

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 714302N**Date: 09-01-2013****Subject Name: Soil Dynamics****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define coefficient of elastic uniform compression, coefficient of elastic uniform shear, coefficient of elastic non-uniform shear, coefficient of elastic non-uniform compression, damping ratio, cyclic stress ratio. Explain resonant column test in detail with spring-base model. **07**
- (b)** Derive expression for the vibration response of free damped SDOF structural system. **07**
- Q.2** A vertical vibration test was conducted on a 1.5m x 0.75m x 0.75m high concrete block in an open pit having depth 2.5m which is equal to the anticipated depth of actual foundation. The test was repeated at different settings (θ) of eccentric masses. The data obtained from the tests are given below: **14**

Sr.No	θ (degree)	f_{nz}	Amplitude at resonance (microns)
1	37	41	14
2	74	39	25
3	110	33	32
4	150	31	41

The soil is sandy in nature having angle of internal friction $\phi = 36^\circ$ and saturated density $\gamma_{sat} = 20.5 \text{ kN/m}^3$. The water table lies at a depth of 3.5 below ground surface. Probable size of actual foundation 4.0 x 3.0 x 3.5m high. Determine the values of C_u , E and G to be adopted for the design of actual foundation. Limiting vertical amplitude of the machine is 150μ .

- Q.3 (a)** For a given site at Ahmedabad, the top 12m soil is round medium grained sand having dry unit weight as 17.3 kN/m^3 . The water table is 5m below the ground surface. The value of G is 2.69. The direct shear test gave the value of ϕ as 38° . Determine the value of shear modulus of the soil at depth of 7m ground surface. **07**
- (b)** List the various factors considered in cyclic triaxial compression test. Discuss the observations made by Casagrande & Shannon on Cambridge clay and Manchester sand. Explain relationship between total stress and total strain under pulsating load conditions as depicted by Seed and Chan. **07**

OR

- Q.3 (a)** Define liquefaction and explain mechanism of liquefaction. Explain Seed and Lee observations by dynamic triaxial test (undrained condition) on Sacramento river sand with plots. **07**
- (b)** For a given site at Baroda, a Standard Penetration tests was carried out at given site for depth upto 13m and following results were recorded: **07**

Depth (m)	Soil Classification	D ₅₀ (mm)	N-value	D _R (%)	Remarks
1.5	SP	0.18	3	19	Position of water table lies 2.0m below ground surface. Take $\gamma_{\text{moist}} = 19\text{kN/m}^3$, $\gamma_{\text{sub}} = 10\text{kN/m}^3$
4.5	SM	0.12	6	35	
7.5	SM	0.13	12	45	
10.5	SW	0.20	20	52	
13	SW	0.22	24	60	

The given site belongs to seismically active region and is likely to be subjected by an earthquake of magnitude 7.5. Determine the zone of liquefaction using (i) Seed and Idriss method (ii) Iwasaki method. Assume $N_s = 20$. Refer figs 1 & 2 if necessary.

D _R (%)	Cr
0-50	0.57
60	0.60
80	0.68

- Q.4 (a)** 1. Two pendulums are hanging on an ideal spring with equal mass. The period of vibration for the pendulums is 6 sec & 3 sec respectively. What is the stiffness of the second pendulum with respect to first? **07**
 2. What is the natural period of vibration of the second system with respect to first if both systems are identical except height? $H_1 = 3H_2$
(b) Explain the concept of Active & Passive isolation in detail. **07**

OR

- Q.4 (a)** A simply supported beam of negligible mass spanning 6 m supports a machine of 20 kN at center with an unbalanced rotor applying a vertical force of $0.4 \sin 60t$ kN. The damping force is 0.5 kN-s/m & Flexural rigidity of beam is 15000 kN-m². Determine (i) maximum amplitude of vibration (ii) amplitude of vibration at resonance **07**

- Q.4 (b)** Explain construction aspects of Machine Foundation **07**

- Q.5 (a)** A SDOF vibrating system is having following parameters. **07**
 $m = 20$ kg, $k = 300$ N/m, $c = 10$ N – sec / m.
 Determine (i) the damping factor (ii) the natural frequency of damped vibration (iii) logarithmic decrement (iv) the ratio of two successive amplitudes & (v) the number of cycles after which the original amplitude is reduced to 30%

- (b)** Write short note on vibration measuring equipments **07**

OR

- Q.5 (a)** A two storey single bay RC frame is supported by four corner columns. Building is located in Pune has lumped floor weights of 200 kN & having storey stiffness 100 kN/m at every floor level. Perform free vibration analysis and determine all natural frequencies & sketch mode shape. Interpret the result of mode shape. **07**

- (b)** (i) With reference to above problem (ref Q-5(a) OR), Calculate natural frequency by approximate method. (ii) It was decided to install machinery of mass 40 tonne at second floor. Draw mode shape & interpret the result. Give your valuable comment about the result. **07**

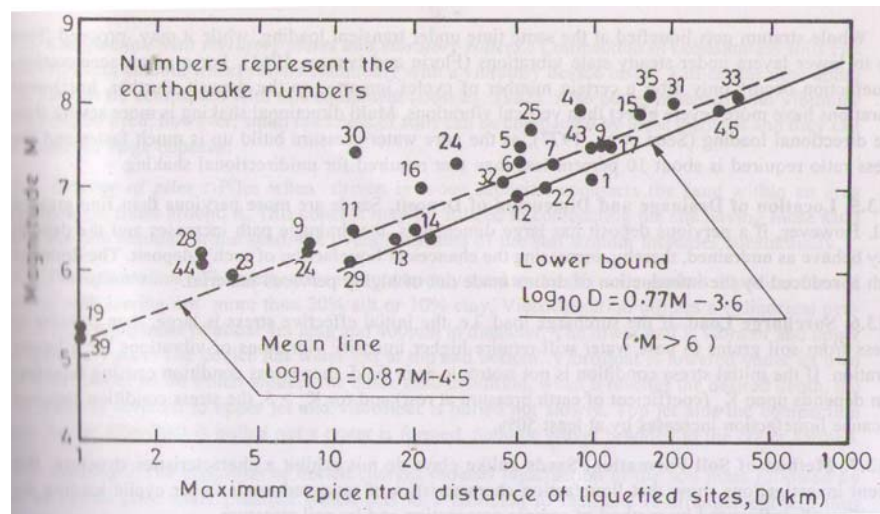


Figure 1(Q-3(b))

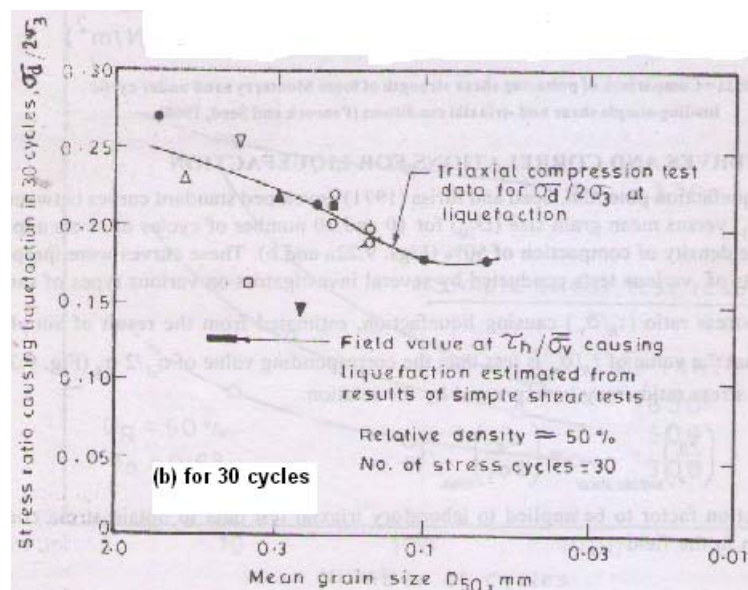
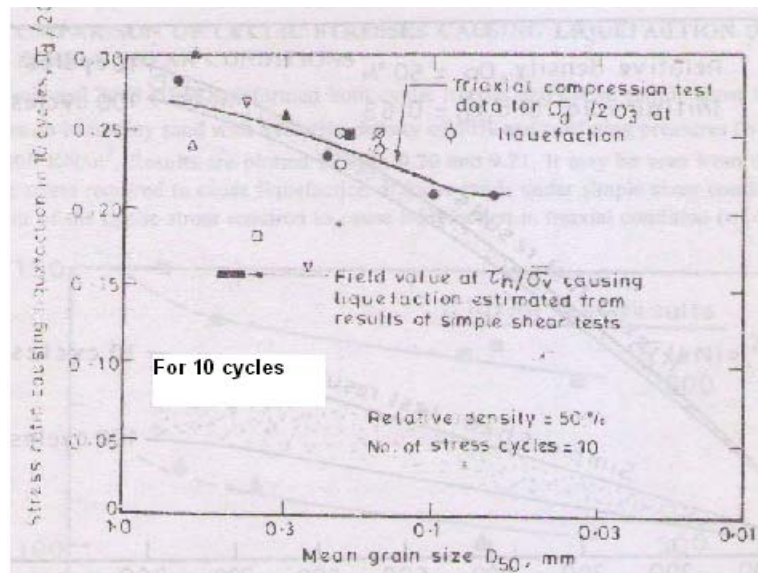


Figure 2(Q-3(b))