VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

V SEMESTER

CE6502 – FOUNDATION ENGINEERING

Regulation – 2013

Academic Year 2018 – 19

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QUESTION BANK

SUBJECT : CE6502 – FOUNDATION ENGINEERING

SEM / YEAR : V/III

PART A

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and objectives – Methods of exploration – auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – Sampling techniques – Representative and undisturbed sampling – methods - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Penetration tests (SPT and SCPT) - Bore log report – Data interpretation – strength parameters and Liquefaction potential - Selection of foundation based on soil condition.

Q.No	Questions	K Level	Competence
1	**What are components of total foundation settlement?** elastic settlement, consolidation settlement, secondary consolidation settlement	K1	Remember
2	**What are the types of shear failure?** general shear failure, local shear failure, punching shear failure	K1	Remember
3	**What are assumptions in Terzaghi's bearing capacity theory?** - the base of the footing is rough - the load on footing is vertical and uniformly distributed - the footing is continuous	K1	Remember
4	**List out the methods of computing elastic settlements?** based on the theory of elasticity, Pressure meter method, Janhu –Bjerram method,	K1	Remember

	Schmentmann's method		
5	**What are the limitations of Terzaghi's analysis?** - As the soil compresses, pi changes slight down ward movement of footing may not develop fully the plastic zones - Error due to assumption that the resultant passive pressure consists of three components is small	K1	Remember
6	**Define ultimate bearing capacity** Gross pressure at the base of the foundation at which the soil fails in shear is called ultimate bearing capacity.	K1	Remember
7	**Define net ultimate bearing capacity** Net pressure increase in pressure at the base of the foundation that causes failure in shear, is called as net ultimate bearing capacity.	K1	Remember
8	**Define allowable bearing capacity** It is the net loading intensity at which neither the soil fails in shear nor there is excessive settlement detrimental to the structure.	K1	Remember
9	**Show the expression for correction due to dilatancy submergence?** Ne = 15 + (No-15)	K1	Remember
10	**What are the factors which depends depth?** Type of soil, size of structure, magnitude of loads, environmental conditions, etc	K1	Remember
11	**Define net pressure intensity** It is the excess pressure, of the gross pressure after the construction of the structure and the original overburden pressure.	K1	Remember
12	**What are the zones used in the Terzaghi's bearing capacity analysis for dividing the failure envelope of the soil.?** Elastic equilibrium zone, Radial Stress zone, plastic zone	K1	Remember

13	**Show the ultimate bearing capacity equation for the general shear failure of soil in Terzaghi's analysis for a strip footing.** qu = c Nc + _DNq + 0.5 _B N_	K1	Remember
14	**Define Shallow foundation.** If the depth of the foundation is less than its breadth, such foundation is known as shallow foundation.	K1	Remember
15	**When will the total settlement be completed in the case of cohesion-less soil?** Once the construction is over, the total settlement is assumed to be completed.	K1	Remember
16	**Define differential settlement** If any two points of the foundation base experiences different settlements then such settlement is known as differential settlement.	K1	Remember
17	**What type of shear failure of soil is more likely to happen in the case of very dense soil?** Usually punching shear failure and local shear failure may also be possible.	K1	Remember
18	**When will the Consolidation settlement get completed?** In the case of cohesion-less soil, the consolidation settlement gets completed once the construction is over. But In the case of cohesive soil, the consolidation settlement takes place for several years.	K1	Remember
19	**Define Deep foundation** If the depth of the foundation is equal to or greater than the breadth of the foundation such foundation is called as deep foundation.	K1	Remember
20	**What are the requirements for a stable foundation?** -must be safe from failure -must be properly located -must not settle or deflect sufficiently to damage the structure or impair its usefulness.	K1	Remember
21	**Find the area ratio for the split barrel soil sampler of outer diameter 51mm and inner diameter 35mm.comment on the nature of sample.**	K1	Remember

	A_r = Maximum cross sectional area of the cutting edge x 100 Area of the soil sample = $\frac{D_2^2 - D_1^2}{D_1^2}$ x 100 = $\frac{51^2 - 35^2}{35^2}$ x 100 = 112		
22	**What do you mean by 'significant depth' in soil exploration?** Exploration depth, in general it should be carried out to a depth upto which increase in the pressure due to structural loading is likely to cause shear failure, such depth is known as significant depth.	K1	Remember
23	**What are the information obtained in general exploration?** preliminary selection of foundation type depth of water, depth, extent and composition of soil strata engineering properties required disturbed or partly disturbed samples approximate values of strength and compressibility	K1	Remember
24	**Find the area ratio of a seamless tube sampler of inner diameter 48mm and outer diameter 51mm and comment on the nature of samples to be obtained in the sampler.** = $\frac{D_2^2 - D_1^2}{D_1^2}$ x 100 = $\frac{51^2 - 48^2}{48^2}$ x 100 = 12.8	K1	Remember
25	**What is bore log?** A complete record of the boring is maintained in the form of a chart, indicating the soil characters in various strata. This chart is known as "log of bore hole".	K1	Remember
26	**Define soil exploration.** The process of exploring the site with reference to the soil properties and other conditions of the underground strata is called soil exploration.	K1	**Remember**
27	**What is Area ratio?** Area ratio is defined as the ratio of maximum cross sectional area of the cutting edge to the area of the soil sample A_r = Maximum cross sectional area of the	K1	Remember

	cutting edge x 100 Area of the soil sample = $\frac{D_2^2 - D_1^2}{D_1^2}$ x 100 Where, D_2 = Outside diameter of cutting edge D_1 = Inside diameter of cutting edge		
28	**Define recovery ratio.** Recovery Raio**:** R_r = height of sample obtained x 100 Distance of penetration of samples = $\frac{L'}{L}$ x 100	K1	Remember
29	**What are the types of soil samples?** 1. Disturbed soil sample 2. Undisturbed soil sample	K1	Remember
30	**What is site reconnaissance?** Site reconnaissance are done for obtaining the information about subsurface conditions at the site of proposed construction.	K1	Remember
31	**What is depth of exploration?** Depth of exploration required at a particular site depends upon the degree of variation of the subsurface data in the horizontal & vertical directions.	K1	Remember
32	**.What are the types of soil samples?** 1. Disturbed soil sample 2. Undisturbed soil sample .	K1	Remember
33	**.What are the disadvantages of wash boring?** • It is a slow process in stiff soil • It cannot be used effectively in hard soil, rocks, etc .	K1	Remember
34	**.What are design features that affect the sample disturbance?** Area ratio, inside clearance, outside clearance,	K1	Remember

	inside wall friction, .method of applying force .		
35	**.What are the corrections to be applied to the standard penetration number?** 1. Overburden pressure correction 2. Dilatancy correction .	K1	Remember
36	**.What are the various methods of site exploration?** open excavation borings geophysical methods sub-surface soundings .	K1	Remember
37	**.What are the methods of boring?** Auger borings, shell boring, wash boring, rotary boring, percussion boring .	K1	Remember
38	**.How will you reduce the area ratio of a sampler?** By increasing the size of the soil sample. .	K1	Remember
39	**.What are the types of sampler?** Types of sampler: 1. split spoon sampler (thick walled sampler) 2. thin walled tube sampler (shell by tube sampler) 3. piston sampler 4. rotary sampler .	K1	Remember
40	**Explain the expression for correction due to Overburden pressure?** $N_C = N_R \times (350/(\sigma_o + 70)$.	K2	Understand

PART-B

1	**Explain the detailed note on various samplers.**	K2	understand
2	**Explain static cone penetration test in detail**	K2	understand
3	**What is mean by boring? and what are all the various types of boring.**	K1	Remember
4	**List out the various types of samplers.**	K1	Remember
5	**Explain SPT test and plate load test in detail.**	K2	understand
6	**Explain the various parameters which affect the sampling in detail.**	K2	understand
7	**Explain the Geophysical methods.**	K2	understand
8	**Explain in detail about the selection of foundation based on soil condition.**	K2	understand
9	**Explain dynamic cone penetration test**	K2	understand
10	**Explain in detail about the salient features of a good sub-soil investigation report?**	K2	understand

UNIT II SHALLOW FOUNDATION

Introduction – Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (SPT, SCPT and plate load)Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

PART-A

1	**What are the information obtained in general exploration?** preliminary selection of foundation type depth of water, depth, extent and composition of soil strata engineering properties required disturbed or partly disturbed samples approximate values of strength and compressibility	K1	Remember
2	**Define significant depth?** Exploration depth, in general it should be carried out to a depth upto which increase in the pressure due to structural loading is likely to cause shear failure, such depth is known as significant depth.	K1	Remember
3	**What are the types of soil samples?** disturbed soil sample undisturbed soil sample	K1	Remember
4	**What is the difference between disturbed and undisturbed soil sample?** Disturbed soil sample Natural structure of soils get partly or fully modified and destroyed Undisturbed soil sample Natural structure and properties remain preserved	K1	Remember

5	**What are the disadvantages of wash boring?** It is a slow process in stiff soil It cannot be used effectively in hard soil, rocks ,etc.	K1	Remember
6	**What are design features that affect the sample disturbance?** area ratio, inside clearance, outside clearance, inside wall friction, method of applying force	K1	Remember
7	**What are the corrections to be applied to the standard penetration number?** overburden pressure correction dilatancy correction	K1	Remember
8	**What are various methods of site exploration?** open exacavation, borings, geophysical methods, sub-surface soundings	K2	Understand
9	**What are the methods of boring?** auger borings, shell boring, wash boring, rotary boring, percussion boring	K1	Remember
10	**Define area ratio?** Area ratio is defined as the ratio of maximum cross sectional area of the cutting edge to the area of the soil sample	K1	Remember
11	**Define liquefaction of sand?** The mass failure occurs suddenly, and the whole mass appears flow laterally as if it were a liquid such failure is referred to as liquefaction.	K1	Remember
12	**Define the term net ultimate bearing capacity of soil.** Net pressure increase in pressure at the base of the foundation that causes failure in shear, is called as net ultimate bearing capacity	K1	Remember

13	**What is ultimate bearing capacity?** Gross pressure at the base of the foundation at which the soil fails in shear is called ultimate bearing capacity.	K1	Remember
14	**What is mean by Bearing capacity of soil:** It is the maximum load which the soil can take per unit area without yielding or failure is known as bearing capacity of soil. It is also known as ultimate bearing capacity of soil. It depends upon the characteristics of its soil particles size, compactness and moisture content.		
15	**What is net pressure intensity?** It is the excess pressure, of the gross pressure after the construction of the structure and the original overburden pressure.	K1	Remember
16	**What is safe bearing capacity?** It is the maximum pressure which the soil can carry safely without risk of shear failure. It is equal to the net safe bearing capacity plus original overburden pressure. S.B.C = $\frac{\text{ultimate bearing capacity}}{\text{Factor of safety}}$ $q_s = q_{ns} + \gamma D = \frac{q_{nf}}{} + \gamma D$	K1	Remember
17	**Define the term "Net safe bearing capacity"?** The net safe bearing capacity is the net ultimate bearing capacity divided by a factor of safety F. $q_{ns} = \frac{q_{nf}}{F}$	K1	Remember
18	**Define Shallow foundation.** If the depth of the foundation is less than its breadth, such foundation is known as shallow foundation	K1	Remember
19	**Define Deep foundation** If the depth of the foundation is equal to or greater than the breadth of the foundation such foundation is called as deep foundation.	K1	Remember
20	**What are components of total foundation settlement?** Elastic settlement, consolidation settlement, secondary consolidation settlement.	K1	Remember

21	**What are the types of shear failure?** General shear failure, local shear failure, punching shear failure	K1	Remember
22	**What are the requirements of foundations?** Location and depth criteria Shear failure or bearing capacity criteria Settlement criteria	K1	Remember
23	**What are the components of settlement?** Immediate settlement Primary consolidation settlement Secondary compression settlement	K1	Remember
24	**What are the assumptions of Terzaghi's bearing capacity theory/** The base of the footing is rough. The footing is laid at a shallow depth The shear strength of the soil above the base of the footing is neglected. The footing is long i.e. L/B ratio is infinite Shear strength of the soil is governed by Mohr- Coulomb equation.	K1	Remember

PART-B

1	**What are the IS code recommendations for the location and depth of foundation?**	K1	Remember
2	**Explain the different modes of failure of foundation soil.**	K2	understand
3	**Explain the procedures for the SPT, SCPT and Plate load test.**	K2	understand
4	**What is settlement? What are the components of settlement? Distinguish between them?**	K1	Remember
5	**Find the Safe bearing capacity per unit area of** **(1) a strip footing 1 m wide** **(2) a square footing 3m x 3m, and** **(3) a circular footing of 3m diameter.** **(4) a rectangular footing of 1.3x2.2m** **Unit weight of the soil 1.8 t/m3, cohesion = 2t/m2 And Φ = 20o,Nc = 17.5, Nq = 7.5 and N γ = 5. Depth of footing is 1.6m below ground surface.**	K1	Remember
6	**A strip footing 2 m wide carries a load intensity of 400 KN/m2 at a depth of 1.2 m in sand. The saturated unit weight of sand is 19.5Kn/m3 and unit weight above water table is16.8KN/m3. The shear strength parameters are c = 0 and Φ = 35o . find the factor of safety with respect to shear failure for the following cases of location of water table. Determine the ultimate bearing capacity of the footing , if the ground water table is located** **(a) at a depth of 0.5 m below the ground surface,** **(b) at a depth of 0.5m below the base of the footing.** **(c) at the base of footing** **(d) at the ground level.** **Use Terzaghi theory.**	K1	Remember
7	**An R.C. Column footing 2.26 m in square shape is to rest 1.5 m below level ground level is on cohesive soil. The unit weight is 17.6kN/m3 . What is the safe load if cohesion is 30kN/ m3 factor of safety 2.4. angle of internal friction 33° and value of Nc= 30.4 Nγ = 33 and Nq = 32.**	K1	Remember
8	**Design a strip footing to carry a load of 750kN/m at a depth of 1.6m in a cohesive soil having unit weight of 18kN/ m3 & c=20kN/ m2 and angle of internal friction is 25 degree. Find the width of footing, using F.O.S as 3. Use**	K1	Remember

	terzhagi's equations. Nc = 25.1, Nq = 12.7 and N γ = 9.7		
9	**In a plate bearing test on pure clayey soil failure occurred at a load of 12.2 tones. The size of the plate was 45 cm x 45 cm and the test was one at a depth of 1.0 m below ground level. Find out the ultimate bearing capacity for a 1.5 m wide continuous wall footing with its base at a depth of 2m below ground level. The unit wt. of clay may be taken as 1.9 gm/ c.c. and Nc = 5.7, Nq = 1 and Nγ = 0.**	K1	Remember
10	**A square footing located at a depth of 1.5 m below the ground surface in cohesionless soil carries a column load of 1280 kN. The soil is submerged having an effective unit weight of 11.5 kN/m3 and an angle of shearing resistane of 30o. Find the size of the following for Fs = 3 by Terzaghi's theory of general shear failure.**	K1	Remember
11	**A footing foundation of 3m X 3m is to be constructed at a site at a depth of 1.5 m below ground level. The water table is at the base level of foundation. The average static cone penetration resistance obtained at the site is 20 Kg/m2. The soil is cohesive Find the safe bearing capacity for a settlement of 40mm.**	K1	Remember
12	**Two plate load test s were conducted at the level of a prototype foundation in cohesionless soil close to each other. The following data are given. Size of plate Load applied Settlement recorded** **0.3m X 0.3m 30 KN 25 mm** **0.6m X0.6m 90 KN 25 mm** **If the footing is to carry a load of 100KN, Find the size of the footing for the same settlement of 25 mm.**	K1	Remember
13	**A footing with size of 1.8x3m has to transmit load of a column at a depth of 1.5m. Find the safe load with FOS=3, & soil has following properties. Porosity = 10%, sp.gra= 2.67,C= 8kN/ m2. Φ = 35o. Use IS equation**	K1	Remember

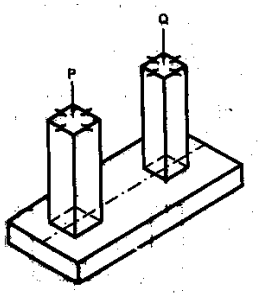
UNIT III FOOTINGS AND RAFTS

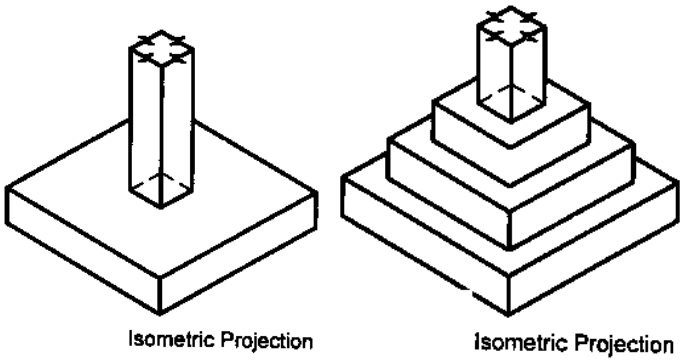
Types of footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning – Mat foundation – Types and applications – Proportioning – Floating foundation– Seismic force consideration – Codal Provision.

PART-A

1	**Under what circumstances, a strap footing is adopted?** When the distance between the two columns is so great, so that trapezoidal footing is very narrow and so it is uneconomical. It transfers the heavy load of one column to other column.	K1	Remember
2	**What is a mat foundation?** It is a combined footing that covers the entire area beneath a structure and supports all the walls and columns.	K1	Remember
3	**Where mat foundation is used?** It is used when the area of isolated footing is more than fifty percentage of whole area or the soil bearing capacity is very poor.	K1	Remember
4	**Define spread footing?** It is a type of shallow foundation used to transmit the load of isolated column, or that of wall to sub soil. The base of footing is enlarged and spread to provide individual support for load.	K1	Remember
5	**What are the types of foundation?** shallow foundation , deep foundation	K1	Remember
6	**What are the footings comes under shallow foundation?** spread footing or pad footings , strap footings, combined footings, raft or mat foundation	K1	Remember
7	**What are the footings comes under deep foundation?** pile, caisons(well foundation)	K1	Remember
8	**Define floating foundation?** It is defined as a foundation in which the weight of the building	K1	Remember

	is approximately equal to the full weight of the soil including water excavated from the site of the building.		
9	**What is mean by proportioning of footing?** Footings are proportional such that the applied load including the self weight of the footing including soil .the action are not exceeding the safe bearing capacity of the soil.	K1	Remember
10	**What are the assumptions made in combined footing?** - the footing is rigid and rests on a homogenous soil to give rise to linear stress distribution on the bottom of the footing. - the resultant of the soil pressure coincides with the resultant of the loads, then it is assumed to be uniformly distributed.	K1	Remember
11	**When you provide rectangular combined footing?** When the two column loads are equal, the rectangular combined footing is provided. If the footing is to support an exterior column at the property line, where the projection have to be limited and provided the interior column carry a greater load. The length of the footing is established by the projection of the footing the interior column.	K1	Remember
12	**List various types of foundations.** a. Shallow foundation 1. Footings Spread footing a. Continuous footing b. Isolated footing Strap footing Combined footing 2. Rafts(Mats) b. Deep Foundation i. Piles ii. Piers	K1	Remember
13	**Explain the assumptions made in the conventional structural design of footings.** The foundation is considered to be infinitely rigid as compared with the subsoil. The actual deflection of the raft doesn't influence the contact pressure distribution acting on the raft. The pressure distribution is assumed to be planar. The centroid of the soil pressure joined with the line of action of the resultant of all the loads acting on the foundation.	K2	Understand

14	**. When trapezoidal combined footings are provided?** When the two column loads are unequal, the exterior column is acting a higher load and then the property line is close to the exterior column, the trapezoidal footing is provided. The length is usually limited by the property line at one end and adjacent consumption.	K1	Remember
15	**What is mat foundation?** A raft or mat is a combined footing that covers the entire area beneath a structure and supports all the walls and columns	K1	Remember
16	**What is called stepped footing?** When the foundation width is considerably more than the thickness of the wall, then the footings should be stepped for transmission of the load. Also, stepped footings may be provided when the ground has a slope. The footings may be two or more steps of brick or stone masonry.	K1	Remember
17	**Define combined footing.** It is adopted when space between two columns is so small. A common footing for two or more columns are called combined footing  Isometric Projection	K1	Remember
18	**Define Isolated footing:** It is provided under column to transfer the load safely to the soil bed. It may be constructed in brickwork, masonry or concrete. A footing is defined as a spread footing when it is constructed in brick masonry or concrete under the base of a wall or column for the purpose of distributing the load over a greater area. In framed structure, where several columns are to be constructed, this footing should be provided. Footing may be square, rectangular or circular in shape in	K1	Remember

	plan  		
19	**Define Strap footing or Cantilever footing.** strap footing comprises two or more footings connected by a beam called 'strap'.	K1	Remember
20	**Under what circumstances, a strap footing is adopted?** When the distance between the two columns is so great, so that trapezoidal footing is very narrow and so it is uneconomical. It transfers the heavy load of one column to other column.	K1	Remember
21	**Where mat foundation is used?** It is used when the area of isolated footing is more than fifty percentage of whole area or the soil bearing capacity is very poor.	K1	Remember
22	**Define floating foundation?** It is defined as a foundation in which the weight of the building is approximately equal to the full weight of the soil including water excavated from the site of the building.	K1	Remember
23	**What is mean by proportioning of footing?** Footings are proportional such that the applied load including the self weight of the footing including soil .the action are not exceeding the safe bearing capacity of the soil.	K1	Remember
24	**Define modulus of subgrade reaction?** The ratio of soil reaction (p) to the deflection (y) at any point is defined as the modulus of subgrade reaction Es or soil modulus.	K1	Remember
25	**What are the assumptions made in combined footing?** The footing is rigid and rests on a homogenous soil to	K1	Remember

	give rise to linear stress distribution on the bottom of the footing. The resultant of the soil pressure coincides with the resultant of the loads, and then it is assumed to be uniformly distributed.		
26	**What are the types of raft foundation?** Flat slab type Flat slab thickened under columns Two way beam and slab type Flat slab with pedestals Cellular type Basement walls as rigid frame	K1	Remember

PART-B

1	**Explain the Principles of proportioning of footings.**	K2	understand
2	**Explain the general procedure for designing the footing**	K2	understand
3	**Explain the Procedure for designing the P.C.C. strip footings**	K2	understand
4	**Explain the Procedure for designing the R.C.C. strip footings.**	K2	understand
5	**Explain the procedure for the Design of spread or Isolated footings.**	K2	understand
6	**Explain the Procedure for proportioning and designing of the rectangular combined footings.**	K2	understand
7	**Explain the Procedure for proportioning and designing of the Trapezoidal combined Footings**	K2	understand
8	**Design and show a trapezoidal Footing for the two columns. Take allowable soil pressure as 200kN/m2**	K1	Remember
9	**Explain the Procedure for proportioning and designing of the strap footings.**	K2	understand
10	**A trapezoidal footing is to be produced to support two square columns of 30 cm and 50 cm sides respectively. Columns are 6 meters apart and the safe bearing capacity of the soil is 400 kN/m2. The bigger column carries a load of 500 kN and the smaller carries a load of 3000kN. Design and show a suitable size of the footing so that if does not extend beyond the face of the columns.**	K1	Remember
11	**Explain the Procedure of conventional design of the raft footings.**	K2	understand
12	**Design and show a square footing to carry a load of 1000kN on a column 300x300 mm. allowable soil pressure 200kN/m2. Premissble stress 500kN/m2.use M20 & Fe415 steel.**	K1	Remember

UNIT IV PILE FOUNDATION

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity- Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

PART-A

1	**List out the type of pile based on material used?** timber pile, concrete pile, steel pile, composite pile	K1	Remember
2	**How is the selection of pile carried out?** The selection of the type, length and capacity is usually made from estimation based on the soil condition and magnitude of the load.	K1	Remember
3	**What is mean by group settlement ratio?** The settlement of pile group is found to be many times that of a single pile. The ratio of the settlement of the pile group to that of a single pile is known as the group settlement ratio.	K1	Remember
4	**What are the factors consider while selecting the type of pile?** -the loads -time available for completion of the job -availability of equipment -the ground water conditions -the characteristics of the soil strata involved	K1	Remember
5	**What are the type of hammer?** drop hammer, diesel hammer, double acting hammer, single acting hammer, vibratory hammer	K1	Remember

6	**What is pile driver?** Piles are commonly driven by means of a hammer supported by a crane or by a special device known as a pile driver.	K1	Remember
7	**What are methods to determine the load carrying capacity of a pile?** - dynamic formulae - static formula - pile load test - penetration tests	K1	Remember
8	**What are the two types of dynamic formulae?** - Engg. news formula - Hiley's formula	K1	Remember
9	**What is meant by single-under reamed pile?** The pile has only one bulb is known as single under reamed pile	K1	Remember
10	**What is mean by static formulae?** The static formulae are based on assumption that the ultimate bearing capacity Qup of a pile is the sum of the ultimate skin friction Rf and total ultimate point or and bearing resistance Rp. Qup=Rf+Rp Qup=Asrf+Ap.rp	K1	Remember
11	**Define modulus of subgrade reaction** The ratio of soil reaction (p) to the deflection (y) at any point is defined as the modulus of subgrade reaction Es or soil modulus.	K1	Remember
12	**How is the selection of pile carried out?** The selection of the type, length and capacity is usually made from estimation based on the soil condition and magnitude of the load.	K1	Remember
13	**Classify the pile according to method of installation.** Driven piles Cast in-situ piles Driven and cast in-situ piles	K2	understand
14	**Explain the static formulae?** The static formulae are based on assumption that the	K2	understand

	ultimate bearing capacity Q_{up} of a pile is the sum of the ultimate skin friction R_f and total ultimate point or and bearing resistance R_p. $Q_{up} = R_f+R_p$ $Qup = A_s.r_f+A_p.r_p$		
15	**Define group efficiency of piles.** It is defined as the ratio of ultimate load of the group to the no of piles in the group multiplied by the ultimate load of the individual pile.	K1	Remember
16	**What are all the Common types of cast in-situ piles are:** i. Raymond standard piles ii. Raymond step taper piles iii.Union metal pile of monotube iv. Macarthur compression uncased pile v. Macarthur cased pile vi. Franki standard pile vii.Western button bottom pile	K1	Remember
17	**Define End bearing pile.** It is used to transfer load through water or soft soil to a suitable bearing stratum.	K1	Remember
18	**What is an under reamed file?** An under reamed pile is one with an enlarged base or bulb, the bulb is called 'under ream'. This piles are cast in-situ piles, which may be installed both in sandy and in clayey soil.	K1	Remember
19	**What are the factors consider while selecting the type of pile?** - the loads - time available for completion of the job - availability of equipment - the ground water conditions - the characteristics of the soil strata involved	K1	Remember
20	**What is negative skin friction?** Negative skin friction is a downward drag acting on a pile due to the downward movement of the surrounding compressive soil relative to the pile	K1	Remember

21	**What are the two types of dynamic formulae?** i. Engineering news formula ii. Hiley's formula	K1	Remember
22	**What are methods to determine the load carrying capacity of a pile?** a. dynamic formulae b. static formula c. pile load test d. penetration tests	K1	Remember
23	**In what situation the friction piles are used?** It is used to transfer loads to a depth of a friction load carrying material by means of skin friction along the length of piles.	K1	Remember
24	**In what situation the compaction piles are used?** It is used to compact loose granular soil, thus increasing their bearing capacity. Compaction piles do not carry any load. The pile tube, driven to compact the soil gradually taken out and sand is filled in its place thus forming a sand pile.	K1	Remember
25	**Explain the applications of anchor piles and tension piles.** Tension or Uplift piles: Anchor down the structure subjected to uplift due to hydrostatic pressure due to overturning moment. Anchor piles: It provides anchorage against horizontal pull from sheet piling or other pulling forces.	K2	Understand
26	**List out the type of pile based on material used?** Timber pile, concrete pile, steel pile, composite pile	K1	Remember

PART-B

1	**Explain the method of Hammer driving**	K2	Understand
2	**Explain the method of vibration driving and jetting**	K2	Understand
3	**What are the effects of Effects of pile driving?**	K1	Remember
4	**Explain the Static method for Estimating the load carrying capacity of a single pile driven in cohesion less soil (Sand)**	K2	Understand
5	**Explain the in- situ penetration tests for Estimating the load carrying capacity of a single driven pile**	K2	Understand
6	**Explain the Dynamic formulae for Estimating the load carrying capacity of a single driven pile**	K2	Understand
7	**Explain Vertical load test on piles (compression)**	K2	Understand
8	**Explain Vertical cyclic loading test (compression)**	K2	Understand
9	**Explain how the Group capacity can be found by different methods**	K2	Understand
10	**Explain the Static method for Estimating the load carrying capacity of a single pile driven in cohesive soil (Clay)**	K2	Understand
11	**How the settlement of a group of piles can be determined**	K1	Remember
12	**A concrete pile 30 cm diameter is driven into a medium dense sand ($\varphi = 35°$, r=21 kN/m3), k = 1.0, tan $\delta = 0.7$, Nq = 60). For a depth of 8m. classify the safe load, taking a factor of safety of 2.5, if the water table rises to 2 m below the ground surface take rw = 10 kN/m2.**	K2	Understand
13	**A square concrete pile (30cm side) 10 m long is driven into coarse sand having r = 18.5 kN/m3 & N = 20. Find the allowable load (F.S = 3.0)**	K1	Remember
14	**A precast concrete pile is driven by a single acting steam hammer. Find the allowable load using** **a. ENR formula (F.S = 6)** **b. Hiley formula** **c. Danish formula**	K1	Remember
15	**A pile group consists of 9 friction piles of 30cm diameter and 10m length driven in clay (Cu = 100kN/m2. r = 20kN/m3) as shown in the figure. Find the safe load for the group (F.S =3, $\alpha = 0.6$)**	K1	Remember

UNIT V RETAINING WALLS

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls.

PART-A

1	**Define conjugate stresses** The stress acting on the conjugate planes is called conjugate.	K1	Remember
2	**How do you check the stability of retaining walls?** - the wall should be stable against sliding - the wall should be stable against overturning - the base of the wall should be stable against bearing capacity failure	K1	Remember
3	**Define angle of repose** Maximum natural slope at which the soil particles may rest due to their internal friction, if left unsupported for sufficient length of time	K1	Remember
4	**Define theory of plasticity** The theory on which the condition of the stress in a state of a plastic equilibrium is called as theory of plasticity.	K1	Remember
5	**What are the assumption in coulomb wedge theory?** - the backfill is dry, cohesionless, isotropic, homogenous, - the slip surface is plane which passes through the head of the wall	K1	Remember
6	**How to prevent land sliding?** Sheet piles, retaining wall may be used to prevent the land sliding	K1	Remember
7	**Explain any two assumptions of Rankine's theory?** - semi infinite soil	K2	understand

	- cohesion-less backfill - homogenous soil - the top surface is a plane which may be inclined or horizontal.		
8	**Compare Coloumb's wedge theory from Rankine's theory?** Rankine considered a soil particle at plastic equilibrium but Coulomb considered the whole soil mass.	K2	understand
9	**Explain any two assumptions of Rankine's theory?** - semi infinite soil - cohesion-less backfill - homogenous soil - the top surface is a plane which may be inclined or horizontal.	K2	understand
10	**What are assumption in coulomb wedge theory?** - The backfill is dry, cohesionless, isotropic, homogenous, - The slip surface is plane which passes through the head of the wall	K1	Remember
11	**Define angle of repose?** Maximum natural slope at which the soil particles may rest due to their internal friction, if left unsupported for sufficient length of time	K1	Remember
12	**How do you check the stability of retaining walls?** - the wall should be stable against sliding - the wall should be stable against overturning - the base of the wall should be stable against bearing capacity failure	K1	Remember

PART-B

1	**A retaining wall is 4 metres high. Its back is vertical and it has got sandy backfill upto its top. The top of the fill is horizontal and carries a uniform surcharge of 85 kN/m2. Find the active earth pressure on the wall per metre length of wall. Water table is 1m below the top of the fill. Dry density of soil = 18.5 kN/m3. Moisture content of soil above water table = 12%. Angle of internal friction of soil = 30°, specific gravity of soil particles = 2.65. Porosity of backfill = 30%. The wall friction may be neglected.**	K1	Remember
2	**Explain Rankine's Active earth pressure theory for cohesion less soil**	K2	Understand
3	**Explain Rankine's Active earth pressure theory for cohesive soil**	K2	Understand
4	**Explain Rankine's Passive earth pressure theory for cohesion less and cohesive soil**	K2	Understand
5	**Explain coulomb's wedge theory**	K2	Understand
6	**Explain Culmann's construction for active pressure of cohesion less soil**	K2	Understand
7	**Explain the Effect of line load on retaining wall.**	K2	Understand
8	**A cantilever retaining wall of 7 metre height retains sand. The properties of the sand are γd = 17.66KN/m3 and γsat = 29.92 KN/m3 φ = 30°. usingRankine's theory determine active earth pressure at the base when the backfill is** **(i) Dry,** **(ii) Saturated and** **(iii) Submerged. A rigid retaining wall of 6 m high, has a saturated backfill of soft clay soil.** **The properties of the clay soil are γsat = 17.56 kN/m3, unit cohesion cu = 18 kN/m2. Find the expected depth of tensile crack in the soil**	K1	Remember
9	**A retaining wall of 6 m high has a saturated backfill of soft clay soil. The properties of the clay soil are γsat = 17.56 kN/m3, unit cohesion cu = 18 kN/m2. Find** **(a) the expected depth of tensile crack in the soil**	K1	Remember

	(b) the active earth pressure before the occurrence of tensile crack, and **(c) the active pressure after the occurrence of tensile crack**		
10	**A gravity retaining wall retains 12 m of a back fill, r = 17.7 kN/m3, r sub = 10kN/m3. φ = 25° with a uniform horizontal surface. Assume the wall interface to be vertical, find the magnitude and point of application of the total active pressure. For an earth retaining structure shown in Fig. Construct earth pressure diagram for active state find the total thrust per unit length of the wall.**	K1	Remember
11	**A wall of 8 m height retains sand having a density of 1.936 Mg/m3 and angle of internal friction of 34°. If the surface of the backfill slopes upwards at 15° to the horizontal, find the active thrust per unit length of the wall. Use Rankine's conditions.**	K1	Remember

Course In-charge **Course Coordinator** **Module coordinator** **HOD/CIVIL**