Time: 3 hours   Marks: 80

NB: 1) Question No. 1 is compulsory
         2) Attempt any 3 of the remaining 5 questions
         3) Assume suitable data wherever necessary
         4) Numbers to right indicate full marks.

1.   Answer any 4:
a)   Explain the scope of soil engineering.   05
b)   Write a short note on Atterberg's limits.   05
c)   Derive the expression for average co-efficient of permeability for flow of water normal to the   05
      plane of stratification of soil.
d)   Write a short note on quick sand condition.   05
e)   Explain the factors affecting compaction.   05

2. a) Derive the expression for the relationship between void's ratio, water content, specific gravity   05
       and degree of saturation.
b)   A soil has liquid limit and plastic limit of 45% and 30% respectively. If the volumetric shrinkage   10
      at liquid limit and plastic limit are 40% and 25%, determine the shrinkage limit.
c)   Classify the following soil as per IS classification system systematically with justifications: %   05
      passing 75 micron sieve = 8%, retained on 4.75 mm sieve = 35, coefficient of curvature = 2.5,
      uniformity coefficient = 7, liquid limit = 15, plasticity index = 3.

3. a) In a site reclamation project 2.5 m of graded soil with $\Upsilon = 22kN/m^3$ was laid in compacted   10
       layers over existing layers of silty clay with $\Upsilon = 18kN/m^3$ which was 3m thick. This was above
       a 2 m thick layer of gravel ($\Upsilon = 20kN/m^3$). Assuming that the water table remains at the surface
       of the silty clay, draw the effective stress profile for the soil profile i) before the fill is place and
       ii) after the fill has been placed
b)   The following results were obtained from a standard proctor test on a sample of soil   10

Water content (%)	0.12	0.14	0.16	0.18	0.20	0.22
Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.86	1.85

      The volume of the mould used was 1000 ml. Find optimum moisture content and maximum dry
      density. Also, plot the zero air voids line if G = 2.70.

4. a) Explain the role of Montmorillonite, Illite mineral in producing the plastic behaviour of soil.   05
b)   There are two borrow areas A and B which have soils with void ratios of 0.80 and 0.70   10
      respectively. The in-place water content is 20% and 15% respectively. The fill at the end of
      construction will have a total volume of 10,000 m^3, bulk density 2.0 gm/cc and placement water
      of 22%. Determine the volume of the soil required to be excavate from both areas. Take G=
      2.65, If the cost of excavation of soil and transportation is Rs. 200 per 100 m^3 for area A and
      220 per 100 m^3 for area B, state which borrow pit is economical.
c)   Write the uses of particular size distribution cure   05

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5. a) A test well of 0.5m in diameter penetrates through saturated aquifer of 10 m thick overlaying   10
an impervious layer. The steady discharge of well is 20 m3/hr. The drawdown at the distance of
R1 = 25m, from the centre of test well is found to be 1.9m. What will be the drawdown at the
distance of 50m? If the permeability of soil is 3.8×10^{-4} m/s. Estimate approximate drawdown
of centre well also.

b) In a falling head permeability test on a soil sample of length 100 mm, the head of water in   10
the stand pipe takes 10 seconds to fall from 850 mm to 175 mm above the tail-water level.
Then another soil of length 60 mm is placed on top of the first soil. The time taken for the
head to fall between the same limit is 18 seconds. The permeameter has a cross-sectional area
of 5000 mm^2 and a stand pipe area of 150 mm^2. Calculate the permeability of the 2nd soil.

6. Write a short note on:
a) Thixotrophy of clay   05
b) Uses of flow nets   05
c) Types of boring   05
d) Borehole logs   05

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