B.E / B.Tech. (Full Time) DEGREE ARREAR EXAMINATION, APR / MAY 2011

AGRICULTURAL AND IRRIGATION ENGINEERING BRANCH

FOURTH SEMESTER – (REGULATIONS 2004)

AI 281 – SOIL SCIENCE AND ENGINEERING

Time : 3 hours.   Max Marks: 100

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1.   What are the major components of soil?
2.   How do the negative charges on the surfaces of silicate clays originate?
3.   Find the compacted volume of an embankment per 1.0 m³ of borrow pit, whose natural moisture content w1 is 12% unit weight is 18.5 KN/m³ and G is 2.7. The voids ratio of the embankment soil is 0.45.
4.   Define degree of saturation?
5.   What is Darcy's law?
6.   The soil at the toe of a dam is fully saturated and has a water content of 32%, and specific gravity of soil grains is 2.65. for safety measures against piping, the exit gradient is restricted to 17% of the critical gradient. Calculate the permissible exit gradient.
7.   Using Rankin's formula, find the minimum depth of foundation of a square footing 1m x 1m of a column carrying a load of 20 tons. The foundation consists of sandy soil weighing 1.85 tons with a shear angle of 35°.
8.   Define the terms infinite and finite slopes.
9.   Interpret the following expression based on the Soil Taxonomical Classification: "*Miami fine loamy mixed mesic typic hapludalf*".
10.   What are the types of soil as per soil Taxonomy classification?

Part – B (5 x 16 = 80 Marks)

11.   i) Explain briefly the influence of soil reaction on nutrients availability?   10)
      ii) Explain, with a diagram, the three phase system in soils that facilitates the regulation and availability of cations and anions for plant use.   (6)

12. a i) An oven-dry soil sample of volume 225 cm3 weighs 390 gram. If the grain specific gravity is 2.72, determine the void-ratio and shrinkage limit. What will be the water content which will fully saturated the sample and also cause an increase in volume equal to 8% of the original dy volume.   (8)
      ii) Explain how the shrinkage limit of soil is determined in the laboratory with neat sketch.
                                                                                            (8)
                                           or
    b. What is stroke's law? Describe the procedure used for doing hydrometer analysis for determining grain size distribution of the fine grain soils.   (10)
      ii) Find the time taken by a soil particle of diameter 10µ to settle from the surface to the bottom of a pond 3 m deep. Assume any data which you require.   (6)

13. a i) What is Coulomb's equation for shear strength of soils? Discuss the factors which affect the shear strength parameters of soil.   ·   (8)

ii) A soil of specific gravity 2.65 has a moisture content of 18% when fully saturated. 1.9 cm thick sample of this tested in a consolidometer shows a compression of 0.050 cm when the load is increased from 40 KN/sq m. Compute the compression index of the soil. (8)

or

b i) Explain with a neat diagram, a method for determining coefficient of permeability of medium sand in the laboratory. (8)

ii)A sample of filter sand was tested in a constant head permeameter. The size of the space for the sample in the permeameter was 11 cm (diameter) and 15 cm (height).A hydrostatic head of 50 cm was applied for a period of 10 sec, and a quantity of water equal to 3000 cc was collected. Find the coefficient of permeability of sand. (8)

14. a i) Enumerate the important methods, which are generally used for analyzing stability of slopes of embankments. Discuss in details, any one of these methods. (10)

ii) Show by an example, the effect of sudden drawdown on stability of slopes. How is stability determined? (6)

or

b i) Write down the Terzaghi's general equation for coputing ultimate of soil below footings, classifying the basis and assumptions made in its derivation. (8)

(ii). Design a strip footing to carry a load of 750 KN/m at a depth of 1.6m in a frictional cohesive soil having a unit weight of 18 KN/m^3 and the shear strength parameters cohesion is 20 KN/m^2 and angle of internal friction is 25°. Determine the width of footing using a factor of safety of 3 against shear failure. Use Terzaghi's equation Nc=25.1, Nq=12.7 and Nγ=9.7. (8)

15. a i) Define soils? How are they formed in nature/ Give a brief account of major soil groups of India? (12)

ii) Write notes on soil profile and gully erosion (4)

or

b. i) Contrast reconnaissance and detailed soil survey on the basis of scale, observation intensity, mapping uinit, area coverage, utility and other parameters. (5)

ii) Explain on what considerations the choice of the detail of survey be made using an example. (3)

iii) Describe in detail the definition and classes of soil and land irritability, and list the soil factors used for determining soil irritability as well as how the soil irritability score is evolved using them. (8)