CVL 706: Soil Dynamics and Earthquake Geotechnical Engineering

Minor Test II (March 26, 2018)

Max Marks: 25 Time: 1 hr

Q.1 State the types of machine foundations and draw schematic diagram of each type. State the type of machine for which each type of foundation is used. What is the distinct advantage of each type and which method is used for design of each type? (5)

Q.2 What is high tuning? What is its advantage? Why and when it is difficult to achieve high tuning? What precaution is needed when high tuning is not possible? (2)

Q.3 Discuss how the acceptable limits of vibration for the machine foundations are decided. (2)

Q.4 A reciprocating machine of negligible mass is located on a foundation block of 1.2 m x 0.8 m x 0.5 m (high). Assume G = 1.5 x 10^4 kN/m^2, γ_t = 15 kN/m^3 and Poisson's ratio = 0.35. Operating frequency of machine is 200 rpm. Maximum unbalanced Rocking Moment = 0.5 kN-m. Neglect horizontal force. Use elastic half space lumped parameter method. Assume γ_{conc} = 24 kN/m^3, g = 10 m/s^2. Determine natural frequency, and maximum angular, vertical and horizontal displacements.

Use: $k_\phi = [8G(r_0)^3]/[3(1-\nu)]$; $B_\phi = [3M_{m\phi}(1-\nu)]/[8\rho(r_o)^5]$; $D_\phi = 0.15/[(1+B_\phi)(B_\phi)^{0.5}]$

(7)

Q.5 A forging hammer is to be installed has following specifications:
Weight of tup = 10 kN, Maximum tup stroke = 1.0 m, Total weight of Anvil = 200 kN, g = 10 m/s^2, Bearing area of Anvil = 3 m x 3 m, thickness of wooden pad below anvil = 0.5 m, Young's modulus of pad material = 6 x 10^5 kPa and Coefficient of restitution of Anvil = 0.5. Dimensions of foundation block is 4 m x 6 m x 1.0 m (high). The foundation soil has the following details: (C_u) at allowable maximum strain level for impact loading = 2.0 x 10^4 kN/m^3, and Unit weight of soil = 18 kN/m^3. Determine coupled natural frequencies and maximum vibration amplitudes of foundation and anvil. (9)

Use:

$$w_{n1,2}^2 = 0.5\left((1+\mu_m)(w_{n\alpha}^2 + w_{n\beta}^2) \pm \sqrt{\left(((1+\mu_m)(w_{n\alpha}^2 + w_{n\beta}^2))^2 - (4(1+\mu_m)w_{n\alpha}^2 w_{n\beta}^2) \right)} \right)$$

$$z_1 = \frac{(w_{n\alpha}^2 - w_{n1}^2)(w_{n\alpha}^2 - w_{n2}^2)(V_\alpha)}{(w_{n\alpha}^2)(w_{n2})(w_{n1}^2 - w_{n2}^2)}$$

$$z_2 = \frac{(w_{n\alpha}^2 - w_{n1}^2)(V_\alpha)}{(w_{n2})(w_{n1}^2 - w_{n2}^2)}$$