Code No: C2009 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I - SEMESTER EXAMINATIONS, APRIL/MAY-2012
SOIL DYNAMICS AND FOUNDATION ENGINEERING
(STRUCTURAL ENGINEERING)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
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1.a) Derive the expression for natural frequency in case of SDOF - Free Vibration and subjected to no damping.

b) A foundation weighs 840 kN. The foundation and the soil can be approximated as a mass-spring-dashpot system. If the spring constant, k = 25 x 10^4 kN/m and the dashpot coefficient, c = 2500 kN m/s, determine the following: i) Natural circular frequency, ii) Critical damping coefficient, iii) Damping ratio, iv) Logarithmic decrement and v) Damped natural circular frequency.

2. Discuss in detail the ensuing motion of SDOF - free vibration system subjected to damping for the following cases: i) over damped ii) critically damped and iii) under damped systems.

3.a) Explain in detail, how the coefficient of elastic uniform compression can be computed using block resonance test.

b) Using Barkan's approach determine the coefficient of uniform compression, if a vibration test on a block 1m x 1m x 1m gave a resonance frequency of 20 Hz in the vertical direction. The mass of the oscillator used was 120kg. The mass density of the test block material is 2500 kg/m^3.

4.a) Discuss in detail the method of conducting seismic cross hole test and write the suitable formulae for shear modulus estimation.

b) A cyclic plate load test was carried out on a soil deposit to estimate the elastic coefficients for the design of a compressor foundation. The test was carried out at a depth of 5m using a 0.3m x 0.3m test plate. For the data given below, plot the stress versus elastic settlement relationship and determine the coefficient of elastic uniform compression at i) 0.3 x 0.3m plate area and ii) 6m^2 footing area. Take Poissons ratio = 0.40 and unit weight of soil = 14 kN/m^3.

Stress (kN/m^2)	15	30	45	60	75	100	150
Elastic settlement (mm)	0.2	0.39	0.58	0.75	0.92	1.24	1.84

5.a) Define and discuss critically the 'radiation damping' and 'internal damping'. Write the negative effects of damping.

b) A block vibration test was performed on a block made up of M_{15} grade concrete of size 1mx1mx1m using vertical excitation. The unit weight of concrete is 24 kN/m^3. The frequency at the peak amplitude of $2\sqrt{2}$ mm was found to be 20 Hz and the frequencies corresponding to amplitude equal to 2 mm are 15Hz and 25 Hz. Determine the damping ratio of the system. Also determine the resonance frequency of the system corresponding to the frequencies at 2mm amplitude and for a damping ratio of 0.3.

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6.a) Discuss in detail the Pauw's analogy for natural frequency and write how apparent soil mass is computed using this analogy.

7.a) Discuss the parameters involved in Hsieh's analogy for vertical vibrations.

b) Explain how the natural frequency of a footing is influenced by its shape on vibratory response.

8.a) Discuss the properties of vibration isolating materials such as steel and cork.

b) Design a suitable foundation block for a double acting steam hammer whose data are given below. Weight of the falling ram = 5t, height of the drop = 1.5m, area of the piston = $0.2m^2$. Average steam pressure on piston = 120 t/m^2. Weight of the anvil = 100t. base area of the anvil = $6m^2$, weight of the frame = 1.5t, which is fixed to the foundation block, the thickness of the pad under the anvil is 0.60m, 'E' of the material of pad = 5.0×10^4 t/m^2, coefficient of impact (restitution) = 0.65, soil properties: coefficient of uniform compression = $C_u = 4.5 \times 10^3$ t/m^3, mass density of soil = 1.9 g/cc. safe bearing capacity of the soil is 25 t/m^2.

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