6. If k_1, k_2 and k_3 are the permeability's of layers h_1, h_2 and h_3 thick, what is its equivalent permeability in the horizontal and vertical directions ? Derive the formulae used.

The coefficient of permeability of soil is found to be 1×10^{-5} m/s at a void ratio of 0.6. If the void ratio is 0.4 and the other factors remaining same, what will be its coefficient of permeability. **10+5**

Unit IV

7. Describe in detail the design and construction procedure of highway drainage system in a waterlogged area. **15**

8. Write short notes on the following : **15**
   (a) Land Slides
   (b) Geo-textiles
   (c) Components of Reinforced Earth Structures.

BB731

M. Tech. EXAMINATION, May 2019

(Second Semester)

(B Scheme) (Re-appear)

CE(HSE)

CEH578

HIGHWAY SUB GRADE AND FOUNDATION ANALYSIS

Time : 3 *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. What do you understand by Index Properties of Soil ? A soil sample has a porosity of 36 per cent. The specific gravity of solids is 2.65. Calculate (i) voids ratio, (ii) Dry density and (iii) Unit weight if the soil is completely saturated. **15**

2. Sandy soil is a borrow pit has unit weight of solids as 25.8 kN/m^3, water content equal to 11% and bulk unit weight equal to 16.4 kN/m^3. How many cubic metre of compacted fill could be constructed of 3500 m^3 of sand excavated from borrow pit, if required value of porosity in the compacted fill is 30%. Also calculate the change in degree of saturation. **15**

Unit II

3. (a) What is Effective Stress ? Explain with examples. **5**

(b) Determine the effective stress at 2 m, 4 m, 6 m and 8 m and 10 m is a soil mass having γs = 21 kN/m^3. Water table is 2 m below ground surface. Above water table there is capillary rise upto ground surface. Also draw total stress diagram up to 10 m. **10**

4. Explain the direct shear test to determine the shear strength of soil. Two identical soil specimens were tested in a triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m^2 when the cell pressure was 2000 kN/m^2. Second Speecimen failed at a deviator stres of 1370 kN/m^2 under a cell pressure of 400 kN/m^2. Determine the value of c and φ analytically. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m^2. Estimate the shear stress at failure. **5+10**

Unit III

5. What are the various types of samplers used for soil investigation ? Discuss their advantages and disadvantages.

List various methods of soil investigation and describe any *one* method. **8+7**