties of construction material for earthquake resistance.

b- The lift system shown is capable f moving loads up and down. Given a table illustrating the variation of the system's natural period, T, versus mass height, H. Using given response spectra shown, What will be the maximum overturning moment at the base ?

H (m)	7.5	15.0	22.5	30.0
T (sec.)	0.30	0.80	1.20	2.0

Question (5) (15 %)

a- State common causes of structure failure during earthquakes.

b- Discuss how to increase the period of vibration and energy dissipating-capacity of a building to resist earthquake.

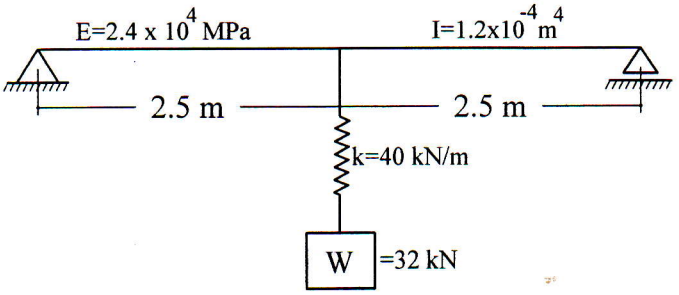
c- The bridge structure shown is subjected to a lateral load of 500 kN. Columns have the same section, material, and height. The supporting columns A and C are fixed at the tops and bottoms. Assuming center column B is fixed at the top and hinged at the bottom, what will be the resisting force in each column ?

Question (6) (16 %)

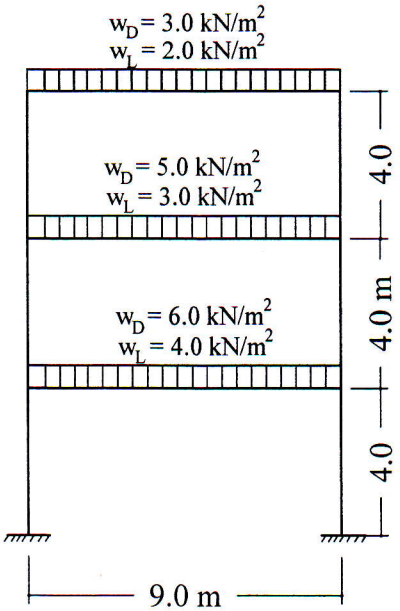
a- Explain briefly the three models used in solving structures subjected to dynamic loads.

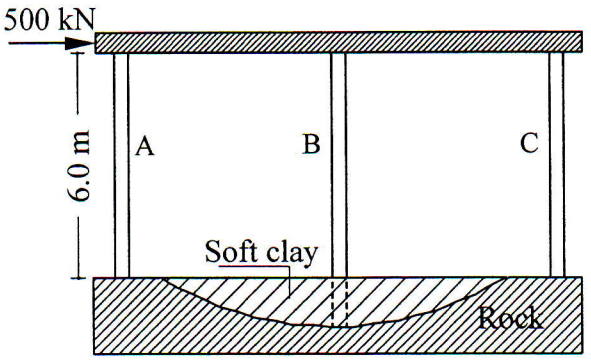
b- Simplicity and symmetry are the key to make a building earthquake resistant. Explain the concept with suitable examples.

c- A diver weighing 75 kg standing at the end of 2.5 m cantilever board, oscillates at a frequency of 2.0 Hz. Calculate the modulus of elasticity of board material , E, if the diving board dimensions is 0.8 x 0.2 m. .

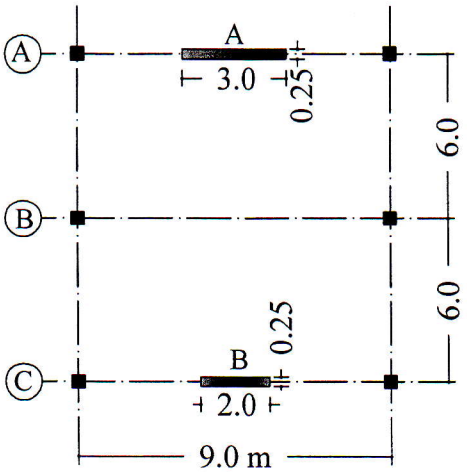


Question- 2-d

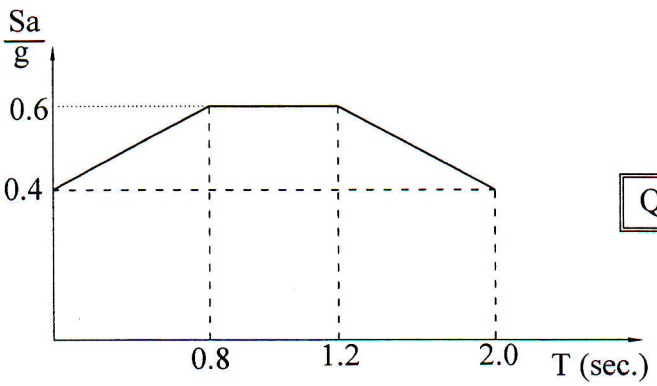




Question- 5-c



Question- 3-c



Question- 4-b