

Earthquake Engineering questions -----

Question 7: Fill out blank spaces in the following statements with given words.

High stiffness houses have (1)..... (shorter, longer) period, and Soft ground has a (2) (shorter, longer) period.

If the thickness of soft layer is deep, displacement response tends to (3) (increase, decrease), but acceleration response tends to (4) (increase, decrease).

Soil liquefaction is the phenomena that (5) (loose, dense) sand loses their strength due to (6) (increase, decrease) of water pressure during an earthquake.

Question 8:

Calculate the increase of the seismic energy (E) of an earthquake, when the magnitude (M) increases by 2!

$$\log_{10} E = 4.8 + 1.5 \times M$$

When the magnitude increases by 1, the seismic energy of an earthquake increases by approximately 30 times (Fig.4).

Question 9:

Figure 5 shows the response spectra for the Kobe earthquake and the Tohoku earthquake. The seismic damage on railway viaducts whose natural periods were around 0.5 (sec), was severe in the Kobe Earthquake but limited in the Tohoku Earthquake.

Please explain the reason of this briefly.

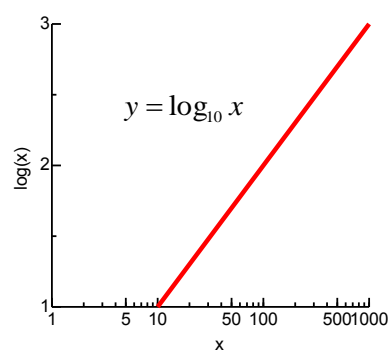


Fig.4

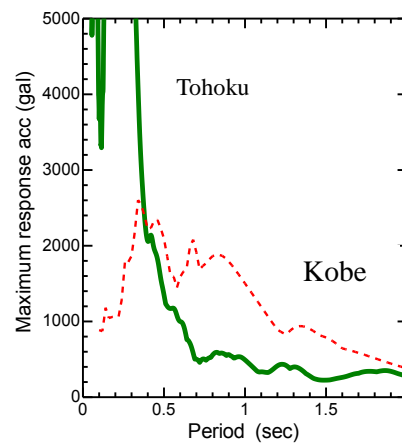


Fig.5

End of questions.

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Answer sheet for Spring Term Exam, Geotechnical Engineering, 2015

Student ID _____ Name _____ Mark _____

| | |
|---|--------|
| Answer of Question No. 1 | 9/100 |
| For NATM method, deep well, well point or drainage tunnel is used. Closed type shield tunnelling does not required any countermeasures, but open tunnel does. For cut and cover method, deeper penetration of earth retaining wall, or soil improvement is needed. | |
| Answer of Question No. 2 | 9/100 |
| A: Wale, B: Strut, C: Retaining wall | |
| Answer of Question No. 3 | 16/100 |
| $P_{up} = \text{Force on upper face: } 18 \times 10 \times (10 \times 1) = 1800 \text{ kN}$ $s_{h1} = 10 \times 18 \times 0.5 = 90 \text{ kPa}$, $s_{h2} = 20 \times 18 \times 0.5 = 180 \text{ kPa}$, $P_{side} = \text{Force on side face: } (90 + 180) \times 10 \times (0.5) = 1350 \text{ kN}$ | |
| Answer of Question No. 4 | 6/100 |
| Sinkhole is a large cavity in the ground. It is caused by instability of tunnel face or gradual movement of soil by water erosion into tunnel or cavern. | |
| Answer of Question No. 5 | 18/100 |
| Igneous rock is formed through the cooling and solidification of magma or lava. Sedimentary rocks are formed by the deposition of material. Metamorphic rocks are formed by transformation of existing rock types. Schist → Group 3: Metamorphic rock Granite → Group 1: Igneous rock Conglomerate → Group 2: Sedimentary rock | |
| Answer of Question No. 6 | 6/100 |
| (2), south | |
| Answer of Question No. 7 | 18/100 |
| 1- shorter, 2- longer, 3-increase, 4-decrease, 5-loose, 6-increase. | |
| Answer of Question No. 8 | 9/100 |
| 1000 times | |
| Answer of Question No. 9 | 9/100 |
| Natural period of Tohoku Earthquake was very short and approximately 0.3 second. Natural period of railway viaducts were around 0.5 (sec) greater than 0.3 (sec) and they did not vibrate strongly . That's why damages were limited. | |