Registration no: | | | | | | | | | | |

Total Number of Pages:02 **B.TECH**
PECI 5413

8th Semester Regular Examination – 2016-17
SOIL DYNAMICS AND EARTHQUAKE ENGINEERING
Branch(S): Civil
Time: 3 Hours
Max marks: 70
Q Code:Z229

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks. Assume suitable data wherever necessary

Q 1 Answer the following questions: **(2 x 10)**

a) How the maximum shear modulus is determined from the shear wave velocity? Is it large strain modulus?
b) What do you mean by Principal mode of vibration?
c) Define 'Tsunami'. How does it occur?
d) Sketch and discuss the Love waves. What is its tentative velocity? When it reaches?
e) Define 'material index', 'horizontal stress index' and 'dilatometer modulus' as related to Dilatometer Test.
f) What is 'state parameter'? How does it help you to determine whether a soil is liquefiable or not?
g) What is seismic moment? How moment magnitude is calculated?
h) Sketch the CVR line and Steady State Line and show their utility.
i) What is pore water pressure ratio? How does it vary with cycles of loading? Sketch the variation.
j) What is a stone column? How does it help prevent liquefaction?

Q 2 (a) Describe the internal structure of the earth. What do you mean by Moho discontinuity? Discuss the variation of shear wave velocity in different layers of the earth. **(5)**

(b) How a soil sample is prepared for tests in a static/cyclic tri-axial testing machine? Explain the process for saturated and consolidated un-drained cyclic tri-axial test at a constant cyclic strain. **(5)**

Q 3 a) Discuss various causes of earthquake. How can you measure the size and energy of an earthquake? **(5)**

b) An earthquake causes an average of 2.5 m strike-slip displacement over an 80 km long, 23 km deep portion of a transform fault. Assuming that the rock along the fault had average rupture strength of 200 kPa, estimate the seismic moment and moment magnitude of the earthquake. **(5)**

Q 4 How can you locate an earthquake? Discuss various methods. **(5)**

(a) Two Seismographic stations A and B are located 300 km apart on level ground. An earthquake occurred between these two stations and the epicenter is located exactly on the line joining these two stations. The difference in time between P and S wave arrivals was 24 seconds at A and 30 seconds at B. Determine the location of epicenter from these two stations.

(b) How CRR is estimated? A series of cyclic triaxial tests were conducted on similar saturated silty sand specimens at a constant void ratio of 0.54 with different CSRs as listed in Table: 1 below. Estimate its cyclic resistance ratio (CRR) corresponding to 20 cycles of uniform loading. **(5)**

Table: 1

Cyclic Stress Ratio (CSR)	**Cycles of Loading till Liquefaction**
0.13	436
0.15	324
0.18	176
0.204	82
0.23	33
0.256	19
0.284	04

Q 5 (a) List and discuss the factors on which the liquefaction of saturated sands depends. Show the difference between liquefaction and cyclic mobility. Discuss the cyclic stress approach of evaluation of liquefaction potential of a soil. **(5)**

(b) A uniform deposit of sand occurs up to a great depth. The observed N values are 20. The water table occurs at the ground surface. Assuming unit weight of saturated soil to be 22.4 kN/m^3, estimate if liquefaction occurs at this site for an earthquake of magnitude 7. **(5)**

Q 6 (a) Discuss in brief various ground improvement techniques to stabilize the foundation soils for constructions in earthquake prone zones with neat sketches. **(5)**

(b) An undrained cyclic triaxial test on a saturated clay specimen produces the stress-strain loop having following details: (i) Peak deviator stress = 300 kPa, (ii) maximum axial strain = 1.4%, (iii) area of the Hysteresis loop = 4.5 kPa. Determine the dynamic shear modulus, dynamic elastic modulus and the damping ratio. **(5)**

Q7 (a) Discuss various approaches to estimate the seismic bearing capacity of cohesionless soils with neat sketches and calculations. **(5)**

(b) A load of 250 kN/m is being transferred from the building to an underlying footing of width 3 m which rests on a cohesionless soil deposit having submerged unit weight = 11 kN/m^3, angle of internal friction = 32^0 and pore pressure ratio = 0.21. If N_γ = 23, find the factor of safety against failure. **(5)**

Q8 Write brief notes on any **FIVE** **(5 x 2)**

a) Permeation grouting

b) Earthquake drains

c) Seismic demand

d) Bender element test

e) Soil nailing

f) Zone of liquefaction

g) State parameter

h) Body wave magnitude