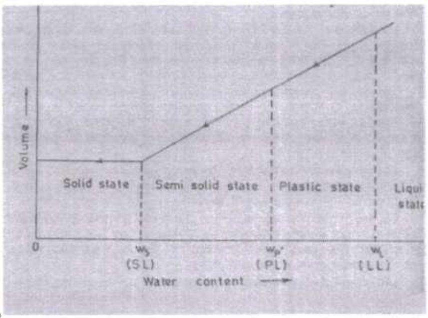
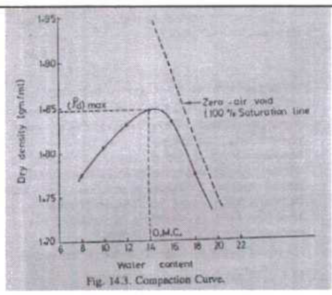
QID -8894

SCHEME OF VALUATION

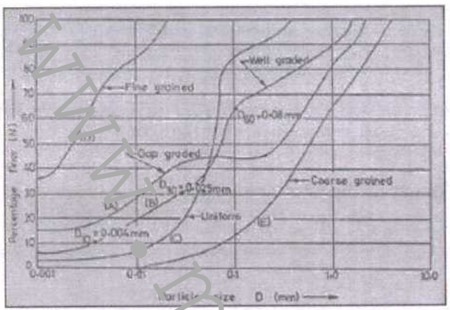
(Scoring Indicators)

Revision: 2015 **Geotechnical Engineering**				**Course code: 5013**
Q. no	**Scoring indicator**	**Split up**	**Sub total**	**Total**
I. 1.	**Part A** Soil engineering – unconsolidated mass – disintegrations of rocks – application in civil engineering – foundations – stability of slopes – underground structure – retaining wall – pavement – earth dams	2	2	10
2.	Ratio of mass of given volume of soil to the mass of equal volume of water at 4° C. $G = \rho_{s/}\rho_w$	2	2	
3.	For laminar flow through saturated soil mass, the discharge per unit time is proportional to hydraulic gradient. $v = k.\ i$ where, k = coefficient of permeability i = hydraulic gradient	2	2	
4.	Spilt spoon samplers, Scraper bucket sampler, Shelby tubes, Piston sampler, Denison sampler, Hand – carved sampler	2	2	
5.	Foundation – the element of a structure which connects it to the ground, and transfers loads from the structure to the ground. Foundations are generally considered either shallow or deep.	2	2	

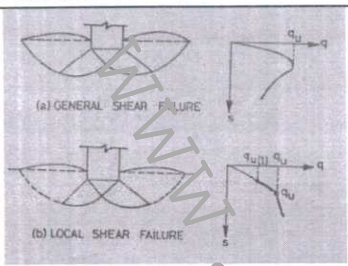
II. 1.	**Part B**  **Soil** – solid, semi-solid, plastic and liquid. **Shrinkage limit** – water content loss of moisture will not result in any more volume reduction. **Plastic limit** – the thread breaks apart at a diameter of 3 mm. **Liquid limit** – Minimum water content where soil flows as liquid, shear strength approximately zero.	6	6	
2.	**Permeability** – soil allowing water through it. **i) Size of soil particle** – coarse grain: permeability more, fine grain permeability less **ii) Specific Surface Area of Soil Particle -** Higher the specific surface area lower the permeability. **iii) Shape of soil particle -** Rounded Particles more permeable than angular shaped. **iv) Void ratio -** Permeability increases with void ratio **v) Soil structure vi) Degree of saturation -** Fully saturated soil is more permeable **vii) Water properties -** permeability increase when viscosity decreases. **viii) Temperature -** Greater the temperature, higher permeability **ix) Adsorbed water -** permeability reduces **x) Organic Matter -** decreases the permeability	6	6	
3.	 Fig. 14.3. Compaction Curve. The curve showing the relationship between the density (dry unit weight) and the water content of a soil for a given compactive effort. The aim of the test is to establish the maximum dry density that may be attained for a given soil with a standard amount of compactive effort. When a series of samples of a soil are compacted at different water content the plot usually shows a distinct peak.	6	6	

	• The maximum dry density occurs at an optimum water content • The curve is drawn with axes of dry density and water content and the controlling values are values read off: r_d(max) = maximum dry density w_{opt} = optimum water content • Different curves are obtained for different compactive efforts			30
4.	i) The Depth of Influence is Limited to certain extent (ii) The determined bearing capacity is only for the soil that is up to 2 times of the diameter of the plate (iii) Long time consolidation of soil cannot be found out (iv) To do this test, small amount of excavation is carried out and this may cause significant Ground Disturbance. (v) If ground is disturbed, then the soil properties will be changed and this paves the way for wrong observation (vi) The effect of Scale is very small	6×1	6	
5.	The seismic-refraction method – principle: elastic shock waves travel at different velocities in different materials. Shock waves - generated on the ground surface - get refracted at the interface. The time of arrival - recorded by geophones - refracted waves. A plot is made between distance on the x-axis and time on the y-axis.	6	6	
6	Foundation is a device to transmit the load of the structure to the soil below. The main objectives of the foundation are to 1. Distribute the weight of the structure over large area so as to avoid over loading of the soil beneath 2. Load the sub- stratum evenly and thus prevent unequal settlement. 3. To provide a level surface for building operations. 4. Take the structure deep into the ground and thus increase its stability , and prevent overturning	6	6	
7	**A deep foundation** is a type of foundation which			

	transfers building loads to the earth farther down from the surface than a shallow foundation does, to a subsurface layer or a range of depths. **Shallow Foundations -** A shallow foundation is a type of building foundation that transfers building loads to the earth very near to the surface, rather than to a subsurface layer or a range of depths as does a deep foundation.	6	6	
III a)	**Part C** ○ Clean and dry the containers and weigh them and note down the mass of each container (M_1). Fill the containers with required quantity of soil sample and weigh the each container and note down its mass (M_2). Place the containers in hot air oven, arrange temperature to $110^{\circ} \pm 5^{\circ}$ C and allow them to dry for 24 hours. After 24 hours turn off the oven. After that weigh containers and note down the mass (M_3). ○ Water content, w =	8	8	15
b)	(i) **Meniscus correction**: It is determined from the readings at the top and bottom of meniscus in the comparison cylinder – it is a constant value. $R_h = R_{h'} + C_m$ (ii) **Temperature correction**: Hydrometer is generally calibrated at 27 C. If temperature is more than 27 C, correction is positive and vice versa. (iii) **Dispersion agent correction**: It is always negative. It can be determined by noting hydrometer reading in clear water and again in same water after adding dispersing agent.	7	7	
IV a)	**Sand replacement method – Calibration of the Cylinder** – Density of sand, **Measurement of volume of hole –** Volume of hole = Were, M_1 = Mass of cylinder before pouring into hole	8	8	

	M_2 = Mass of sand in cone only M_3 = Mass of cylinder after pouring cone and container M_4 = Mass of cylinder after pouring into the hole V = Volume of hole			
b)	 The curve is obtained from the result of sieve size analysis and it is plotted for grain or particle size versus percentage finer. The shape of curve is generally smooth 'S' curve and with that shape, the soil may be well graded. he percentage finer is represented using normal scale and grain or particle size is plotted in log scale. The percentage of finer is calculate using the relation below. Percentage finer = 100 – Percentage retained The Coefficient of uniformity can be calculated using the relation below. *Cu* is coefficient of uniformity, $C_u = \frac{D_{60}}{D_{10}}$ The Coefficient of Curvature , $C_c = \frac{D_{30}^2}{D_{10}D_{60}}$	7	7	15
V a)	The constant head permeability – to determine the permeability of soil - **coefficient of permeability** of a soil. The soils that are suitable for this tests are sand and gravels. Take about 2.5kg of the soil sample, from a thoroughly mixed wet soil, in the mould. Compact the soil at the required dry density using a suitable compacting device. Remove the collar and base plate. Find the mass of the soil in the mould. For a particular time interval, the quantity of flow can be collected	8	8	

	Coefficient of permeability, k =			15
b)	Cylindrical core cutters of 130mm long and 100mm diameter are used. For determination of the dry density of the soil, the cutter is pressed into the soil mass so that it is filled with the soil. The cutter filled with the soil. The dry density is obtained as $\rho = \frac{\gamma}{1+w} = \frac{(M / V)}{1+w}$	7	7	
VI a)	**Permeability** – is the property of the soil to transmit water through it. Seepage velocity – **Seepage velocity** is not the actual velocity of the water in the pores, but the apparent velocity through the bulk of the porous medium. The **Optimum Water Content (OMC)** of soil is the water content at which a maximum dry unit weight can be achieved after a given compaction effort.	3	9	
b)	**Water content** – At low water content, the soil is stiff and offers more resistance to compaction. **Amount of compaction** – The compaction of soil increases with the increase in amount of compactive effort. **Types of soil** – In general, coarse grained soils can be compacted to higher dry density than fine-grained soils. **Methods of soil compaction**	6	6	15
VII a)	**The open-tube samplers** are the simplest type of samplers for collection of undisturbed samples, also known as thin-wall Shelby tube samplers, also known as thin-wall Shelby tube samplers, used for collection of samples in fine-grained soft soils. **Standard Split-Spoon** – for obtaining undisturbed soil samples, split-spoon sampler is also used to conduct SPT in the borehole. **Piston sampler** consists of two parts – (a) a sampler cylinder and (b) a piston system. The piston rod is 30 cm (12 in.) in diameter at the bottom end and fits easily inside the hollow drill rod, used for sampling soft-to-stiff cohesive soils. **Rotary samplers** are double-tube samplers with a removable thin-wall tube, known as liner, inside an outer tube provided with a cutting bit.	3	9	15
b)	**Ultimate bearing capacity** is the theoretical			

	maximum pressure which can be supported without failure; allowable bearing capacity is the ultimate bearing capacity divided by a factor of safety. **Safe bearing capacity:** It is the bearing capacity after applying the factor of safety (FS). **Allowable Bearing Pressure**: It is the maximum soil pressure without any shear failure or settlement failure.	3	6	
VIII a)	 There is a continuous shear failure of the soil (solid lines) from below the footing to the ground surface, a general shear failure ruptures and pushes up the soil on both sides of the footing. Local shear failure. Failure in which the ultimate shearing strength of the soil is mobilized only locally along the potential surface of sliding at the time the structure supported by the soil is impaired by excessive movement.	2	8	
b)	*(i)* To fix the value of the safe bearing capacity of soil. *(ii)* To select an economical yet safe type of foundation. *(iii)* To fix the depth up to which the foundation must be taken inside the ground. *(iv)* To predict the likely settlement of the selected foundation and to make allowance for the same in the design. *(v)* To know the underground water level and if needed, to decide upon the method to be adopted to solve the ground water problem. *(vi)* To forecast the difficulties which are likely to be encountered due to nature of the sub-soil during construction and to take advance actions in this regard.	8	8	15
IX a)	• Pile foundation is needed in areas where the structures constructed are large & heavy and the soil underlying is weak. • In areas where settlement issues are common due to soil liquefaction or water table issues • In some situtations, the sub-soil water table at the site will be so high that the use of other foundation will be affected badly. • The use of pile foundation help in resisting this	7	7	

	bending action along with supporting the vertical load coming over the foundation. • The pile foundation is necessary to resist the uplift forces created due to water table rise or any other cause.			15
b)	i. Soil type – especially expansive clay soil ii. Poorly compacted fill material iii. Slope failure, mass wasting iv. Erosion v. Poor construction, and vi. Transpiration	8	8	
X a)	The following operation is carried out while sinking the caisson. Excavate material under the inside of well curb mechanically or manually. Allow the well to remain vertical. Up to a depth of 1 m, excavation underwater can be made manually. When the depth of water exceeds 1 m excavate by Jhams or grabs. When well goes on sinking skin friction increases and weight of well decreased due to buoyancy. When the well does not sink, sunk by applying kentledge. If this operation is not sufficient jet outside the well or grease the outside. Go on adding sections of steining (2 to 5 m in length) up to the required founding strata	9	9	15
b)	○ **Based on materials used:** Timber ○ Concrete ○ Steel ○ Composite piles. ○ **Based on mode of transfer of load:** End bearing piles (point bearing piles) ○ Friction piles (cohesion piles) ○ Combination of friction and cohesion piles	6	6	