# GUJARAT TECHNOLOGICAL UNIVERSITY

5th Semester Civil Engineering – PDDC

**Subject Code & Name:** X50603 - Foundation Engineering

| Sr. No. | Course content |
|---|---|
| 1. | **Introduction:** Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation. |
| 2. | **Subsurface Investigation:** Objectives of exploration, planning of exploration program, soil samples and soil samplers, field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log and report writing. |
| 3. | **Bearing Capacity of Shallow Foundation:** Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton), bearing capacity determination using IS Code, Presumptive bearing capacity. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity by use of penetration test data and by plate load test. Be ring capacity of raft. Factors affecting bearing capacity including Water Table. Contact pressure under rigid and flexible footings. Floating foundation. Types of pavements & its design |
| 4. | **Pile foundations :** Introduction, load transfer mechanism, types of piles according to their composition, their method of installation and their load carrying characteristics, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test. Pile group: carrying capacity, efficiency and settlement. Negative skin |
| 5. | **Foundations on problematic soil:** Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures. Under-reamed pile foundation-its concept, design & field installation. Significant characteristics of silt and loess, problems & remedial measures, footing on such soils. |
| 6. | **Introduction to GeoSynthetics:** Types and uses. |

**Term Work:** Term work shall consist of laboratory work and tutorials (mini.30 problems) based on above course. Practical examination shall consist of oral based on term work.

**IS Codes :**

1. IS - 6403 : Code of practice for determination of bearing capacity of shallow foundation
2. IS - 2911 (Part I to IV) : Code of practice for design and construction of pile foundation
3. IS - 2131 : Method for standard penetration test for soil
4. IS - 1892 : Code of practice for subsurface investigation for foundation
5. IS - 1904 : Code of practice for structural safety of buildings: Shallow Foundations
6. IS - 8009 : Code of practice for calculation of settlement of foundations

**References Books:**


1. Arora K.R. : Soil Mechanics & Foundation Engineering
2. Murthy V.N.S. : Soil Mechanics & Foundation Engg Vol.I
3. Peck Ralph B. : Thornburn Thomas H., Hanson Walter E.; Foundation Engineering
4. Das Braja M : Principles of Foundation Engineering

**Seat No : _____** **Enrollment No: _____**

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC SEMESTER– V • EXAMINATION – SUMMER 2015**

**Subject Name : Foundation Engg.** **Date: 13/05/2015**

**Subject Code : X50603**

**Time: 02:30 pm - 05:00 pm** **Total Marks: 70**

Instructions : (1) All questions are compulsory.
(2) Figures to the right indicates the marks.
(3) Use of Programmable calculator is strictly prohibited.
(4) Draw neat sketch wherever necessary.
(5) Write your seat no and enrollment no in space provided on the question paper.

Q.1 (a) Explain Standard penetration test. 07

(b) A square footing 2m x 2m carries a uniformly distributed load of 314 kN/m². find the intensity of vertical pressure at a depth of 6 m below a point 0.5 m inside each of the two adjacent side of footing. 07

Q.2 (a) Explain General shear failure and Local shear failure with neat sketch. 07

(b) A square footing 2.5 m X 2.5 m is built on a homogeneous bed of sand of density 19 kN/m$^3$ having an angle of shearing resistance of 36$^o$. The depth of foundation is 1.5 m below the ground surface. Calculate the safe load that can be applied on the footing with a factor of safety of 3. Take bearing capacity factors as $N_c$= 27, $N_q$ = 30, $N_\gamma$ = 35. 07

**OR**

(b) Discuss effect of inclination of load and water table on bearing capacity. 07

Q.3 (a) How the load transferred by the pile? 07

(b) A 40 cm square pre-cast RCC pile is driven by 8 m into a sandy bed. The standard penetration test results, performed on this ground are given below 07

| Depth(m) | 1.5 | 3 | 4.5 | 6 | 7.5 | 9 | 10.5 | 12 |
|---|---|---|---|---|---|---|---|---|
| SPT-N values | 4 | 6 | 12 | 12 | 20 | 24 | 35 | 39 |

Compute the factor of safety available if 1000 kN of compressive load is applied on this pile.

**OR**

Q.3 (a) A precast concrete pile of size 40 cm X 40 cm is to be driven into stiff clay. The unconfined compressive strength of the clay is 150 kN/m$^2$. Determine the length of pile required to carry a safe working load of 300 kN with factor of safety is 2.5. 07

(b) Briefly explain Settlement of single pile and settlement of group of pile, 07

Q.4 (a) List properties of expansive soil and give details of any two from it. 07

(b) What are the effects of swelling of soils on buildings? 07

**OR**

Q.4 (a) How will you identify the collapsible soil? 07

(b) Explain types and uses of Geosynthetics. 07

Q.5 (a) Explain factors affecting selection of type of foundation. 07

(b) Write purposes of site investigation. 07

**OR**

(a) Enlist boring methods and explain any one in detail. 07

(b) Explain Plate load test. 07

Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–V • EXAMINATION – WINTER • 2014**

**Subject Code: X50603 Date: 04-12-2014**

**Subject Name: Foundation Engineering**

**Time: 10:30 am - 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. **Use of Programmable calculator is strictly prohibited**
5. **Draw neat sketch wherever necessary**

**Q.1** Choose the correct answer from the following: **14**

**(i)** According to Rankine formula, the minimum depth of foundation when q = 180 kN/$m^2$, $\gamma$ = 20kN/$m^3$ and Ø = 30$^o$ is _____
(a) 0.50m (b) 0.75m © 1.0m (d) 2.0m

**(ii)** For an undisturbed sample, the area ratio of the samples should be
(a) zero (b) 10% or less (c) 10% to 20% (d) more than 20%

**(iii)** If the actual value of the standard penetration number (N) is greater than 15 for fine sands below water table, the corrected value of N is
(a) 15 + ((N+15)/2)) (b) 15 - ((N+15)/2))
© 15 + ((N-15)/2)) (d) 15 + ((15 - N)/2))

**(iv)** A shallow foundation is usually defined as a foundation which has
(a) depth less than 0.6m (b) depth less than its width
(c) depth less than 1.0m (d) none of above

**(v)** If the gross bearing capacity of strip footing 1.5m wide located at a depth of 1m in clay is 400 kN/$m^2$, its net bearing capacity for $\gamma$ = 20kN/$m^2$ is
(a) 370 kN/$m^2$ (b) 380 kN/$m^2$ (c) 390 kN/$m^2$ (d) 360 kN/$m^2$

**(vi)** The allowable soil pressure for foundation in cohesive soil is generally controlled by
(a) settlements (b) bearing capacity
(c) both (a) and (b) (d) neither (a) nor (b)

**(vii)** The under-ream pie is best suitable for which type of soil?
(a) Black cotton soil (b) sandy soils
(c) Silty-Clayey soils (d) none of these

**Q.2** **(a)** A 350mm dia pile, 14 m long is driven into a sand deposit. The details of the hammer are as follows **07**
(1) total weight of hammer = 25 kN
(2) Length of stroke = 100 cm
(3) Average penetration per blow = 5mm
Estimate ultimate resistance of pile using Hiley's formula, assuming that driving is without dolly. Thickness of cushion is 3.0 cm. Assume other data if necessary.

**(b)** What do you understand by bearing capacity? Differentiate between net safe bearing capacity and gross safe bearing capacity. Enlist the various analytical methods to determine bearing capacity of soil and define over burden pressure. **07**

**OR**

**(b)** Explain factors affecting bearing capacity in detail and state the various assumptions made in Terzaghi's theory. **07**

| | | | |
|---|---|---|---|
| **Q.3** | **(a)** | Determine the ultimate bearing capacity of strip footing 2.0m wide, and having the depth of foundation 3m. Use Terzaghi's theory and assume general shear failure. Take Ø' = 32°, $\gamma$ = 17.5kN/m$^3$, and c' = 12kN/m$^2$ | **07** |
| | **(b)** | A strip footing of 2.5m width is founded at a depth of 3m below the ground surface. Determine the net ultimate bearing capacity using (a) Skempton's equation (b) IS code. Take soil parameters Ø = 0 and c = 15 kN/m$^2$, $\gamma$ = 18.45kN/m$^3$. Take $N_c$= 5.7, $N_q$ = 1, $N_\gamma$ = 0 | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | A concrete pile, 40cm diameter, is driven into a medium dense sand (Ø =37°, $\gamma$ = 20.8kN/m$^3$, K = 1.0, tan$\delta$ = 0.7) for a depth of 14m, estimate the safe load if the water table rises to 4m below the ground surface. Take $\gamma_w$ = 10 kN/m$^3$ | **07** |
| | **(b)** | Explain plate load test in detail with neat sketch. Also discuss its limitations. | **07** |
| **Q.4** | **(a)** | Discuss the various types of foundation settlement under loads and also state various causes of settlement | **07** |
| | **(b)** | A precast concrete pile of size 450mm x 450mm is to be driven into stiff clay. The unconfined compressive strength of the clay is 165 kN/m$^2$. Determine the length of pile required to carry a safe working load of 400 kN with factor of safety is 2.5. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Define SPT value. Explain the corrections applied to SPT value with engineering reasons. | **07** |
| | **(b)** | What are the characteristics of expansive soil? Explain the installation of foundation on such soil. Also give its codal provisions. | **07** |
| **Q.5** | **(a)** | Enlist and explain types of geosynthetics with its detail application. | **07** |
| | **(b)** | Write a detail note on various methods of modification of an expansive soil for improving its characteristics. In Gujarat for Bharuch region where black cotton soil is found to great depths, suggest any one method for its modification. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | What do you understand by site investigation? What are the different purposes for site investigation? | **07** |
| | **(b)** | Enlist various type of soil samplers for obtaining undisturbed sample and explain any one in detail. | **07** |

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Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–V • EXAMINATION – SUMMER • 2014**

**Subject Code: X50603 Date: 31-05-2014**

**Subject Name: Foundation Engineering**

**Time: 02:30 pm - 05:00 pm Total Marks: 70**

**Instructions:**

**(1)All questions are compulsory.**
**(2)Figures to the right indicates the marks.**
**(3)Use of Programmable calculator is strictly prohibited.**
**(4)Draw neat sketch wherever necessary.**

**Q.1 (A)** What do you understand by disturbed sample and undisturbed sample? How would you obtain undisturbed sample and maintain it till testing? **07**

**Q.1 (B)** Describe the salient feature of good bore log reports. **07**

**Q.2 (A)** A square footing fails under general shear cohesion less soil under an ultimate load of Qu=7500 KN. The footing in placed at a depth 2m below ground level. Given Ø=35°. And $\gamma$=17.25 KN/$m^3$. Determine the size of footing, if the water table is at great depth.$N_c$=46.12 ,$N_q$= 33.3 and $N_\gamma$= 48.03. **07**

**Q.2 (B)** What are the field test from which we can find the bearing capacity? Explain any one. **07**

**OR**

**Q.2 (B)** Write about presumptive bearing capacity and write the values of bearing capacity for non-cohesive and cohesive soils as per IS 1904:1978. **07**

**Q.3 (A)** Classify the types of pile according to, (a) Function,(b) Materials and composition,(c) The installation method and (d) Mechanism of load transfer. **07**

**Q.3 (B)** What are the methods for estimating the load carrying capacity of a pile foundation? **07**

**OR**

**Q.3 (A)** A pile load test gave the following data **07**

| Load in kN | 100 | 200 | 300 | 400 | 500 | 600 |
|---|---|---|---|---|---|---|
| Settlement (mm) | 3 | 6 | 9 | 13 | 19 | 27 |

Plot the settlement curve and determine the allowable load with F.S. of 3.

**Q.3 (B)** Explain negative skin friction and its effect on the pile. **07**

**Q.4 (A)** Explain about the installation methodology for under reamed piles. **07**

**Q.4 (B)** What are the preventive measures before the construction on collapsible soil? **07**

**OR**

**Q.4** Write about the pressure distribution beneath the rigid and flexible footing, when supported by cohesive and non cohesive soil, with neat sketch. **14**

**Q.5 (A)** Explain the steps of site investigation. And explain significance of site investigation. **07**

**Q.5 (B)** explain various uses of geo synthetics in field of soil stabilization (Reinforcement), separation and filtration. **07**

**OR**

**Q.5 (A)** Derive the equation for depth of footing for ultimate bearing capacity. **07**

**Q.5 (B)** Discuss various dynamic formulae for and their limitations. **07**

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Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–V • EXAMINATION – WINTER 2013**

**Subject Code: X50603 Date: 09-12-2013**

**Subject Name: Foundation Engineering**

**Time: 10.30 am - 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. **Use of Programmable calculator is strictly prohibited**
5. **Draw neat sketch wherever necessary**

**Q.1** Choose the correct answer from the following: **14**

**(i)** If the actual value of the SPT (N) is greater than 15 for fine sands below water table, the corrected value of N is _____

(a) 15 + ((N+15)/2)
(b) 15 - ((N+15)/2)
© 15 + ((N-15)/2)
(d) 15 + ((15 - N)/2)

**(ii)** Area ratio is mathematically defined as _____

(a) $(D2^2-D1^2)/D1^2$ (b) $(D2-D1)/D1^2$ (c) $(D2+D1)/D2^2$ (d) $(D2^2+D1^2)/D2^3$

**(iii)** The permissible settlements is the maximum in the case of _____

(a) Isolated footing on clay (b) Raft on clay
(c) Isolated footing on sand (d) Raft on sand

**(iv)** The bearing capacity of soil supporting a footing of size 3m x 3m will not be affected by the presence of water table located at a depth below the base of footing of _____

(a) 1.0 (b) 1.5m
(c) 3.0m (d) 6.0m

**(v)** If the gross bearing capacity of strip footing 2.0m wide located at a depth of 1.5m in clay is 400kN/m$^2$, its net bearing capacity for $\gamma$ = 20kN/m$^2$ is

(a) 370 kN/m$^2$ (b) 380 kN/m$^2$ (c) 390 kN/m$^2$ (d) 360 kN/m$^2$

**(vi)** The load carrying capacity of a pile depends upon the

(a) skin friction (b) point resistance
(c) both (a) and (b) (d) neither (a) nor (b)

**(vii)** A 300mm diameter pile is driven 10m into a homogeneous consolidated clay deposit. The safe load when the factor of safety is 2.5, unit cohesion is 40 kN/m$^2$ and adhesion factor is 0.70,

(a) 150.8 kN (b) 105.6 kN
(c) 215.4 kN (d) 211.2 kN

**Q.2** **(a)** Explain Standard penetration test. **07**

**(b)** A square footing 2.5 m X 2.5 m is built on a homogeneous bed of sand of density 19 kN/m3 having an angle of shearing resistance of $38^0$. The depth of foundation is 1.5 m below the ground surface. Calculate the safe load that can be applied on the footing with a factor of safety of 3. Take bearing capacity factors as Nc= 27, Nq = 30, N$\gamma$ = 35. **07**

**OR**

**(b)** Discuss effect of inclination of load and water table on bearing capacity **07**

**Q.3** **(a)** Explain factors affecting bearing capacity in detail **07**

**(b)** A strip footing 1 m wide and a square footing 1 m side are placed at a **07**

depth of 1 m below the ground surface. The foundation soil has cohesion of 10 kPa, angle of friction of $27^{O}$ and unit weight of 18.2 kN/$m^3$. Calculate the safe bearing capacity using IS:6403. Use factor of safety of 3.

**OR**

**Q.3** **(a)** A precast concrete pile 40 cm x 40 cm is driven by a single acting steam hammer .Estimate the allowable load using (a)Engineering News Record Formula (F.S.=6).(b)Hiley Formula(F.S.= 4).Use the following data: **07**

(i) Maximum rated energy = 4000 kN-cm
(ii) Weight of hammer = 40 kN
(iii) Length of pile = 15 m
(iv) Efficiency of hammer = 0.83
(v) Co-efficient of resistitution = 0.5
(vi) Weight of pile cap = 3.5 kN
(vii) No. of blows for last 25 mm = 8
(viii) Modulus of elasticity of concrete = 2 x $10^7$ kN/$m^2$
Assume the other data, if necessary.

**(b)** Explain factors affecting selection of type of foundation **07**

**Q.4** **(a)** Enlist boring methods and explain any one in detail. **07**

**(b)** Explain the types of geosynthetics and its various applications in foundation engineering. **07**

**OR**

**Q.4** **(a)** What are the effects of swelling of soils on buildings? **07**

**(b)** Briefly explain Settlement of single pile and settlement of group of pile. **07**

**Q.5** **(a)** A 40 cm square pre-cast RCC pile is driven by 9 m into a sandy bed. The standard penetration test results, performed on this ground are given below **07**

Depth(m) 1.5, 3, 4.5, 6, 7.5, 9, 10.5, 12
SPT-N Value 4, 6, 12, 14, 20, 24, 35, 39
Compute the factor of safety available if 1000 kN of compressive load is applied on this pile.

**(b)** Explain General shear failure and Local shear failure with neat sketch. **07**

**OR**

**Q.5** **(a)** Explain Engineering News Record formula and Hileys formula for estimating load carrying capacity of pile with necessary equations. **07**

**(b)** Explain Plate load test. **07**

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Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–V • EXAMINATION – SUMMER 2013**

**Subject Code: X50603 Date: 16-05-2013**

**Subject Name: Foundation Engineering**

**Time: 02.30 pm - 05.00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Explain Plate load test by truss reaction method. 07

(b) Write purposes of site investigation.# 07

Q.2 (a) A square footing is to be constructed on a deep deposit of sand at a depth of 1.0 m to carry a design load of 320 kN with a factor of safety of 2.5. The ground water table may rise to the ground level during rainy season. Design the plan dimension of footing given $\gamma_{sat}$ = 20.8 kN/m$^3$, $N_c$ = 25, $N_q$ = 34 and $N_\gamma$ =32. 07

(b) Write assumptions made in Terzaghi's theory. 07

**OR**

(b) What are the effects of swelling of soil on buildings? 07

Q.3 (a) Explain shear failure criteria of soil used in calculation of safe bearing capacity of soil. 07

(b) Explain factors affecting bearing capacity in detail. 07

**OR**

Q.3 (a) Briefly explain Settlement of single pile and settlement of group of pile. 07

(b) A strip footing 1 m wide and a square footing 1 m side are placed at a depth of 1 m below the ground surface. The foundation soil has cohesion of 10 kPa, angle of friction of 26$^o$ and unit weight of 18 kN/m$^3$. Calculate the safe bearing capacity using IS:6403. Use factor of safety of 3. 07

Q.4 (a) Explain load transfer mechanism of pile. 07

(b) A precast concrete pile 40 cm X 40 cm is driven by a single acting steam hammer .Estimate the allowable load using (a)Engineering News Record Formula (F.S.=6).(b)Hiley Formula(F.S.= 4).Use the following data: 07

(i) Maximum rated energy = 4000 kN-cm
(ii) Weight of hammer = 40 kN
(iii) Length of pile = 15 m
(iv) Efficiency of hammer = 0.82
(v) Co-efficient of resistitution = 0.5
(vi) Weight of pile cap = 3.2 kN
(vii) No. of blows for last 25 mm = 6
(viii) Modulus of elasticity of concrete = 2 x 10$^7$ kN/m$^2$

Assume the other data, if necessary.

**OR**

Q.4 (a) Enlist types of pile according to driving method. 07

(b) A precast concrete pile of size 40 cm X 40 cm is to be driven into stiff clay. The unconfined compressive strength of the clay is 150 kN/m$^2$. Determine the length of pile required to carry a safe working load of 300 kN with factor of safety is 2.5. 07

Q.5 (a) Enlist and explain types and uses of Geosynthetics. 07

(b) How will you identify the collapsible soil? 07

**OR**

Q.5 (a) Explain different type of foundation. 07

(b) Enlist and discuss standards used in standard penetration test. 07

Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER – V • EXAMINATION – WINTER 2012**

**Subject code: X 50603** **Date: 23/01/2013**

**Subject Name: Foundation Engineering**

**Time: 02.30 pm - 05.00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of Programmable calculator is strictly prohibited**
5. **Draw neat sketch wherever necessary**

**Q.1** Choose the correct answer from the following: **14**

**(i)** The standard penetration test is useful to measure
(a) shear strength of soft clays
(b)shear strength of sands
© consistency of clays
(d) none of above

**(ii)** For an undisturbed sample, the area ratio of the samples should be
(a) zero (b) 10% or less (c) 10% to 20% (d) more than 20%

**(iii)** The seismic refraction method cannot be used if the wave velocity in the lower layer is _____ that in the upper layer
(a) greater than (b) less than (c) more than four times (d) more than thrice

**(iv)** A shallow foundation is usually defined as a foundation which has
(a) depth less than 0.6m (b) depth less than its width
(c) depth less than 1.0m (d) none of above

**(v)** If the gross bearing capacity of strip footing 1.5m wide located at a depth of 1m in clay is 400kN/m$^2$, its net bearing capacity for $\gamma$ = 20kN/m$^2$ is
(a) 370 kN/m$^2$ (b) 380 kN/m$^2$ (c) 390 kN/m$^2$ (d) 360 kN/m$^2$

**(vi)** The allowable soil pressure for foundation in cohesive soil is generally controlled by
(a) settlements (b) bearing capacity
(c) both (a) and (b) (d) neither (a) nor (b)

**(vii)** The load carrying capacity of a pile depends upon the
(a) skin friction (b) point resistance
(c) both (a) and (b) (d) neither (a) nor (b)

**Q.2** **(a)** Discuss briefly plate load test with neat sketch and its limitations **07**

**(b)** (i)Define : net safe bearing capacity, gross safe bearing capacity, over burden pressure **07**
(ii) State the names of any three methods to determine ultimate bearing capacity of soil

**OR**

**(b)** Discuss the types of shear failure in brief with neat sketches **07**

**Q.3** **(a)** Determine the ultimate bearing capacity of strip footing 1.4m wide, and having the depth of foundation 1.2m. Use Terzaghi's theory and assume general shear failure. Take Ø' = 35$^o$, $\gamma$ = 18kN/m$^3$, and c' = 15kN/m$^2$ **07**

**(b)** A strip footing of 2m width is founded at a depth of 4m below the ground surface. Determine the net ultimate bearing capacity using (a) Skempton's equation (b) IS code. Take soil parameters Ø = 0 and c = 10 kN/m$^2$, **07**

$\gamma = 20kN/m^3$. Take $N_c = 5.7$, $N_q = 1$, $N_\gamma = 0$

**OR**

| | | | |
|---|---|---|---|
| **Q.3** | **(a)** | A concrete pile, 30cm diameter, is driven into a medium dense sand ($Ø = 35^o$, $\gamma = 21kN/m^3$, K = 1.0, $\tan\delta = 0.7$) for a depth of 10m, estimate the safe load if the water table rises to 2m below the ground surface. Take $\gamma_w = 10\ kN/m^3$ | **07** |
| | **(b)** | State any four reasons for necessity of pile foundations. Define negative skin friction | **07** |
| **Q.4** | **(a)** | Discuss the various types of foundation settlement under loads and also state various causes of settlement | **07** |
| | **(b)** | Explain the types of geosynthetics and its various applications in foundation engineering. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Define SPT value. Explain the corrections applied to SPT value with engineering reasons. | **07** |
| | **(b)** | What are the characteristics of expansive soil? Explain the installation of foundation on such soil. Also give its codal provisions. | **07** |
| **Q.5** | **(a)** | State various methods of borings for exploration. Explain any two in detail | **07** |
| | **(b)** | Discuss briefly various factors affecting selection of type of foundation | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain Engineering News Record formula and Hileys formula for estimating load carrying capacity of pile with necessary equations. | **07** |
| | **(b)** | How would you estimate the group capacity of piles in (a) sand (b) clay ? | **07** |

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**Seat No : _____** **Enrollment No: _____**

# GUJARAT TECHNOLOGICAL UNVERSITY

**PDDC. Semester- V Examination MAY 2012**

**Subject Code : X50603** **Subject Name : Foundation Engineering**

**Date: 16/05/2012** **Time: 10.30 am – 01.00 pm**

**Total Marks: 70**

**Instructions :**

(1) All questions are compulsory.
(2) Figures to the right indicates the marks.
(3) Use of Programmable calculator is strictly prohibited.
(4) Draw neat sketch wherever necessary.
(5) Write your seat no and enrollment no in space provided on the question paper.

**Q.1** **(a)** What do you understand by site investigation? What are the different purposes for site investigation? **07**

**(b)** Enlist various type of soil samplers for obtaining undisturbed sample and explain any one in detail. **07**

**Q.2** **(a)** Differentiate General shear failure and Local shear failure with neat sketch. **07**

**(b)** Determine the allowable gross load and the net allowable load for a square footing of 2 m side and depth of foundation is 1 m. Use Terzaghi's theory and assume local shear failure. Take factor of safety as 3. **07**
Take $\gamma$= 18 kN/m$^3$ , c=15 kN/m$^2$ and $\Phi$'=25° , $N_c'$=14.8 , $N_q'$=5.6 and $N_\gamma'$=3.2.

**OR**

**(b)** Describe contact pressure distribution on saturated clay and on sand. **07**

**Q.3** **(a)** A 30 cm dia pile, 12 m long is driven into a sand deposit. The details of the hammer are as follows **07**
(1) total weight of hammer = 20 kN
(2) Length of stroke = 100 cm
(3) Average penetration per blow = 4mm
Estimate ultimate resistance of pile using Hiley's formula, assuming that driving is without dolly. Thickness of cushion is 2.5 cm. Assume other data if necessary.

**(b)** What are the conditions where a pile foundation is more suitable than a shallow foundation? **07**

**OR**

**Q.3** **(a)** Explain negative skin friction and its effect on the pile. **07**

**(b)** Write a short note on classification of piles on different bases? **07**

**Q.4** **(a)** Explain swell pressure and its significance. **07**

**(b)** Write a note on various methods of modification of an expansive soil for improving its characteristics. **07**

**OR**

**Q.4** **(a)** How will you identify the expansive soil from its index properties? **07**

**(b)** Explain types and uses of geo synthetics. **07**

**Q.5** **(a)** Enlist factor affecting the selection of foundation for any structure. **07**

**(b)** Following are the observation taken during the plate load test **07**

| Vertical stress kN/m$^2$ | 50 | 100 | 150 | 200 | 250 | 300 | 350 |
|---|---|---|---|---|---|---|---|
| Settlement (mm) | 8 | 15 | 23 | 30 | 36 | 60 | 90 |

Draw stress – settlement curve and find out safe bearing capacity of soil using FS=3.

**OR**

**(a)** How will you calculate sample disturbance? **07**

**(b)** Enlist and explain standards used in standard penetration test. **07**

**Seat No.: _____** **Enrolment No._____**

# GUJARAT TECHNOLOGICAL UNIVERSITY

## PDDC SEM-V Examination-Nov-2011

**Subject code: X50603** **Date: 24/11/2011**

**Subject Name: Foundation Engineering**

**Time: 2.30 pm -5.00 pm** **Total marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of Programmable calculator is strictly prohibited.**
5. **Draw neat sketch wherever necessary.**

Q.1 (a) Explain Standard penetration test. 07

(b) A square footing 2m x 2m carries a uniformly distributed load of 314 kN/m². find the intensity of vertical pressure at a depth of 6 m below a point 0.5 m inside each of the two adjacent side of footing. 07

Q.2 (a) Explain General shear failure and Local shear failure with neat sketch. 07

(b) A square footing 2.5 m X 2.5 m is built on a homogeneous bed of sand of density 19 kN/$m^3$ having an angle of shearing resistance of 36°. The depth of foundation is 1.5 m below the ground surface. Calculate the safe load that can be applied on the footing with a factor of safety of 3. Take bearing capacity factors as $N_c$= 27, $N_q$ = 30, $N_\gamma$ = 35. 07

**OR**

(b) Discuss effect of inclination of load and water table on bearing capacity. 07

Q.3 (a) How the load transferred by the pile? 07

(b) A 40 cm square pre-cast RCC pile is driven by 8 m into a sandy bed. The standard penetration test results, performed on this ground are given below 07

| Depth(m) | 1.5 | 3 | 4.5 | 6 | 7.5 | 9 | 10.5 | 12 |
|---|---|---|---|---|---|---|---|---|
| SPT-N values | 4 | 6 | 12 | 12 | 20 | 24 | 35 | 39 |

Compute the factor of safety available if 1000 kN of compressive load is applied on this pile.

**OR**

Q.3 (a) A precast concrete pile of size 40 cm X 40 cm is to be driven into stiff clay. The unconfined compressive strength of the clay is 150 kN/$m^2$. Determine the length of pile required to carry a safe working load of 300 kN with factor of safety is 2.5. 07

(b) Briefly explain Settlement of single pile and settlement of group of pile, 07

Q.4 (a) List properties of expansive soil and give details of any two from it. 07

(b) What are the effects of swelling of soils on buildings? 07

**OR**

Q.4 (a) How will you identify the collapsible soil? 07

(b) Explain types and uses of feosynthetics. 07

Q.5 (a) Explain factors affecting selection of type of foundation. 07

(b) Write purposes of site investigation. 07

**OR**

(a) Enlist boring methods and explain any one in detail. 07

(b) Explain Plate load test. 07

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