2013-CE

EE24BTECH11020 - Ellanti Rohith

1) Following statements are made on compacted soils, wherein DS stands for the soils compacted on dry side of optimum moisture content and WS stands for the soils compacted on wet side of optimum moisture content. Identify the *incorrect* statement.
   a) Soil structure is flocculated on DS and dispersed on WS.
   b) Construction pore water pressure is low on DS and high on WS.
   c) On drying, shrinkage is high on DS and low on WS.
   d) On access to water, swelling is high on DS and low on WS.

2) Four columns of a building are to be located within a plot size of $10\ \text{m} \times 10\ \text{m}$. The expected load on each column is 4000 kN. Allowable bearing capacity of the soil deposit is $100\ \text{kN/m}^2$. The type of foundation best suited is

   a) isolated footing
   b) raft foundation
   c) pile foundation
   d) combined footing

3) For subcritical flow in an open channel, the control section for gradually varied flow profiles is

   a) at the downstream end
   b) at the upstream end
   c) at both upstream and downstream ends
   d) at any intermediate section

4) Group-I contains dimensionless parameters and Group-II contains the ratios.

Group-I	**Group-II**
P. Mach Number	1. Ratio of inertial force and gravitational force
Q. Reynolds Number	2. Ratio of fluid velocity and velocity of sound
R. Weber Number	3. Ratio of inertial force and viscous force
S. Froude Number	4. Ratio of inertial force and surface tension force

   The correct match of dimensionless parameters in Group-I with ratios in Group-II is:

   a) P-3, Q-2, R-4, S-1
   b) P-3, Q-4, R-2, S-1
   c) P-2, Q-3, R-4, S-1
   d) P-1, Q-3, R-2, S-4

5) For a two-dimensional flow field, the stream function ψ is given as $\psi = \frac{3}{2}\left(y^2 - x^2\right)$. The magnitude of discharge occurring between the stream lines passing through points $(0, 3)$ and $(3, 4)$ is:

   a) 6
   b) 3
   c) 1.5
   d) 2

6) An isohyet is a line joining points of

   a) equal temperature
   b) equal humidity
   c) equal rainfall depth
   d) equal evaporation

7) Some of the water quality parameters are measured by titrating a water sample with a titrant. Group-I gives a list of parameters and Group-II gives the list of titrants.

Group-I	**Group-II**
P. Alkalinity	1. N/35.5 $AgNO_3$
Q. Hardness	2. N/40 $Na_2S_2O_3$
R. Chloride	3. N/50 H_2SO_4
S. Dissolved oxygen	4. N/50 EDTA

The correct match of water quality parameters in Group-I with titrants in Group-II is:

a) P-1, Q-2, R-3, S-4
b) P-3, Q-4, R-1, S-2
c) P-2, Q-1, R-4, S-3
d) P-4, Q-3, R-2, S-1

8) A water treatment plant is designed to treat 1 m^3/s of raw water. It has 14 sand filters. Surface area of each filter is 50 m^2. What is the loading rate (in $\frac{m^3}{day \cdot m^2}$) with two filters out of service for routine backwashing? _____

9) Select the strength parameter of concrete used in design of plain jointed cement concrete pavements from the following choices:

a) Tensile strength
b) Compressive strength
c) Flexural strength
d) Shear strength

10) It was observed that 150 vehicles crossed a particular location of a highway in a duration of 30 minutes. Assuming that vehicle arrival follows a negative exponential distribution, find out the number of time headways greater than 5 seconds in the above observation? _____

11) For two major roads with divided carriageway crossing at right angle, a full clover leaf interchange with four indirect ramps is provided. Following statements are made on turning movements of vehicles to all directions from both roads. Identify the *correct* statement:
a) Merging from left is possible, but diverging to left is not possible.
b) Both merging from left and diverging to left are possible.
c) Merging from left is not possible, but diverging to left is possible.
d) Neither merging from left nor diverging to left is possible.

12) The latitude and departure of a line AB are +78 *m* and −45.1 *m*, respectively. The whole circle bearing of the line AB is:

a) 30°
b) 150°
c) 210°
d) 330°

13) The state of 2D-stress at a point is given by the following matrix of stresses:

$$\begin{bmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{xy} & \sigma_{yy} \end{bmatrix} = \begin{bmatrix} 100 & 30 \\ 30 & 20 \end{bmatrix} \text{ MPa}$$

What is the magnitude of maximum shear stress in MPa?

a) 50
b) 75
c) 100
d) 110