BE Semester- VI (Civil Engineering) Question Bank

(Soil Mechanics)

All questions carry equal marks (10 marks)

Q-1.	a) Which theories you studied for calculating stress distribution under a point load applied on ground surface? b) A circular area of 7.5 m in diameter on the ground surface carries a uniformly distributed load of 300 kg/m^2. Find the intensity of vertical pressure below the centre of the loaded area at a depth of 6m below the ground surface. Use boussinesq's analysis.
Q-2	a) Explain assumptions of Boussinesq's theory in detail. b) A circular area is loaded with the uniform load intensity of 10 t/m^2 at ground surface. Calculate the vertical pressure at a point P situated on the vertical line through the centre of loaded area. Such that the area subtends an angle 90 deg at P. use boussinesq's analysis.
Q-3	a) What do you mean by pressure bulb? What is its significance in soil mechanics? b) A concentrated point load of 20 tonnes at the ground surface. Find the intensity of vertical pressure at a depth of 10 m below ground surface, and situated on the axis of loading. What will be the vertical pressure at a point at a depth of 5m and at a distance of 2 m from the axis of loading? Use boussinesq's analysis.
Q-4	a) What is contact pressure? Give contact pressure distribution diagram in different soil for different footing. b) Solve problem 3(b) by westergaard analysis. Take μ=0
Q-5	a) What are approximate methods to calculate stress distribution in soil? Explain any one in detail. b) A rectangular area 3mX1m is uniformly loaded with load intensity of 10 t/m^2 at the ground surface. Calculate the vertical pressure at a point 4m below ane of its corner.
Q-6	a) What is active earth pressure and passive earth pressure and earth pressure at rest. Explain in detail. b) A retaining wall 5m high with a sloping bag at 10 deg to the vertical supports a cohesion less backfill rising from the crest at an angle of 5 deg with the horizontal. The backfill weighs 1.9 t/m^2 and carries a uniformly distributed load of 0.5 t/m^2. The angle of shearing resistance of the backfill is 30 deg and the angle of wall friction is 20 deg. Find by Rebhann's graphical method the total active pressure per metter.
Q-7	a) What is the effect of cohesion on active earth pressure and passive earth pressure? Explain with earth pressure distribution diagram. b) Solve problem 6(b) if there is no surcharge load of 0.5 t/m^2.
Q-8	a) Who gave the earth pressure theory first? Explain the theory. b) A retaining wall 6m high, with vertical back, supports a cohesive backfill have a unit weight 1.9 g/cc; apparent cohesion = 0.25 kg/sqcm and angle of internal friction zero. Calculate 1) lateral pressure intensity at the top of the wall, 2) depth of tension cracks 3) lateral pressure intensity at the base.
Q-9	a) Enumerate graphical method to find out earth pressure. Explain any one in

	detail. b) A 5m high vertical wall supports a cohesive backfill with upper horizontal surface. Properties of the backfill are as follows; 1) upper 3m depth; γ_{sat}= 1.76 t/m^3, C = 0.75 t/m^2& Ø = 20° 2) lower 2mm depth: γ_{sat}= 1.92 t/m^3, C = 1.0 t/m^2& Ø = 20°. The free water level stands behind the wall at the depth of 4m from top. Neglecting negative pressure up to a depth of tension cracks; determine the total active pressure and its point of application.
Q-10	a) Explain culmann's graphical method to calculate active earth pressure. b) A retaining wall 4.2 m high with a smooth vertical back retains a dry sandy backfill of unit weight 1.8 t/m^3. An angle of shearing resistance of 30°. The backfill carries a uniformly distributed load of 1 t/m^2. Find by Rankine's theory the total active pressure per m length of the wall and its point of application above the base. If the water table rises behind the back of the wall to an elevation of 2.1 m below the top of the wall, what is the change in the total active pressure per m 0f the wall. Assume on change in angle of shearing resistance and submerged density of sand as 0.95 t/m^3.
Q-11	a) Derive an equation to find out stability of infinite slopes. b) What do you mean by finite and infinite slopes? Explain with examples.
Q-12	a) What is Taylor's, stability number? Give its utility in stability of slopes. b) A 6 m deep cut is to be made in a cohesive soil with a slope of 1:1. The soil has Cu= 3t/m^3; Øu= 10 ° and γ =1.8 t/m^3. Find the factor of safety w.r.t. cohesion. What will be the critical height of the slope in the soil?
Q-13	a) Explain Swedish circle method to calculate factor of safety for cohesive soil. b) A cutting 5m deep, is made in clay at a slope 45°. The bulk density of clay is 1.82t/m^{3}and the angle of shearing resistance is 10°. What is the value of cohesion necessary to give a factor of safety of 1.5 w.r.t. cohesion?
Q-14	a) What are critical conditions for stability of an earthen dam? Explain any one with engineering reasons. b) A canal, 3m deep runs through a soil having the following properties: Cu= 1 t/m^2; Øu= 10°; e = 0.8 and G=2.72.the angle of the slope of the banks is 45°. Determine the factor of safety with respect to cohesion when canal is full up to the top of banks. What will be the factor of safety in case of sudden drawdown?
Q-15	Derive an expression for factor of safety for C-Ø soils with the help of Swedish circle method.
Q-16	Explain Rebhan's graphical method to find active earth pressure.
Q-17	How to calculate active earth pressure graphically when a line load is acting on the ground surface?
Q-18	Explain Newmark's chart to find out stresses in the ground.
Q-19	Discuss Coulomb's earth pressure theory in detail.
Q-20	Compare critically theories of earth pressure you have studied.
Q.21	Define and explain what is meant by 'compaction', and how is it controlled in the field.
Q.22	Write notes on (i) factors affecting compaction (ii) effect of compaction on the soil properties
Q.23	Explain Standard proctor test in detail and give its utility.
Q.24	Explain the phenomenon of consolidation of clay by Terzaghi's spring analogy, and discuss assumption made in the theory of consolidation.
Q.25	Define and explain the following, indicating the symbols used and their relationship

	with other important parameters (i) Time factor (ii) Coefficient of consolidation (iii)Degree of consolidation (iv) Compression index (v)Coefficient of compression
Q.26	Explain different methods to determine coefficient of consolidation.
Q.27	Explain laboratory test for consolidation and its utility in detail.
Q.28	Explain Mohr's failure criteria, Coulomb's strength theory and Mohr- Coulomb's failure theory in detail.
Q.29	List various methods of finding out shear strength parameters. Explain any one method in detail with its advantages and limitations.
Q.30	Classify shear tests based on drainage condition. Hoe can we achieve these drainage condition in Direct box shear test and triaxial tests? Where do you recommend the use of these tests in practise?
Q.31	Write note on unconfined compression tests and its advantages and disadvantages.
Q.32	Two triaxial tests were run on soil samples. In the first test, the all around pressure was 250 kN/m^2 and failure occurred at an added axial stress of 750 kN/m^2 . In the other test, the all round pressure was 400 kN/m^2 and failure occurred at total axial stress of 1600 kN/m^2. Determine the values of cohesion and angle of internal friction of soil at failure.
Q.33	In an unconfined compression apparatus, a cylindrical sample of sandy clay, 8 cm long and 4 cm in diameter, fails under a load of 80 N. (a) Evaluate the shearing resistance of this soil. (b) Determine its shearing resistance, if failure occurs at 10 % stain and the shortening of the sample is occurred for.
Q.34	An earth embankment is compacted at water content of 17 % to a bulk density of 1.90 gm/cc. If the specific gravity of soil grains is 2.65, calculate the void ratio and degree of saturation of the compacted embankment.
Q.35	A highway embankment is to be compacted to 95% of the standard proctor density. The dry density of a borrow material exactly adjacent to the site is 18.4 kN/m^3 at 100% compaction. Gs = 2.65. How much borrow soil in cu m. will be required to compact 1 cu m. of embankment?
Q.36	A layer of soft saturated clay, 5 m thick lies under a newly constructed building. The effective pressure due to overlying strata on the clay layer is 300 kN/m^2, and the new construction increases the effective over-burden by 120 kN/m^2. If the compression index of the clay is 0.45, compute the settlement, assuming the natural water content of the clay layer to be 43 %, and the specific gravity of its soil grains as 2.7.
Q.37	How many days would be required by a clay stratum 5 m thick, draining at both ends with an average value of coefficient of consolidation = 50 x 10^{-4} cm^2/ sec, to attain 50 % of its ultimate settlement.
Q.38	The following results were obtained from undrained shear box test on soil. Normal load (N) 250 500 750 Failure load (N) 320 400 610 Determine strength parameter in terms of total stress. The cross-sectional area of shear box was 36 cm^2.
Q.39	The following data were recorded while performing the compaction test: Water content (%): 05 10 14 20 25 Bulk density (kN/m^3): 17.7 19.8 21.0 21.8 21.6 Plot the MDD/OMC curve and obtain the optimum water content and maximum dry density. Calculate the water content necessary to completely saturate the sample at its maximum dry density, assuming no change in the volume. Also plot zero air voids curve. Take G = 2.68
Q.40	The following results were obtained from direct shear test on sandy clay sample

	Normal Load (N) 360 720 1080 1440 Shear load proving ring reading (div) 13 19 26 32 If the shear box is 60 mm square and the proving ring constant is 20 N per division, estimate the shear strength parameters of the soil. Would failure occur on a plane within this soil at a point where the normal stress is 320 kN/m^2 and the corresponding shear stress is 138 kN/m^2