

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3164016****Date:10/06/2022****Subject Name:Design of Foundations****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Differentiate Shallow and Deep foundation based on mechanism of load transfer	03
	(b) Show the contact pressure distribution for uniform loading on a Flexible footing ($EI=0$) resting on cohesive soil.	04
	(c) State the typical characteristics and soil properties for General Shear Failure to take place and draw the typical failure surface diagram.	07
Q.2	(a) Show calculation, how to obtain bearing capacity factor $[N_q]$ for $\phi = 35^\circ$ considering it as mixed shear failure, from the Table-1 of IS:6403.	03
	(b) Draw a typical section of Open Caisson and label it.	04
	(c) Explain all geotechnical aspects to be considered for foundation selection and design	07
OR		
	(c) A strip footing 1.50m wide is resting at a depth of 1.50m below EGL on a cohesionless soil with angle of friction as 30° , bulk unit weight of soil as 19kN/m^3 , Saturated unit weight as 20kN/m^3 and corrected SPT N value as 20. If GWT is present at the base of footing, determine the allowable bearing pressure of soil. Consider Mixed Shear failure. (Use IS:6403 and IS:8009) Note: Consider permissible settlement value as 50mm.	07
Q.3	(a) Two circular footing of diameters D_1 and D_2 are resting on the surface of purely cohesive soil. The ratio of $D_1/D_2 = 2$. If the ultimate load carrying capacity of footing of diameter D_1 is 200kN/m^2 , then what will be the ultimate load carrying capacity of footing of diameter D_2 ?	03
	(b) List the factors which can lead to errors in the determination of SPT N-value.	04
	(c) A square footing $2.50\text{m} \times 2.50\text{m}$ is placed at a depth of 2.00m below EGL on a cohesionless soil having angle of friction $= 29^\circ$ and unit weight $= 17 \text{ kN/m}^3$. A column carrying a load of 1200kN is resting on this footing. Comment on the adequacy of footing size. Use IS:6403 method and consider Mixed Shear failure.	07
OR		
Q.3	(a) Terzaghi has given analytical solution for Ultimate Bearing Capacity of Strip footings for General Shear Failure but provided only empirical guidelines for Local Shear Failure. Give Reason.	03
	(b) Explain various ground conditions when SPT N-value is reported as 'Refusal'.	04

- (c) A normally consolidated clay stratum of 9m thickness from EGL having bulk unit weight as 20 kN/m^3 is followed by rock layer. A square footing $3\text{m} \times 3\text{m}$ placed at a depth of 2m is subjected to a uniformly distributed load of 10 T/m^2 . **07**
- When an oedometer test is carried out in a laboratory, Compression index is calculated as 0.094 and void ratio is 0.55.
- Calculate the consolidation settlement of the stratum using IS 8009. (Use Fadum's chart).
- Q.4 (a)** A field SPT is conducted in homogeneous medium to coarse sand strata at 3.00m depth. The blows are measured as 6, 8 and 8 for each 15cm penetration of the split spoon sampler. If the ground water table is at 1m depth below existing ground level, apply necessary corrections to the measured SPT N-value and obtain corrected N-value. Take bulk unit weight as 18 kN/m^3 and saturated unit weight of the strata as 20 kN/m^3 . **03**
- (b)** A Plate load test is carried out on a $300\text{mm} \times 300\text{mm}$ plate placed at a depth of 2.0m below EGL on a homogeneous clay deposit. Ultimate bearing capacity of plate is 250kN/m^2 . What will be the safe bearing capacity of $1.5\text{m} \times 1.5\text{m}$ square footing to be placed at same depth? Assume Factor of Safety as 2.50 **04**
- (c)** A rectangular footing $2.00\text{m} \times 3.00\text{m}$ is resting at a depth of 1.50m below EGL. A submerged clay stratum of 6m thickness from EGL having cohesion $c = 90\text{kPa}$, bulk unit weight of soil as 18kN/m^3 and Saturated unit weight = 20kN/m^3 is followed by rock layer. When an oedometer test is carried out in a laboratory, Compression index = 0.090 and void ratio = 0.80 are obtained. **07**
- If Settlement Co-efficient, $\lambda = 0.9$ and poisson's ratio, $\mu = 0.45$, determine the allowable bearing pressure of soil. (Use IS:6403 and IS:8009)
- Take unit weight of water as 10kN/m^3 and Modulus of Elasticity of soil, $E = 45,000\text{kPa}$.
- Use Fadum's chart. Consider General Shear failure.
- OR**
- Q.4 (a)** State limitations of Plate Load Test. **03**
- (b)** A square footing of $3.0\text{m} \times 3.0\text{m}$, placed at a depth of 2.0m below EGL is resting on cohesionless soil. The corrected SPT N-value is reported as 15 at the placement depth of footing. The water table is encountered at EGL. **04**
- What is the safe bearing pressure on soil as per IS 8009? Consider allowable settlement as 50mm.
- (c)** A rectangular footing $1.50\text{m} \times 2.00$ is placed at a depth of 1.50m below EGL on a soil having cohesion = 20kPa , angle of friction = 26° , bulk unit weight = 16 kN/m^3 and saturated unit weight = 18kN/m^3 . **07**
- If water table is present at GL, determine the ultimate bearing capacity of soil. Take unit weight of water = 10 kN/m^3 .
- Consider Local Shear failure and Use IS 6403 method.
- Q.5 (a)** A concrete pile 8m long was driven by a single acting drop hammer with a rated energy of 100kJ. The average settlement was recorded as 3mm/blow. Using Engineering New's Formula, determine allowable capacity of pile. **03**
- (b)** Explain the term "Negative Skin Friction". **04**
- (c)** In a group of 25 piles (5×5 square pattern), pile diameter is 300mm, length of pile is 8m and c/c spacing is 1.20m. If cohesion $c = 70 \text{ kN/m}^2$, determine whether the failure would occur with the pile acting **07**

individually or as a group. Use Converse-Labarre's formula to determine the efficiency of pile group.

OR

- Q.5** (a) In a group of 36 piles (6 x 6 square pattern), pile diameter is 600mm, length of pile is 8m and c/c spacing is 1.50m. Determine the efficiency of pile group using Feld's rule. **03**
- (b) Under which field conditions, under-reamed piles are used? **04**
- (c) A single bored cast in-situ pile, 300mm in diameter and 10m long is embedded in a soil having following properties:
cohesion $c = 50\text{kN/m}^2$, angle of friction $\phi = 30^\circ$, Saturated unit weight $= 20\text{ kN/m}^3$
If water table is present at GL, determine safe load carrying capacity of pile using static formula given in IS: 2911 (Part1/Sec2) – 2010. **07**
