

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)  $10^{-4.75}$  mmol/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

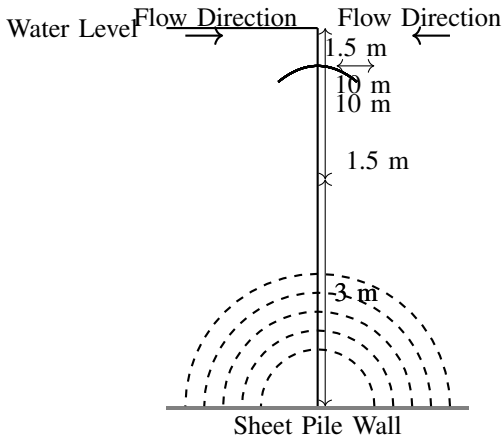
- a) 210  
b) 350  
c) 1728  
d) 21000

- 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

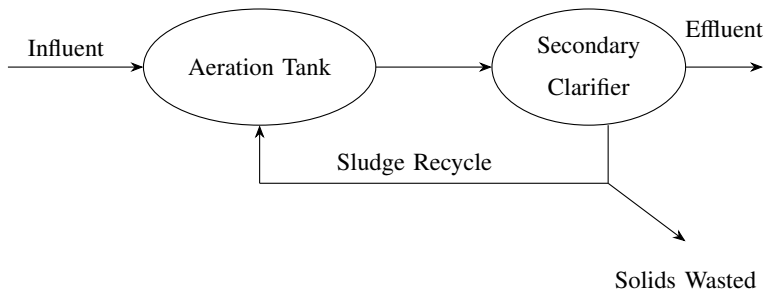
- a) 1.53
  - b) 2.24
  - c) 3.66
  - d) 4.14
- 6) The following data are related to a horizontal curved portion of a two-lane highway: length of curve =  $200m$ , radius of curve =  $300m$  and width of pavement =  $7.5m$ . In order to provide a stopping sight distance (SSD) of  $80\text{ m}$ , the 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  $5.0\text{ m}$ . 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  $3^\circ$  and  $5^\circ$  above horizontal, respectively. The vertical angles from  $P$  and  $Q$  to the base of the tower are  $0.1^\circ$  and  $0.5^\circ$  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 =  $0.09m/\text{day}$  (*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 =  $500m^3$  / hour, influent  $BOD = 150mg/L$ , effluent  $BOD = 10mg/L$ . Aeration tank related data: hydraulic retention time = 8 hours, mean-cell-residence time = 240 hours, volume =  $4000m^3$ , mixed liquor suspended solids

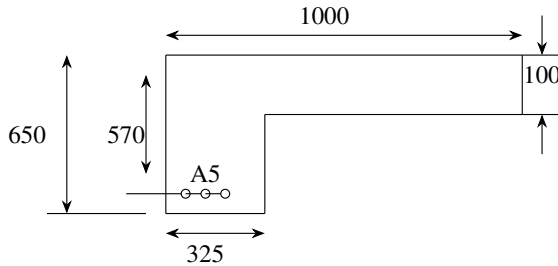


- 11) The food-to-biomass ( $F/M$ ) ratio (in kg BOD per kg biomass per day) for the aeration tank is
- a) 0.015  
b) 0.210  
c) 0.225  
d) 0.240
- 12) The mass (in kg/day) of solids wasted from the system is

- 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  $4000\text{mm}^2$ . 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