

AI24BTECH11004-Bheri Sai Likith Reddy

1 SECTION-A

1) Group I contains parameters and Group II lists methods/instruments.

Group I

- P. Streamflow velocity
- Q. Evapo-transpiration rate
- R. Infiltration rate
- S. Wind velocity

Group II

- 1. Anemometer
- 2. Penman's method
- 3. Horton's method
- 4. Current meter

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

2) Wheat crop requires 55cm of water during 120 days of base period. The total rainfall during this period is 100mm . Assume the irrigation efficiency to be 60%. The area (in ha) of the land which can be irrigated with a canal flow of $0.01m^3/s$ is

- a) 13.82
- b) 18.85
- c) 23.04
- d) 230.40

3) A water sample has a pH of 9.25 . The concentration of hydroxyl ions in the water sample is

- a) $10^{-9.25}$ moles/L
- b) $10^{-4.75}$ mmoles/L
- c) 0.302mg/L
- d) 3.020mg/L

4) A town is required to treat $4.2m^3/min$ of raw water for daily domestic supply. Flocculating particles are to be produced by chemical coagulation. A column analysis indicated that an overflow rate of $0.2mm/s$ will produce satisfactory particle removal in a settling basin at a depth of 3.5m . The required surface area (in m^2) for settling is

- a) 210
- b) 350
- c) 1728
- d) 21000

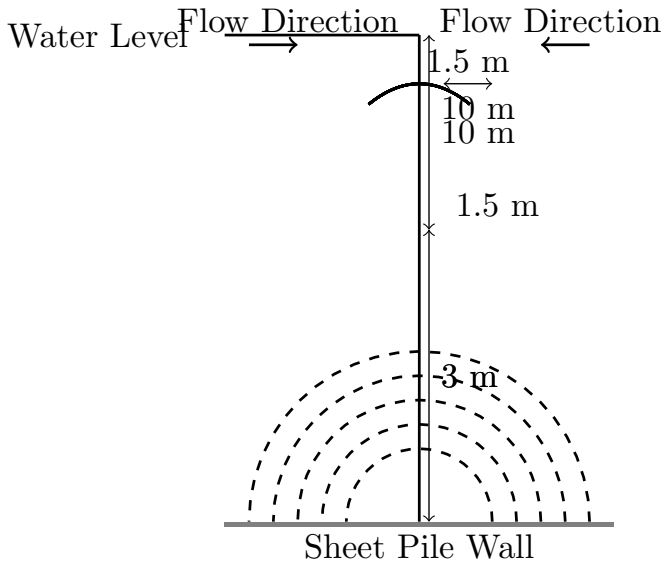
5) A pavement designer has arrived at a design traffic of 100 million standard axles for a newly developing national highway as per IRC : 37 guidelines using the following data: design life = 15 years, commercial vehicle count before pavement construction

= 4500 vehicles/day, annual traffic growth rate = 8%. The vehicle damage factor used in the calculation was

- a) 1.53
 - b) 2.24
 - c) 3.66
 - d) 4.14
- 6) The following data are related to a horizontal curved portion of a two-lane highway: length of curve = $200m$, radius of curve = $300m$ and width of pavement = $7.5m$. In order to provide a stopping sight distance (SSD) of $80m$, the set back distance (in m) required from the centre line of the inner lane of the pavement is
- a) 2.54
 - b) 4.55
 - c) 7.10
 - d) 7.96
- 7) A two-lane urban road with one-way traffic has a maximum capacity of 1800 vehicles/hour. Under the jam condition, the average length occupied by the vehicles is $5.0m$. The speed versus density relationship is linear. For a traffic volume of 1000 vehicles/hour, the density (in vehicles/km) is
- a) 52
 - b) 58
 - c) 67
 - d) 75
- 8) The horizontal distance between two stations P and Q is $100m$. The vertical angles from P and Q to the top of a vertical tower at T are 3° and 5° above horizontal, respectively. The vertical angles from P and Q to the base of the tower are 0.1° and 0.5° below horizontal, respectively. Stations P , Q and the tower are in the same vertical plane with P and Q being on the same side of T . Neglecting earth's curvature and atmospheric refraction, the height (in m) of the tower is
- a) 6.972
 - b) 12.387
 - c) 12.540
 - d) 128.745

common data for questions 48 and 49: The flow net around a sheet pile wall is shown in the sketch. The properties of the soil are: permeability coefficient = $0.09m/day$ (*isotropic*), specific gravity = 2.70 and void ratio = 0.85. The sheet pile wall and the bottom of the soil are impermeable.

- 9) The seepage loss (in m^3 per day per unit length of the wall) of water is
- a) 0.33
 - b) 0.38
 - c) 0.43
 - d) 0.54
- 10) The factor of safety against the occurrence of piping failure is



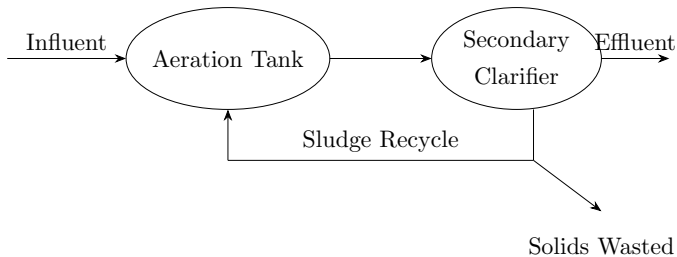
a) 3.55

b) 2.93

c) 2.60

d) 0.39

Common data for questions 50 and 51: An activated sludge system (sketched below) is operating at equilibrium with the following information. Wastewater related data: flow rate = $500\text{m}^3/\text{hour}$, influent $BOD = 150\text{mg/L}$, effluent $BOD = 10\text{mg/L}$. Aeration tank related data: hydraulic retention time = 8 hours, mean-cell-residence time = 240 hours, volume = 4000m^3 , mixed liquor suspended solids



11) The food-to-biomass (F/M) ratio (in kg BOD per kg biomass per day) for the aeration tank is

a) 0.015

b) 0.210

c) 0.225

d) 0.240

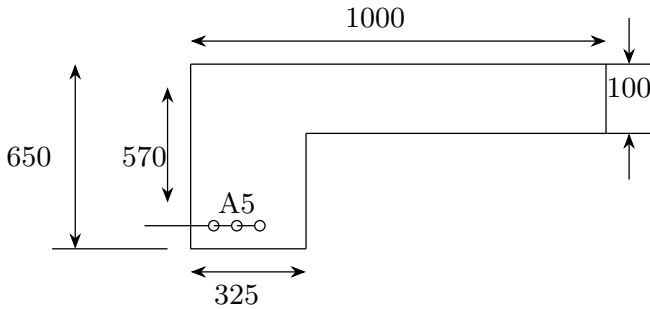
12) The mass (in kg/day) of solids wasted from the system is

a) 58.9s

- b) $75s$
- c) $100s$
- d) $150s$

Linked Answer Questions

Statement for Linked Answer Questions 52 and 53: The cross-section at mid-span of a beam at the edge of a slab is shown in the sketch. A portion of the slab is considered as the effective flange width for the beam. The grades of concrete and reinforcing steel are $M25$ and $Fe\ 415$, respectively. The total area of reinforcing bars (A_s) is 4000mm^2 . At the ultimate limit state, x_u denotes the depth of the neutral axis from the top fibre. Treat the section as under-reinforced and flanged ($x_u > 100\text{mm}$).



all dimensions in mm

- 13) The value of x_u (in mm) computed as per the Limit State Method of IS 456 : 2000 is
- a) 200.0
 - b) 223.3
 - c) 236.3
 - d) 273.6