Enrollment No._____

NAVRACHANA UNIVERSITY
a UGC recognized University

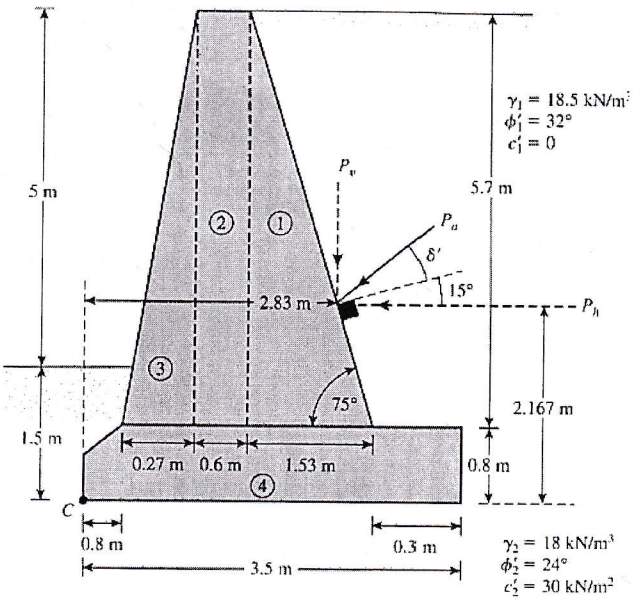
School: School of Engineering and Technology
Program/s: M.Tech Structural Engineering
Year: 2nd **Semester:** 3rd
Examination: End Semester Examination
Examination year: December - 2021

Course Code: SE-114 **Course Name:** Advance Foundation Engineering -II
Date: 03/12/2021 **Total Marks:** 40
Time: 11:30 am to 01:30 pm **Total Pages:** 04

Instructions:

- *Write each answer on a new page.*
- *Use of a calculator is permitted*
- *Copies of Indian Standarad Codes (IS-code): IS 6403 Breaking capacity of shallow foundations, IS 8009 (Part 1) Settlement of foundations and IS 2911-Part 1 Design and Construction of Pile Foundations IS 14458 Part 2 Retaining wall and IRC 45 1972 Well foundations are allowed.*
- *Formulations and Graphs from research paper required as a reference to solve numericals are attached with the paper.*
- *Specify clearly the assumptions made and draw figures wherever applicable.*

Q. No.	Details	Marks	CO	BT
Q.1	Short Questions (Any 10) 1. Short piles unrestrained at top fail by rotation as a rigid body about a centre of rotation. (True/ False) 2. _____shape of well foundation is considered to be highly effective and economical. 3. Define negative skin friction in pile foundations. 4. Depth of well foundation should not be less than 1.55 times maximum scour depth. (True/ False) 5. Passive pressure acting on the toe of the retaining wall disturbs the stability of retaining wall against sliding.(True / False) 6. Vertical pressure remains constant in static method of pile load carrying capacity when the depth of pile > critical dept. (True / False) 7. State the various alternatives to improve FOS during sliding in retaining wall. 8. In order to reduce the time of consolidation and improve strength of soft clayey soils_____ ground improvement technique is adopted. 9. Specify the frequency ratio range in machine foundation to ensure stability of foundation w.r.t to amplitude criteria. 10. _____type of geosynthetics facilitate interlocking of soil/aggregate particles within their opening. 11. IS code method to obtain lateral load carrying capacity of piles is applicable only for short piles. (True/ False)	10	CO1 CO2 CO3 CO4 CO5	1,2,3,4
Q.2	A 300 mm circular pile is driven 5 m below ground level in pre-loaded clay. The load to be applied is 1 m above the ground, c_u = 100kPa, α = 0.3. a. Determine the allowable vertical pile load carrying capacity using static method (FOS =2.5).	10	CO2	1,2,3,4

	b. Determine the allowable ultimate lateral load that can be applied on a pile using IS 2911methods and Broms Method with M_U = 100 kNm. Assume K_h = 15 MN/m^2, E = 10 x 10^2 MN/m^2, FOS =2.5.			
Q.3	A gravity retaining wall is shown in the figure. Use $\delta' = 2/3\ \phi'$ and Coulomb's active earth pressure theory. Determine following: (a) Factor of safety against overturning (b) Factor of safety against sliding (c) Check for bearing capacity failure 	**10**	**CO3**	**1,2,3,4**
Q.4	A well foundation pierfor bridge over river, with 5.5 m x 10.5 m in plan and the depth of well below scour level D = 18 m is subjected to the following loads in a granular deposit: W = 16,000 kN; H = 3500 kN, moment about base level = 40,000 kN The value of ϕ of the granular soil = 30°, wall friction δ = 2/3ϕ, allowable bearing 65 t/m^2; and $k_h/k_v = m$ = 1. Unit weight ofgranular soil is 20 kN/m^3. Check the lateral stability of the well under the above forces according to IRC 45 (1972) recommendations.	**10**	**CO4**	**1,2,3,4**
	OR			
Q.4	A vertical compressor having two cylinder possess weight of 20 t is driven by an electric motor weighing 5 t working at 1000 rpm. The length and breadth of the base of the foundation block are Lx = 10.5m and Ly = 6.5 m, and it weighs 100.4 tons. The foundation is resting on 8m thick OC clay having Cc = 0.3; Cr =0.04 and e_0 = 0.65. Check for the settlement at the middle of the clay layer. The data of forces generated are as follows: (a) Unbalanced forces: vertical = 5.00 tons; horizontal = 0 ton (b) Unbalanced rocking moment = 3 t and Θ = 60° (c) Centre of gravity of system; x = 5.25 m from edge; y = 3.25 from edge; z = 1.2 m from base. (d) M_{m0} = Mass moment of inertia of system = 40.8 t ms^2 (e) Determine the natural frequencies in vertical, sliding, rocking (uncoupled modes) and also in the coupled frequencies of vertical, sliding and rocking mode if C_u = 6.0 x 10^3 t/m^3 and safe bearing capacity 400 kN/m^2.	**10**	**CO5**	**1,2,3,4**

Formulations and Graphs

$$K_a = \cos i \times \frac{\cos i - \sqrt{\cos^2 i - \cos^2 \phi'}}{\cos i + \sqrt{\cos^2 i - \cos^2 \phi'}}$$

$$K_p = \cos i \frac{\cos i + \sqrt{\cos^2 i - \cos^2 \varphi'}}{\cos i - \sqrt{\cos^2 i - \cos^2 \varphi'}}$$

$$K_a = \frac{\sin^2(\beta + \phi')}{\sin^2\beta \sin(\beta - \delta)\left[1 + \sqrt{\frac{\sin(\phi' + \delta)\sin(\phi' - i)}{\sin(\beta - \delta)\sin(\beta + i)}}\right]^2}$$

$$K_p = \frac{\sin^2(\beta - \phi')}{\sin^2\beta \cdot \sin(\beta + \delta)\left[1 - \sqrt{\frac{\sin(\phi' + \delta)\sin(\phi' + i)}{\sin(\beta + \delta)\sin(\beta + i)}}\right]^2}$$

$$A_z = \frac{P_0}{4\,m\,\pi^2\,(f_{nz}{}^2 - f^2)}$$

$$\Delta s(i) = C_c \frac{H_i}{1 + e_o(i)} \log\left(\frac{\bar{\sigma}_o + \Delta\sigma_i}{\bar{\sigma}_o}\right)$$

$$f_{nz}^2 = \frac{C_u A}{4\pi^2 m}$$

$$f_{nx}^2 = \frac{C_\tau A}{4\pi^2 m}$$

$$f_{n\phi}^2 = \frac{C_\phi I - Wz}{4\pi^2 M_{m0}}$$

$$f_{n\psi}^2 = \frac{C_\psi J_z}{M_{mz}}$$

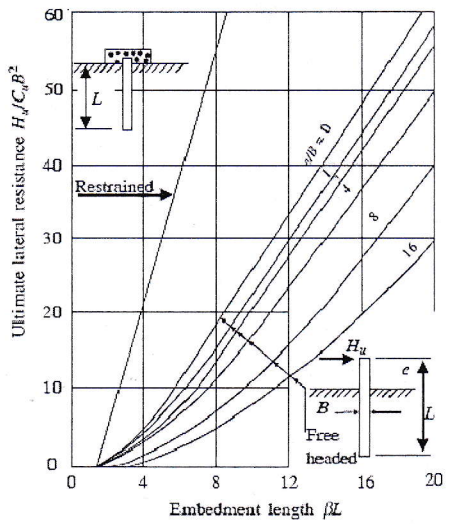
$$rf_n^4 - \left(f_{nx}^2 + f_{n\phi}^2\right)f_n^2 + f_{nx}^2 f_{n\phi}^2 = 0$$

Brom's Chart

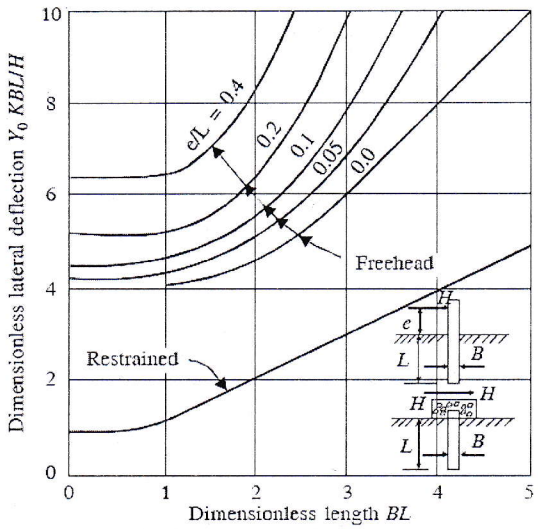
Short Piles in Cohesive soil

$$\beta = \left(\frac{KB}{4EI}\right)^{1/4}$$

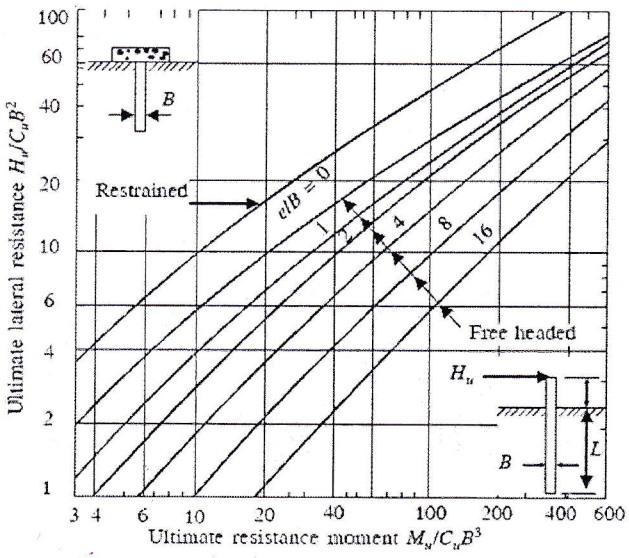
K = modulus of subgrade reaction in MN/m³



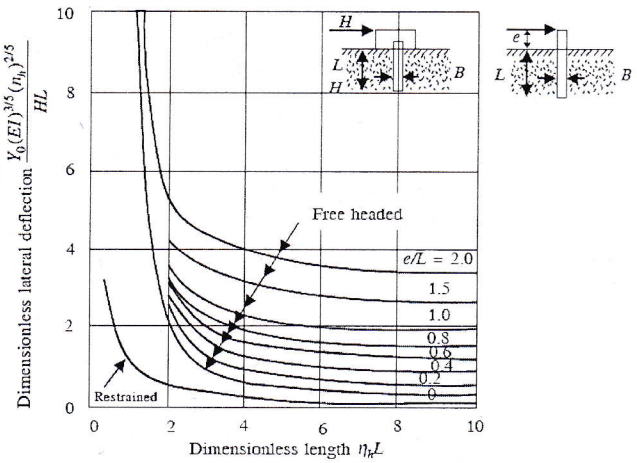
Lateral Deflection in Cohesive soil



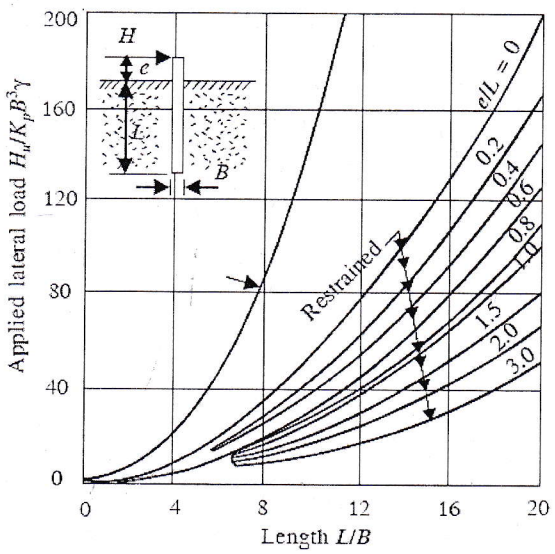
Long Piles in Cohesive soil



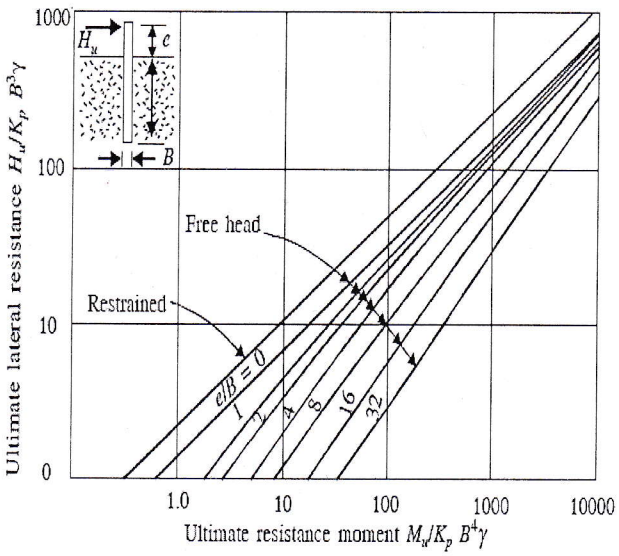
Lateral deflection in Cohesionless soil



Short Piles in Cohesionless soil



Long Piles in Cohesionless soil



$$\eta = \left[\frac{\eta_h}{EI}\right]^{1/5}$$

$$K_P = \frac{1+\sin\phi}{1-\sin\phi}$$

**********End of Question Paper**********