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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

END SEMESTER EXAMINATION-2015

B.Tech IV Semester

COURSE CODE: 10B11CE411 MAX. MARKS: 45

COURSE NAME: GEOTECHNICAL ENGINEERING

COURSE CREDITS: 4 MAX. TIME: 3 HRS

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume necessary data wherever required.*

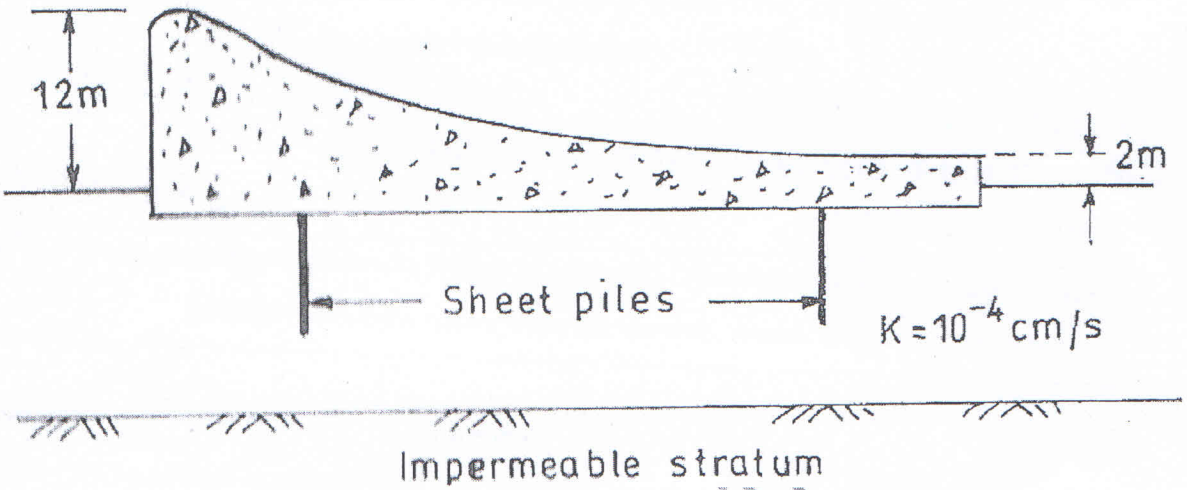
Section A [9 marks]

1. An infinite mass of sand has $\gamma = 20$ kN/m^3 and is just stable at a slope of 30°. If the entire mass is inundated and ends up below the water table, will the slope remain stable? If not at what inclination will it be stable? [2]
2. Justify why a vertical cut in clay the active earth pressure is zero at a depth of $\frac{2c'}{\gamma}$ [2]
3. An oil tank is to be constructed on a deposit of saturated clay. In an oil tank the main load consists of the weight of the oil; oil is often pumped into the tank from some source and the filling process is quite rapid. For investigating the foundation for bearing capacity failure:
   a) What strength parameters or shear strength is relevant?
   b) What test will provide this relevant property? [2]
4. State the reason why an OCC exhibit volume expansion and NCC exhibits volume reduction when sheared under undrained conditions. [1]
5. Soil under quick sand condition tends to suck into itself anything that treads upon it. Justify. [2]

Section B [13.5 marks]

1. Derive Terzaghi's one dimensional consolidation equation. [3]
2. Explain the term "optimum moisture content". How is it affected by compacting effort? State the factors affecting field compaction of soil. [2]

3. Given the flow situation shown in the figure.



a) Is this a case of confined or unconfined flow?

b) What are the boundary conditions for the flow situation depicted in the figure?

c) A flownet drawn for this condition gives $n_f = 3$; $n_d = 30$. What is the quantity of flow per metre run occurring under the weir?

d) The elementary square at the toe of the weir has dimensions of 0.6 m. What is the exit gradient?

e) For what reservoir height would the exit gradient be equal to 1? What is the implication of condition to the safety of the weir? **[5]**

4. The void ratio and specific gravity of a sample of clay are 0.73 and 2.7 respectively. If the voids are 92% saturated, find the bulk density, the dry density and the water content. What would be the water content for complete saturation, the void ratio remaining the same? **[3.5]**

Section C **[22.5 marks]**

1. A retaining wall 6 m high, with a smooth vertical back is pushed against a soil mass having c' = 40 kN/m^2, ϕ' = 15° and γ =19 kN/m^3. Using Rankine's theory, compute the total pressure and the point of application of the resultant thrust, if the horizontal soil surface carries a uniform surcharge load of 50 kN/m^2. **[5]**

2. A 6 m thick clay stratum is overlain by a 8 m thick stratum of coarse sand and is underlain by an impermeable shale. A raft footing, supported the columns of a building, is to be founded at a depth of 1.2 m below the ground level. The size of the raft is 8.5 m x

13.6 m and it is loaded uniformly with a stress intensity of 9.2 t/m^2. The water table is located at 2 m below the ground level. The unit weight of sand above and below the water tables are 1.90 and 2.10 t/m^3. The clay has an initial void ratio of 0.72, specific gravity of solids is 2.71, liquid limit is 42% and coefficient of consolidation is 2.2×10^{-3} cm^2/sec. Determine:

a) Probable settlement of the raft

b) The time required to undergo a settlement of 5 cm. **[4 + 4 = 8]**

3. An embankment has slope of 2H : 1V with a height of 10 m. It is made of a soil having c = 30 kN/m^2, $\phi = 5°$ and $\gamma = 20$ kN/m^3. Considering any slip circle passing through toe and using Friction Circle method, find the factor of safety with respect to cohesion. **[6]**
4. Samples of dry sand are to be tested in triaxial and direct shear test. In the triaxial test the specimen fails when the major and minor principal stresses are 960 kN/m^2 and 260 kN/m^2 respectively. What shear strength would be expected in direct shear test when the normal stress is 230 kN/m^2? **[3.5]**