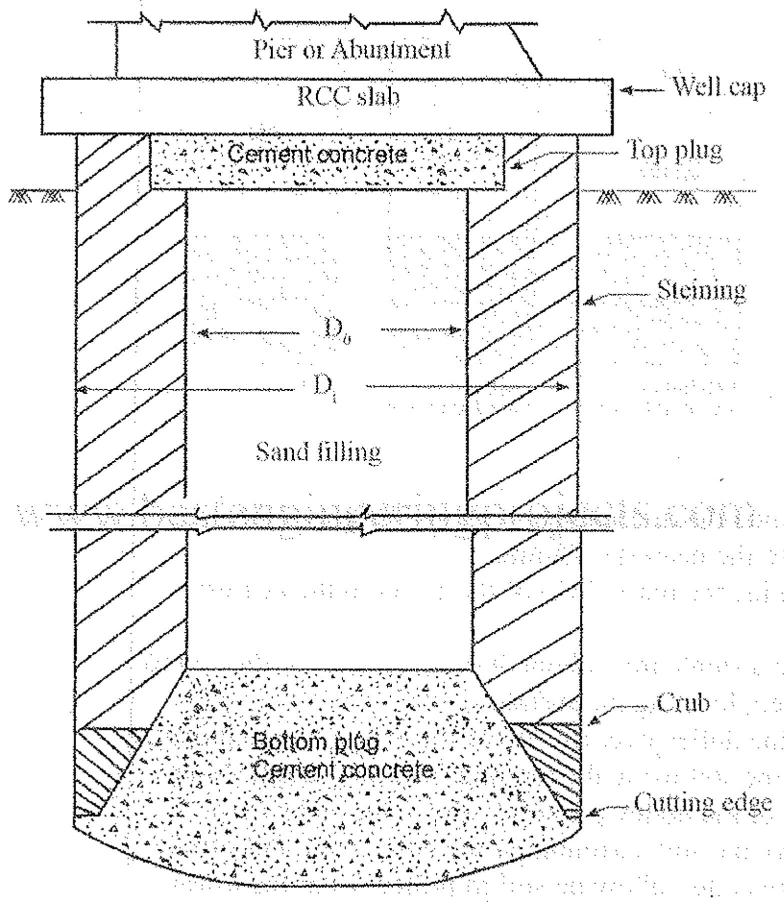
ScoringIndicators

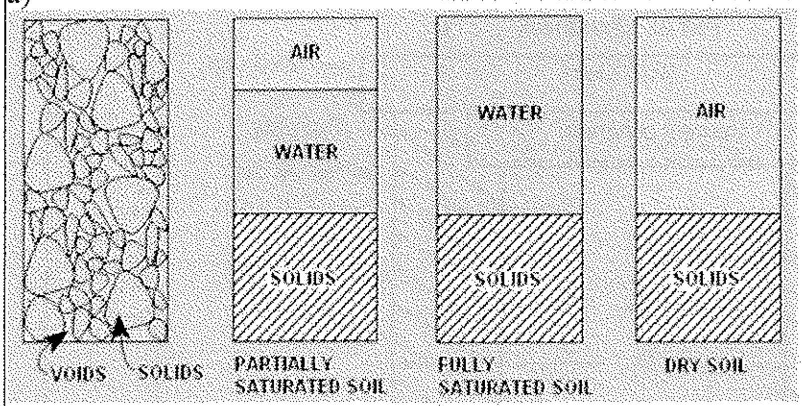
COURSENAME: GEOTECHNICAL ENGINEERING

COURSECODE:5013 **QID:** 1503240236

QNo	ScoringIndicators	Split score	Sub Total	Total score
	PARTA			**10**
I.1	Void ratio = volume of void / volume of solid Porosity = volume of void / total volume	1 1	2	10
I.2	1. Pychnometer method 2. Density bottle method	1 1	2	
I.3	Reduction of volume of soil due to removal of air is known as compaction	2	2	
I.4	Safe net bearing capacity: It is the net soil pressure which can be safety applied to the soil considering only shear failure. Allowable Bearing Pressure: It is the maximum soil pressure without any shear failure or settlement failure.	1 1	2	
I.5	D/B less than or equal to 1	2	2	
	PARTB			30
II.1	Alluvial (water transported) Soil Aeolian (Wind Transported) Soil Glacial (Ice Transported) Soil Lacustrine (Lake Transported) Soil Colluvial (gravity transported) soil	6	6	30
II.2	1. Tamper/ Rammer: • Hand operated – block of iron with wooden rod • Mechanical – operated by compressed air or gasoline power • Used to compact soil near the existing Structure 2. Vibratory compactors: • Vibrations are induced • Vibrator mounted on drum – vibratory roller • Suitable for granular soil 3. Rollers 1. Smooth wheel roller- finishing operations after, compaction of fills orcompacting granular base 2. Pneumatic roller– compressedair, suitable for both cohesive& cohesion less soil 3. Sheep foot roller - suitable forcohesive soil	2 2 2	6	
II.3	Darcy‘s law which state that For laminar flow in a homogeneous soil, thevelocity of flow between two points in the soil is directly proportional tothe hydraulic gradient applied to it.	4	6	

	• v α i • V= ki Where k = coefficient of permeability I = hydraulic gradient Coefficient of permeability is defined as the velocity of flow whichwould occur under unit hydraulic gradient	2		
II.4	1. Test Pits- Test pits are normally either square or circular in section of about 1.2 m to 1.5 m in width or diameter are often used for investigating all types of soils. 2. Test Trenches -Test trenches are normally square or rectangular in section with minimum width of 1 m to 1.2 m. 3. Open Borings - A open boring of about 1.2 m diameter is generally preferred. Open borings are drilled with power machines in soil and very soft rock.	2 2 2	6	
II.5	The test is conducted in a bore hole by means of a standard split spoon sampler.Once the drilling is done to the desired depth, the drilling tool is removed and the sampler is placed inside the bore hole. By means of a drop hammer of 63.5kg mass falling through a height of 750mm at the rate of 30 blows per minute, the sampler is driven into the soil. This is as per IS -2131:1963. The number of blows of hammer required to drive a depth of 150mm is counted. Further it is driven by 150 mm and the blows are counted. Similarly, the sampler is once again further driven by 150mm and the number of blows recorded. The number of blows recorded for the first 150mm not taken into consideration.. The number of blows recorded for last two 150mm intervals are added to give the standard penetration number (N). In other words, N = No: of blows required for 150mm penetration beyond seating drive of 150mm.	6	6	
II.6	a) Proportioning of footing • DL from each column, including the weight of the footing is determined • Maximum LL to which each footing is subjected is determined • ratio of max LL to DL for each footing is computed • Footing which have largest LL to DL ratio – governing footing • Area of governing footing Ag = (DL+LL)/ allowable bearing capacity • Service load for all the footing are determined • Design bearing capacity of all the footing is determined Qd = service load governing footing / Ag • Area of other footing A = service load for that footing/ qd	6	6	

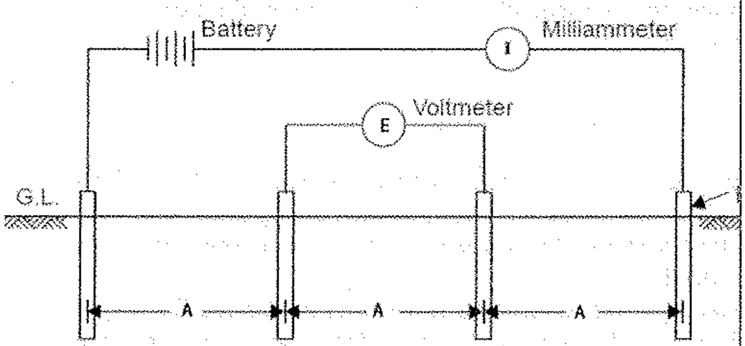
II.7	 Fig 1 Parts of a Well Foundation	6	6	
	PARTC			60

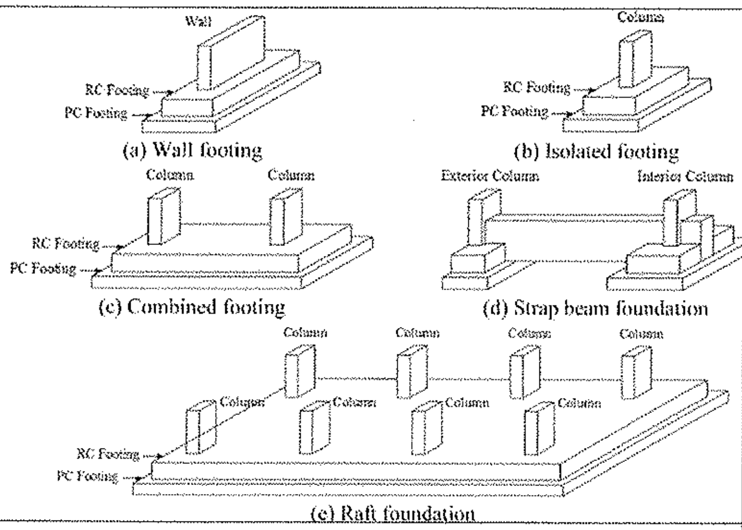
III	a)  	7	15	60
	b) • Determine the internal diameter and height of the core cutter to the nearest 0.25mm. • Determine the mass (M1) of the cutter to the nearest gram. • Expose a small area (about 300mm square) of the soil to be tested, leveling the surface. • Place the dolley over the top of the core cutter and press it into the soil using the rammer, stopping when about 15mm of the dolley protrudes above the soil surface. • Remove the soil surrounding the core cutter and extract the core cutter, allowing soil to project from the lower end. • Remove the dolley and carefully trim the tip and bottom surface of the core cutter using a straight edge. • Weigh the core cutter filled with soil to the nearest gram (M2). • Remove the soil core from the cutter, taking a representative sample for water content determination. • Determine the water content.	8		
IV	a) Volumetric relationship 1. Void Ratio Void ratio(e) is defined as the ratio of the volume of voids to the volume of solids. 2. Porosity (n) Porosity(n) is defined as the ratio of the volume of voids to the total volume of the soil. 3. Degree of Saturation (S) The degree of saturation(S) is defined as the ratio of the volume of water to the volume of voids. 4. Percentage of Air Voids (na) Percentage of air voids in the soil is obtained by dividing the volume of air to the total volume. 5. Air Content Air content is the ratio of the volume of air to the volume of voids. Air content is mostly represented in percentage.	10	15	

	b) Relation between void ratio and porosity **Void Ratio, e** — **Porosity, n** $e = \frac{V_v}{V_s}$ — $n = \frac{V_v}{V}$ $e = \frac{V_v}{V - V_v}$ — $n = \frac{V_v}{V_s + V_v}$ $e = \frac{V_v}{V - V_v} \frac{1/V}{1/V}$ — $n = \frac{V_v}{V_s + V_v} \frac{1/V_s}{1/V_s}$ $e = \frac{V_v/V}{1 - V_v/V} \rightarrow n = V_v/V$ — $n = \frac{V_v/V_s}{1 + V_v/V_s} \rightarrow e = V_v/V_s$ $e = \frac{n}{1 - n}$ — $n = \frac{e}{1 + e}$	5		
V	a) Factors affecting permeability 1. Particle size 2. Structure of soil mass 3. Void ratio 4. Shape of particle 5. Properties of water 6. Degree of saturation 7. Adsorbed water 8. Impurities in water	7		
	b) Procedure 1. Determine the standpipe area (a). Note that the diameter of the standpipe depends on the permeability of the tested soil. 2. Locate hl and h2 on the standpipe. Then fill it with distilled water. 3. Allow water to flow down through the sample and observe the water level in the standpipe. As soon as it reaches the level h1,start the timer clock. 4. When the level of water in the standpipe reaches h2, stop the clock and record the time required for the water in the standpipe to drop from h1 to h2. 5. Refill the standpipe and repeat the test two to three times. Use the same h1and h2 values and obtain the corresponding elapsed times. Record the temperature of water (T) for each run.	8	15	
VI	a) Factors affecting compaction 1. Water content – dry density increases with water content 2. Amount of compaction – dry density increases with compaction effort 3. Type of soil - coarse grained soil can be compacted tohigh density than fine grained soil 4. Method of compaction - kneading action, dynamic action and static action 5. Admixtures - compaction characteristics can be improved –lime, cement, bitumen	7	15	
	b) Standard proctor test	8		

	1. Take a representative oven-dried sample, approximately 5 kg in the given pan. Thoroughly mix the sample with sufficient water to dampen it with approximate water content (for cohesionless soils approx. 4-6% and for cohesive soils approx.14- 18%). 2. Weigh the proctor mould without base plate and collar. Fix the collar and base plate. Place the soil in the Proctor mould and compact it in 3 layers giving 25 blows per layer with the 2.6 kg rammer falling through. The blows shall be distributed uniformly over the surface of each layer. 3. Remove the collar; trim the compacted soil even with the top of mould using a straight edge and weigh. 4. Divide the weight of the compacted specimen by volume of the mould and record the result as the bulk density (ρb). 5. Remove the sample from mould and slice and obtain a small sample from mid layer for water content. 6. Thoroughly break up the remainder of the material until it will pass 4.75 mm sieve as judged by the eye. Add water in sufficient amounts to increase the moisture content of the soil sample by one or two percentage and repeat the above procedure for each increment of water added. Continue this series of determination until there is either a decrease or no change in the wet unit weight of the compacted soil.			
VII	a) Plate load test 1 In the gravity loading method of the plate load test, a platform is built over the column, and sandbags are placed for the application of the load. 2 The hydraulic jack is placed between the column and the loading platform so that the load can be applied gradually. Such loading is termed reaction loading. 3 Three dial gauges are set up on the platform at the diagonal corners of the plate to measure the plate settlement. 4 A seating load of 0.7 Tonne/m^2 is applied initially in order to compact the load. 5 Soon after, loading is applied at the rate of 0.25 mm/hour. 6 The load is applied using the hydraulic jack, and the force is slowly increased. The increment is usually one-fifth of the expected safe bearing capacity, one-tenth of the ultimate bearing capacity, or any smaller value. 7 Load is measured by the pressure gauge. 8 Upon application of each load increment, settlement is measured on the dial gauge. The settlement should be checked after 1, 4, 10, 20, 40, and 60 minutes, and then every hour until the rate of settlement is less than 0.02 mm per hour. 9 After all the data for a certain load have been collected, the next load increment is added, and readings are taken under the new load. 10 This process of increasing the load and collecting the data is repeated until the maximum load is applied. The maximum load	7	15	

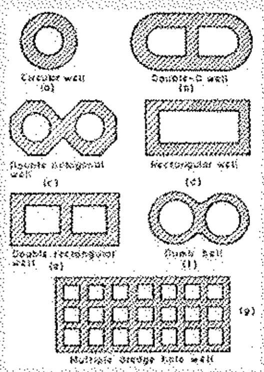
	is 1.5 times the expected ultimate load or 3 times the expected maximum pressure. b)Limitations 1 The test depicts the settlement characteristics of the soil for depths less than twice the width of the bearing plate. But in an actual field scenario, the influence zone of the footing can be of a greater depth. 2 The plate load test is a quick test and is performed for a short period of time. It cannot give a true depiction of the settlement occurring over a longer period of time. 3 The bearing capacity of clayey soil, as determined by the plate load test, is fairly accurate. However, the plate load test gives a conservative value for dense sand soil. The actual capacity of dense sand is higher than what is computed from the test. 4 The settlement caused in sands is greater than the theoretical settlement.	8		
VIII	a) Shear failure 1. General shear failure • Occurs in dense sand and stiff clay • Failure is sudden • Failure surface is extended upto ground surface • Heave on side is observed • Easy to find out failure load intensity qu 2. Local shear failure • Occur in medium dense sand or in clay of medium consistency • Foundation movement is accompanied by jerk • It is not easy to predict(qu) • Failure surface gradually extended to surface • Heave may be observed if there is substantial vertical movement 3. Punching shear failure • Occur in loose sand or soft clay • Failure surface do not extend upto groundsurface • Footing fails at qu • No heave observed • Only vertical movement b) Electrical profiling method	7 8	15	

	 In this method a dc current of known magnitude (I) is passed between the two outer (current) electrodes, thereby producing an electric field within the soil, whose pattern can be determined by the resistivities of the soils present within the field and the boundary conditions.			
IX	a) 1. Based on material • STEEL PILES • thick pipe, H sections • Epoxy coating to prevent corrosion • CONCRETE PILES • Cement concrete • Precast or cast in situ • TIMBER PILES • Straight, sound, free from defects • COMPOSITE PILES • Composed of two material	3.5	15	
	2. Based on installation • DRIVEN PILES – driven to soil by hammer • DRIVEN AND CAST IN SITU PILES – driving casing then filled withconcrete • BORED AND CAST IN SITU PILES – excavating hole and filled withconcrete • SCREW PILES - screwed into soil • JACKED PILES – jacked into the soil by a hydraulic jack	3.5		
	b) Shallow foundation	8		

<table>
<tr><td></td><td>
</td><td></td><td></td><td></td></tr>
<tr><td>X</td><td>a)

<u>Types of well shapes:</u>

• Circular well
• Rectangular well
• Double Rectangular well
• Double Octagonal well
• Double – D well
• Twin circular well



b)
• Regulation of grabbing
• Eccentric loading
• Water jetting
• Excavation under cutting edge
• Inserting wooden sleeper under cutting edge
• Pulling the well
• Strutting the well
• Pushing the well by jack</td><td>7

8</td><td>15</td><td></td></tr>
</table>