VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

V SEMESTER

CE6502 – FOUNDATION ENGINEERING

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UNIT 1- 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.

PART – A (2 Marks)

1.	What are the various methods of soil exploration techniques.	BT-1	Remembering
2.	Summarize the correction applied in SPT test.	BT-2	Understanding
3.	Define depth of exploration.	BT-1	Remembering
4.	Formulate the merits and demerits of wash boring.	BT-6	Creating
5.	Discuss the different objectives of site investigation?	BT-6	Creating
6.	Summarize Auger boring.	BT-2	Understanding
7.	Explain standard penetration number	BT-5	Evaluating
8.	Discuss the factors affecting quality of samples?	BT-4	Analysing
9.	What are the functions of drilling mud?	BT-1	Remembering
10.	What do you infer from soil exploration and state it uses?	BT-1	Remembering
11.	Write the different types of samplers.	BT-3	Applying
12.	Illustrate the various parameters affecting the sampling disturbance.	BT-2	Understanding
13.	Summarize the advantages of SCPT over SPT.	BT-2	Understanding
14.	Examine a report on spacing of bore holes.	BT-4	Analysing
15.	Identify the difference between disturbed & un-disturbed samples.	BT-3	Applying
16.	Tabulate a difference on representative and non-representative samples.	BT-1	Remembering
17.	Define liquefaction of sand and its importance.	BT-1	Remembering
18.	Explain about area ratio and give the acceptable range of area ratios for soft and stiff soils	BT-5	Evaluating
19.	List the uses of Bore log report.	BT-4	Analysing
20.	The internal diameter of a sampler is 50 mm and the external diameter is 52 mm. Identify the sample obtained from the sampler as disturbed or undisturbed?	BT-3	Applying

PART – B (13 Marks)

1.	Discuss the salient features of a bore log report?	BT-6	Creating
2.	Summarize the following samplers with neat sketches (i) Split spoon sampler. (7) (ii) Thin walled sampler. (6)	BT-2	Understanding
3.	With a neat sketch, explain the types of boring (i) Auger boring (7) (ii) Wash boring (6)	BT-2	Understanding
4.	Summarize a detailed report on various types of samplers.	BT-2	Understanding
5.	Discuss the factors incorporated in SPT test and tell about correction applied on same.	BT-4	Analysing
6.	List out the various parameters which affect the sampling in detail.	BT-4	Analysing
7.	Describe the following types of Geophysical methods (i) Electrical resistivity methods (7) (ii) Seismic refraction method (6)	BT-3	Applying
8.	Evaluate the selection of foundation location based on soil condition.	BT-5	Evaluating
9.	What is mean by dynamic cone penetration test and explain in detail about it.	BT-1	Remembering
10	What are the scope and objectives of subsoil investigation.	BT-1	Remembering
11	Prepare a short notes on the following (i) Significant depth of exploration (5) (ii) Spacing of Bore holes (4) (iii) Site investigation report (4)	BT-1	Remembering
12	Mention the advantage and disadvantages of SPT test over SCPT test.	BT-1	Remembering
13	Discuss the following in detail (i) Soil Exploration Methods (10) (ii) Importance of area ratio (3)	BT-4	Analysing
14	Describe the following methods (i) Liquefaction potential (7) (ii) Bore Well logging (6)	BT-3	Applying

PART – C (15 Marks)

1.	Distinguish between non-representative, representative and undisturbed samples and name the various laboratory tests that could be conducted in each of these samples.	BT-2	Understanding
2.	List out various field penetration tests used in soil investigation and explain in detail	BT-1	Remembering
3.	Discuss about the Geophysical methods of site exploration?	BT-6	Creating
4.	Why SPT 'N' values recorded in sand at different depths are corrected for overburden and submergence? How these corrections are applied?	BT-1	Remembering

UNIT 2- 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 (2 Marks)

1.	Compare shallow foundation with deep foundation.	BT-2	Understanding
2.	Discuss the factors to be considered while designing the foundation	BT-6	Creating
3.	Distinguish between bearing capacity and ultimate bearing capacity	BT-2	Understanding
4.	Summarize Safe bearing capacity and Allowable bearing pressure	BT-2	Understanding
5.	Formulate the Terzaghi's equation.	BT-5	Evaluating
6.	Describe the different modes of shear failure	BT-3	Applying
7.	Relate local shear failure and General shear failure.	BT-1	Remembering
8.	List the factors affecting Bearing capacity.	BT-4	Analysing
9.	Select the Assumptions & Limitations made in Terzaghi's Analysis?	BT-5	Evaluating
10.	Estimate the factors affecting Bearing capacity.	BT-6	Creating
11.	Define Settlement.	BT-1	Remembering

12.	Classify the components of settlement	BT-2	Understanding
13.	Define Co-efficient of volume change and volume change.	BT-1	Remembering
14.	Compare Immediate Settlement and consolidation settlement.	BT-4	Analysing
15.	State primary consolidation and secondary consolidation.	BT-1	Remembering
16.	What do you understand from Secondary compression settlement?	BT-1	Remembering
17.	Describe the corrections to be made for the Settlement due to Consolidation.	BT-3	Applying
18.	Identify the corrections made for the observed SPT values.	BT-3	Applying
19.	Write the procedure to find effective dimension of a eccentrically loaded footing.	BT-1	Remembering
20.	Examine the factors consider in seismic design of shallow foundation.	BT-4	Analysing

PART – B (13 Marks)

1.	A square footing 2.5 m by 2.5 m is built in a homogeneous bed of sand of unit weight 20 kN/m3 and having an anlge of shearing resistance of 360. The depth of the base of footing is 1.5 m below the ground surface. Find the safe load that can be carried by a footing with a factor of safety of 3 aginst complete shear failure. Use terzaghi's analysis.	BT-1	Remembering
2.	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 $17.6 kN/m^3$. What is the safe load if cohesion is $30 kN/m^3$ Factor of safety 2.4. Angle of internal friction 33° by IS code.	BT-1	Remembering

3.	Explain the following
	    (i) General shear failure
	    (ii) Local shear failure
	    (iii) Punching shear failure
		BT-5	Evaluating

4.	Calculate the Safe bearing capacity per unit area of
	    1. a strip footing 1 m wide (4)
	    2. a square footing 3m x 3m (3)
	    3. a circular footing of 3m diameter. (3)
	    4. a rectangular footing of 1.3x2.2m (3)
	Unit weight of the soil 1.8 t/m^3, cohesion = $2t/m^2$ And $\Phi = 20^0$, Nc = 17.5, Nq = 7.5 and N γ = 5. Depth of footing is 1.6m below ground surface.
		BT-3	Applying

5.	A strip footing 2m 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 19.5 kN/m3 and unit weight above water table is 16.8 kN/m3. The shear strength parameters are C=0 and $\Phi = 35^0$. Determine the factor of safety with respect to shear failure for the following cases of location of water table :	BT-3	Applying

	(a) Water table is 4m below G.L		
	(b) Water table is 1.2 m below G.L		
	(c) Water table is 2.5 m below G.L		
	(d) Water table is 0.5 m below G.L		
	(e) Water table is G.L itself		
	Use Terzaghi's equations.		

6.	A strip footing is to carry a load of 750kN/m at a depth of 1.6m in a cohesive soil having unit weight of 18kN/ m^3 & C=20kN/ m^2 and angle of internal friction is 25 degree. Determine the width of footing, using F.O.S as 3. Use terzhagi's equations. $N_c = 25.1$, $N_q = 12.7$ and $N\gamma = 9.7$	BT-4	Analysing
7.	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/m^3 and an angle of shearing resistance of 30^0. Show and find the size of the footing for Fs = 3 by Terzaghi's theory of general shear failure.	BT-2	Understanding
8.	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. Calculate 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 $N_c = 5.7$, $N_q = 1$ and $N\gamma = 0$.	BT-2	Understanding
9.	A plate load test was conducted with a 30 cm square plate at a depth of 1.2 m below the ground level, in a cohesive soil having $\Phi = 0$. The failure was observed at a load of 36 kN. The water table was observed to be at a depth of 4.7 m below ground surface. Compute the ultimate bearing capacity for a strip footing, 1m wide with its base located at the same level as the test plate, and in the same soil. Take the bulk unit weight of the soil as 16.8 kN/m^3. Also, calculate the safe bearing capacity of factor at a safety of 3.	BT-2	Understanding
10.	Discuss about the Plate load test for determining the Bearing capacity of foundation and How do you estimate the settlement of a footing on sand using the results of a plate load test?	BT-4	Analysing

11.	(i)An RCC foundation of size 18m x 36m have a uniform pressure of 180 KN/m^2 on a soil mass with modulus of elasticity 45 KN/m^2.Determine the immediate settlement Assume poisons ratio as 0.5 (10) (ii)Draw the pressure distribution of rigid footing in cohesive soil (3)	BT-4	Analysing
12.	How to find the bearing capacity from Standard penetration test and static cone penetration test?	BT-1	Remembering

13.	(i) A rectangular footing 3m x 2m exerts a pressure of 100kN/m^2 on a cohesive soil Es= 5×10^4 kN/m^2 and μ = 0.5. Estimate the immediate settlement at the centre, assuming
	      (a) the footing is flexible (5)
	      (b) the footing is rigid (5)
	 (ii) Write about influence of water table in determination of bearing Capacity. (3)
		BT-6	Creating

14.	The load settlement curve data from a plate load test on a sandy soil are as under : <table><tr><td>Load, t/m^2</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td></tr><tr><td>Settlement, mm</td><td>4.5</td><td>10</td><td>15.5</td><td>22</td><td>29</td><td>38.5</td><td>50</td><td>64</td></tr></table> The size of the plate used was 0.3m x 0.3 m. Find the size of the square column footing to carry a net load of 250 t with a maximum settlement of 25mm.	BT-1	Remembering

PART – C (15 Marks)

1.	Explain terzaghi's analysis of bearing capacity of soil in general shear failure with assumptions.	BT-2	Understanding
2.	Explain the IS code recommendations for the location and depth of foundation.	BT-2	Understanding
3.	A footing 2m square, rests on a soft clay soil with its base at a depth of 1.5 m from ground surface. The clay stratum is 3.5 m thick and is underlain by a firm sand stratum. The clay soil has LL=30%,G=2.7, water content at saturation = 40 %, cohesion = 0.5 kg/cm^2 (Φ = 0). It is known that the clay stratum is normally consolidated. Compute the settlement that would result if the load intensiy is equal to safe bearing capacity of soil were allowed to act on the footing. Natural water table is quite close to the ground surface. For given conditions, bearing capacity factor (N_c) is obtained as 6.9. Take factor of safety as 3.Assume load spread of 2(vertical) to 1 (horizontal).	BT-6	Creating
4.	What is mean by settlement? What are the components of settlement? Distinguish between them?	BT-1	Remembering

UNIT 3- 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 (2 Marks)

1.	Differentiate Rigid and Elastic Foundation	BT-2	Understanding
2.	Based on function and design, classify types of various footings adopted	BT-2	Understanding
3.	Compare strip footing and strap footing	BT-2	Understanding
4.	Compare the two methods of design of raft foundation as per IS code	BT-2	Understanding
5.	Where can be the raft or mat foundation adopted	BT-1	Remembering
6.	What is the condition for selecting the critical section to check diagonal shear and punching shear of a spread (or) isolated footing?	BT-1	Remembering
7.	By adopting mat foundation, what are the two methods to reduce differential settlements?	BT-1	Remembering
8.	What do you mean by Cantilever Footing?	BT-1	Remembering
9.	Under which circumstances Raft foundation is preferred?	BT-1	Remembering
10.	What do you mean by buoyancy raft foundation?	BT-1	Remembering
11.	Explain the concept of bulb of pressure in footings.	BT-5	Evaluating
12.	Assess the condition for selecting the critical section for bending moment of a spread or isolated footing.	BT-5	Evaluating
13.	Elaborately discuss about Mat Foundation.	BT-6	Creating
14.	Discuss the need for Rectangular or trapezoidal footings.	BT-6	Creating
15.	Sketch the critical region of eccentricity	BT-4	Analysing
16.	Draw the pressure distribution diagram of a trapezoidal footing along with proportioning.	BT-4	Analysing
17.	Mention the assumptions made in the conventional method of design of raft foundation	BT-4	Analysing
18.	Identify the seismic force and its consideration on footings	BT-3	Applying
19.	Illustrate the principle behind floating foundation.	BT-3	Applying
20.	Summarize the concept of contact pressure distribution	BT-3	Applying

PART – B (13 Marks)

1.	Show the step by step procedure of proportioning of Trapezoidal combined footing with neat sketch.	BT-1	Remembering
2.	Prepare a short notes on the following (i) Seismic considerations in foundation design(6) (ii) Design Procedure of strip footing.(7)	BT-1	Remembering

3.	Explain the procedure for the Design of spread or isolated footings.	BT-2	Understanding
4.	Show the procedure for proportioning and designing of the Rectangular combined footing with neat sketch .	BT-1	Remembering
5.	Describe the following (i) Proportioning and designing of the strap footings.(7) (ii) Pressure distribution in foundation(6)	BT-3	Applying
6.	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/m^2. The bigger column carries a load of 5000 kN and the smaller carries a load of 3000 kN. Analyse and design a suitable size of the footing so that if does not extend beyond the face of the columns.	BT-4	Analysing
7.	Explain the conventional methods of proportioning of raft foundation.	BT-2	Understanding
8.	Asses the design of a square footing which carries a load of 1000 kN on a column 300 x 300 mm. Allowable soil pressure 200kN/m^2.	BT-5	Evaluating
9.	Plan and compute a mat foundation with 9 columns. Assuming the mat is rigid, determine the soil pressure distribution. All the columns are of size 0.6 m x 0.6 m . Assume relevant loads on column as per IS standards.	BT-4	Analysing
10.	Design a RCC footing for a wall 30 cm wide and having a load of 80 kN/m. The allowable soil pressure is 50 kN/m^2	BT-6	Creating
11.	(i) What are all the various types of mat foundation.(7) (ii) List the Application and condition where mat foundations are used(6)	BT-1	Remembering
12.	Proportion a rectangular combined footing for two columns 5 m apart. The exterior column of size 0.3 m x 0.3 m carries a load of 600 kN and interior column of size 0.4 m x 0.4 m carries a load of 900 kN. The allowable soil pressure is 100 kN/m^2.	BT-3	Applying
13.	Write brief notes on: (i) Mat foundation (7) (ii) Floating foundation (6)	BT-2	Understanding
14.	Determine the dimension for strap footing for the two columns of size 0.4 m x 0.4 m, allowable soil pressure is 100 kN/m^2. Distance between C/C two columns is 6 m. Take eccentricity of footing of column is 1 m. Assume necessary data if needed.	BT-4	Analysing

PART – C (15 Marks)

1.	Asses the IS codal provisions and recommendations for the design of raft foundation.	BT-5	Evaluating
2.	How choice of foundation type is selected and what are all the preliminary Selection process?	BT-1	Remembering
3.	Briefly discuss about the various types of footing with neat sketch.	BT-2	Understanding
4.	(i) Explain the design procedure of a combined footing (8) (ii) List out the various factors consider in earthquake area (7)	BT-4	Analysing

UNIT 4 - 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 in-situ 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 (2 Marks)

1.	Where the deep foundations are employed?	BT-1	Remembering
2.	What are the various factors that are to be considered for the selection of pile type?	BT-1	Remembering
3.	List the different types of piles according to Material of construction.	BT-4	Analysing
4.	Describe about under reamed pile? When is it preferred?	BT-3	Applying
5.	Examine the different types of piles according to its function and construction?	BT-4	Analysing
6.	How do you proceed to calculate the settlement of a group of friction piles in clay?	BT-1	Remembering
7.	What is meant by group settlement ratio?	BT-2	Understanding
8.	State the methods of pile driving	BT-3	Applying
9.	How to Protect the pile during driving.	BT-1	Remembering
10.	What are the precautions should be taken to avoid heaving of soil while driving the pile?	BT-5	Evaluating
11.	Classify the methods for estimating the load –carrying capacity of a pile.	BT-2	Understanding
12.	Report on reasons for conducting initial tests on piles.	BT-2	Understanding
13.	Write Converse-Labarre formula to get the group efficiency of piles?	BT-1	Remembering
14.	Define Negative skin friction (or) down drag	BT-2	Understanding
15.	Write about Group action of piles and spacing of piles in group action?	BT-1	Remembering
16.	What is the result of driving a displacement pile into a loose sand and plastic clay?	BT-4	Analysing
17.	Discuss about Pile group efficiency and list the factors affecting pile group efficiency	BT-6	Creating
18.	For a pile designed for an allowable load of 400 kN driven by a single acting steam hammer with a energy of 221 t-cm, Estimate the approximate terminal set of pile.	BT-6	Creating
19.	State Feld's rule for determining group capacity of pile groups.	BT-3	Applying
20.	State the seismic considerations in pile foundation	BT-5	Evaluating

PART – B (13 Marks)

1.	Define pile foundation. Briefly discuss about the type of pile and their functions.	BT-1	Remembering
2.	(i) A wooden pile is being driven with a drop hammer weighing 20 kN having a free fall of 1 m. The penetration in the last blow is 5 mm. Determine the load carrying capacity using engineering news formula.(7) (ii) Compare and contrast engineering news and Hileys formula(6)	BT-2	Understanding

3.	Discuss the following methods of load carrying capacity of pile	BT-4	Analysing
	(i) Static formula (7)		
	(ii) Dynamic formula(6)		
4.	Elaborate the following	BT-6	Creating
	(i) Under reamed piles (5)		
	(ii) Negative skin friction (4)		
	(iii) Pile Cap and Settlement of pile group in clay (4)		
5.	(i) A concrete pile 30 cm diameter is driven into a medium dense sand ($\varphi = 35°$, $\gamma = 21$ kN/m^3), k = 1.0, tan $\delta = 0.7$, $N_q = 60$). For a depth of 8m, Find the safe load. Taking a factor of safety of 2.5, if the water table rises to 2 m below the ground surface take $\gamma_w = 10$ kN/m^2. Assume necessary data if available (7)	BT-2	Understanding
	(ii) Classify the pile foundation based on method of installation and load transfer mechanism (6)		
6.	A square concrete pile (30cm side) 10 m long is driven into coarse sand having $\gamma = 18.5$ kN/m^3 & N = 20. Determine the allowable load (F.S = 3.0)	BT-1	Remembering
7.	A reinforced concrete piles weights 30 kN, is driven by a drop hammer weights 40 kN having an effective fall of 0.8 m. The average set per blow is 1.4 cm. The total temporary elastic compression is 1.8. Assuming coefficient of resistance as 0.25. Determine the safe load using	BT-2	Understanding
	(i) Engineering News Formula(7)		
	(ii) Hileys Formula(6)		
8.	(i) What is 'negative skin friction' on pile and why does it cause concern? How do you estimate its value in clay and sandy soil? Suggest means of controlling it. (7)		
	(ii) Discuss the method of obtaining ultimate load and also allowable load on a single pile from pile load test. (6)	BT-3	Applying
9.	(i) Design a square pile group to carry 400 kN in clay with an unconfined compressive strength of 60 kN/m^2. The piles are 30 cm diameter and 6 m long. Adhesion may be taken as 0.6 (7)	BT-1	Remembering
10.	A 16 pile group has to be arranged in the form of a square in soft clay with uniform spacing. Neglecting end bearing, determine the optimum value of the spacing of the piles in terms of the pile assuming a shear mobilization factor of 0.6	BT-3	Applying

11.	(i) Determine the group capacity of 15 piles arranged in 3 rows of diameter 300 mm. If the piles are driven 8 m in to clay with cohesion 25 kN/m^2. Take spacing of piles as 0.8 m. (ii) Discuss the method of obtaining ultimate load and also allowable load on a single pile from pile load test.	BT-4	Analysing
12.	Analyze the following (i) Group capacity of pile (7) (ii) Seismic Consideration in pile design (6)	BT-5	Evaluating
13.	A square group of 25 piles extends between depth of 2m and 12m in a deposit of 20 m thick stiff clay overlying rock. The piles are 0.5 m in dia and are spaced at 1m centre to centre in the group. The undrained shear strength of the clay at the pile base level is 180 kPa and the average value of the undrained shear strength over the depth of the pile is 110 kPa. The adhesion coefficient α is 0.45. Estimate the capacity of the pile group considering an overall factor of safety equal to 3 against shear failure. N_c corresponding to $\varphi_u = 0$ is 9.	BT-4	Analysing
14.	A group of nine piles of 300 mm diameter, spaced at 1m. Find the efficiency of pile group using Felds rule and Converse-Labarra formula.	BT-1	Remembering

PART – C (15 Marks)

1.	A group of 16 piles of 50 cm diameter is arranged with a center to center spacing of 1 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.	BT-5	Evaluating
2.	(i) Summarize the behavior of a group of piles in (a) sand and (b) clay, as compared to that of single pile in terms of the 'group efficiency factor'. (8) (ii) Explain the methods of determining load carrying capacity of a pile. (7)	BT-2	Underdstanding
3.	It is proposed to provide pile foundation for a heavy column: the pile group consisting of 4 piles, placed at 2 m center to center, forming a square pattern. The underground soil is clay, having C_u at surface as 60 kN/m^2 and at depth 10m, as 100 kN/m^2. Determine the allowable column load on the pile cap, if the piles are circular having diameters 0.5m each and length as 10 m.	BT-5	Evaluating

4.	A group of nine piles, 12 m long and 250 mm in diameter, is to be arranged in a square form in a clay soil with an average unconfined compressive strength of 60 kN/m^2. Find the center to center spacing of the piles for a group efficiency factor of 1. Neglect bearing at the tip of the piles.	BT-1	Remembering

UNIT 5- 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 (2 Marks)

1.	State Active and Passive Earth pressure.	BT-1	Remembering
2.	State whether the following statement is true or not and justify your answer. 'Retaining structures are mostly designed for active pressure and not for passive earth pressure'.	BT-1	Remembering
3.	Summarize coefficient of earth pressure	BT-1	Remembering
4.	Enumerate the assumptions made in Rankine's theory.	BT-1	Remembering
5.	What is the critical height of an unsupported vertical cut in cohesive soil?	BT-4	Analyzing
6.	List out the various important assumptions involved in Coulomb's earth pressure theory.	BT-5	Evaluating
7.	Compare Coloumb's wedge theory with Rankines theory.	BT-4	Analyzing
8.	Sketch the variation of earth pressure and coefficient of earth pressure with the movement of the wall	BT-4	Analyzing
9.	Give the minimum factor of safety for the stability of a retaining wall.	BT-3	Applying
10.	If a retaining wall of 5 m high is restrained from yielding, what will be the total earth pressure at rest per metre length of wall? Given: the back fill is cohesion less soil having $\varphi = 30°$ and $\gamma = 18$ kN/m^3.	BT-3	Applying
11.	Make an estimate of lateral earth pressure coefficient on a basement wall supports soil to a depth of 2 m. Unit weight and angle of shearing resistance of retained soil are 16 kN/m^3 and 32° respectively.	BT-2	Understanding
12.	Is granular materials are preferred for the backfill of a retaining wall? Why?	BT-3	Applying
13.	How do tension cracks influence the distribution of active earth pressure in pure cohesion?	BT-1	Remembering
14.	Why lateral wall movement required for complete mobilization of passive state is higher than that for active state?	BT-2	Understanding
15.	What are different states in which a soil mass can exist?	BT-1	Remembering

16.	What do you understand by plastic equilibrium in soils?	BT-2	Understanding
17.	State critical failure plane.	BT-5	Evaluating
18.	Write about surcharge angle.	BT-6	Creating
19.	Discuss about earth pressure at rest	BT-2	Understanding
20.	If the Poisson's ratio of soil is 0.4. Find its coefficient of earth pressure at rest.	BT-6	Creating

PART – B (13 Marks)

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/m^2. Dry density of soil = 18.5 kN/m^3. 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. Determine the following (i) Depth of Zero tension Crack (4) (ii) Active pressure acting on the wall (9)	BT-1	Remembering
2.	Explain Rankine's Active earth pressure theory for cohesion less soil and cohesive soil	BT-1	Remembering
3.	A 4m high vertical wall supports a saturated cohesive soil φ = 0 with horizontal surface. The top 2.5m of the backfill has bulk density of 17.6 kN/m^3 and apparent cohesion of 15 kN/m^2. The bulk density and apparent cohesion of the bottom 1.5 m is 19.2 kN/m^3 and 20 kN/m^2 respectively. If tension cracks develop, what would be the total active pressure on the wall? Also draw the pressure distribution diagram.	BT-1	Remembering
4.	(i) What are the different modes of failure of a retaining wall (6) (ii) Analyze the Effect of line load on retaining wall. (7)	BT-2	Understanding
5.	A retaining wall of 6 m high has a saturated backfill of soft clay soil.	BT-1	Remembering

	The properties of the clay soil are γ sat = 17.56 kN/m^3, unit cohesion C_u = 18 kN/m^2. Determine (i) the expected depth of tensile crack in the soil (5) (ii) the active earth pressure before the occurrence of tensile crack (4) (iii) the active pressure after the occurrence of tensile crack (4)		
6.	A wall of 8 m height retains sand having a density of 1.936 Mg/m^3 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.	BT-4	Analyzing
7.	A retaining wall has a vertical back and is 7.32 m high. The soil is sandy loam of unit weight 17.3kN/m^3. it shows a cohesion of 12 kN/m^2 and φ = 20°. Neglecting wall friction, determine the thrust on the wall. The upper surface of the fill is horizontal.	BT-4	Analyzing
8.	A smooth rigid retaining wall of 6 m high carries a uniform surcharge load of 12 kN/m^2. The backfill is clayey sand possessing the following properties. γ = 16.0 kN/m^3, φ = 25°, and c = 6.5 kN/m^2 for a retaining wall system, the following data were available: (i) Height of wall = 7 m. (ii) Properties of backfill: γd =16 kN/m3, φ = 35 ° (iii) Angle of wall friction, δ = 20° (iv) Back of wall is inclined at 20° to the vertical (positive batter) (v) Backfill surface is sloping at 1:10. Find the following (i) Active earth pressure (7) (ii) Passive earth pressure (6)	BT-6	Creating
9.	Prepare a short note on (i) Plastic Equilibrium of Soils. (8) (ii) Stability of retaining Wall. (5)	BT-5	Evaluating
10.	Discuss in details on the method of estimating the active earth pressure on a retaining wall by using the Culmann's method.	BT-4	Analyzing
11.	Summarize the following (i) Depth of Tension Crack (5) (ii) Economical design of Retaining Walls. (4) (iii) Nature and magnitudes of earth pressures (4)	BT-2	Understanding
12.	Give a brief note on the following with variation of pressure distribution (i) Cantilever Retaining Wall (7) (ii) Counterfort Retaining Wall (6)	BT-2	Understanding
13.	A retaining wall 6m height retains the backfill of bulk unit weight 19 kN/m^3, C = 20 kN/m^3, angle of internal friction 30° and with the top horizontal. The backfill carries a surcharge of 30 kN/m^2. Compute the total active and passive earth pressure on the wall and their point of application. Draw the earth pressure distribution diagram.	BT-3	Applying

14.	A retaining wall 6m high retains sand with $\varphi = 30°$ and unit weight 24kN/m^3 upto the depth of 3 m from top. From 3 m to 6 m the material is cohesive soil with c = 20kN/m^2 and $\varphi = 20°$. Unit weight of cohesive soil is 18 kN/m^3. A uniform surcharge of 100 kN/m^2 acts on top of the soil determine the total lateral pressure acting on the wall and its points of application	BT-3	Applying

PART - C (15 MARKS)

1.	What are the Rankine's theory for various backfill conditions to calculate active earth pressure.	BT-1	Remembering
2.	Construct a coulomb's wedge theory for soil pressure distribution.	BT-6	Creating
3.	Classify the different types of earth pressure? Give examples. Derive the an equation for determining the magnitude of earth pressure at rest	BT-2	Understanding
4.	A retaining wall 10 m high retains a cohesionless soil having an angle of internal friction of 30^0. The surface of the soil is level with the top of the wall. The top 3 m of the fill has a unit weight of 20 kN/m^3 and that of the rest is 30 kN/m^3. Find the magnitude per metre run and point of application of the resultant active thrust. Assume φ the same for both the strata.	BT-1	Remembering