Name:	
Enrolment No:	UPES
	UNIVERSITY OF TOMORROW

UPES
End Semester Examination, May 2025

Course: Advanced Foundation Design   Semester   : VI
Program: B Tech Civil Engineering   Time   : 03 hrs.
Course Code: CIVL 3069P   Max. Marks: 100

Instructions: Draw neat sketch and assume suitable data if required and mention those clearly.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	A square footing fails by general shear in a cohesionless soil under an ultimate load of $Q_u = 7500\ kN$. The footing is placed at a depth of $12\ m$ below ground level. Given $\varphi = 35°\ (N_c = 57.8, N_q = 41.4, N_\gamma = 42.4)$ and $\gamma = 17\ kN/m^3$, determine the size of the footing if the water table is at a great depth.	4	CO1
Q 2	A pile is driven in a uniform clay of large depth. The clay has an unconfined compression strength of $90\ kN/m^2$. The pile is $30\ cm$ diameter and $6\ m$ long. Determine the safe frictional resistance of the pile, assuming a factor of safety of 3. Assume the adhesion factor $\alpha = 0.7$.	4	CO2
Q 3	Describe various types of drilled pier foundation with neat sketches.	4	CO3
Q 4	Describe in short, the following with respect to machine foundations: (*a*) Frequency (*b*) Amplitude (*c*) Time period	4	CO4
Q 5	A mass supported by a spring oscillates at a natural frequency of $16\ Hz$. Determine the corresponding static deflection of the mass.	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	(a) Explain pile group efficiency. (b) A group of 16 piles of $50\ cm$ diameter is arranged with a centre to centre spacing of $1.0\ m$. The piles are $9\ m$ long and are embedded in soft clay with cohesion $30\ kN/m^2$. Bearing resistance may be neglected for the piles—Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group.	2+8	CO1
Q 7	Discuss different methods for pile installation. OR Describe negative skin friction with neat sketch and how it can be assessed.	10	CO2

Q 8	Illustrate any three types of caisson foundation with neat sketches and mention their functions.	10	CO3
Q 9	(a) Write a short note on viscous damping. (b) Derive the standard equation of motion for undamped free vibration of a spring–mass system.	3+7	CO4
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	(a) Design a square pile group to carry $400\ kN$ in clay with an unconfined compression strength of $60\ kN/m^2$. The piles are $30\ cm$ diameter and $6\ m$ long. Adhesion factor may be taken as 0.6. (b) A square pile group of 9 piles pass through a recently filled up material of $4.5\ m$ depth. The diameter of the pile is $30\ cm$ and pile spacing is $90\ cm$ centre to centre. If the unconfined compression strength of the cohesive material is $60\ kN/m^2$ and unit weight is $15\ kN/m^3$, compute the negative skin friction of the pile group.	8+12	CO2
Q 11	A $2\ m$ wide strip footing carries a load intensity $400\ kN/m^2$ at a depth of 1.2 m in sand. The saturated unit weight of sand is $19.5\ kN/m^3$ and unit weight above water table is $16.8\ kN/m^3$. The shear strength parameters are $c = 0$ and $\varphi = 35°$ ($N_c = 57.8, N_q = 41.4, N_\gamma = 42.4$). Determine the factor of safety using Terzaghi's equations with respect to shear failure for the following cases: (i) When water table is at $4\ m$ below ground level (GL) (ii) When water table is at $2.5\ m$ below GL (iii) When water table is at $1.2\ m$ below GL (iv) When water table is at $0.5\ m$ below GL (v) When water table is located at GL OR A raft footing is founded at a depth of $0.5\ m$ below GL in a $18.5\ m$ thick stratum of normally consolidated clay underlain by a dense sand layer is to be supported by a group of 16 piles of embedded depth of $12\ m$ and diameter $500\ mm$ arranged in a square formation. The gross load to be carried by the pile group including the self-weight of the pile cap is $4000\ kN$. The piles are spaced at 1.2 m c/c and the water table is located at the ground level. The properties of the foundation soil are: $\omega = 34\ \%, G = 2.65$ and LL $= 42\ \%$. Estimate the probable consolidation settlement of the pile group.	20	CO1