2007 AE 52-68

AI24BTECH11019-KOTHA PRATHEEK REDDY

1) Water emerges from an ogree spillway with velocity = 13.72 m/s and depth = 0.3m at its toe. The tail water depth required to form a hydraulic jump at the toe is [Gate 2008]

a) 6.48 m
b) 5.24 m
c) 3.24 m
d) 2.24 m

2) The flow of water (mass density = 1000 kg/m^3 and kinematic viscosity = 10^{-6} m^2/s) in commercial pipe, having equivalent roughness k_s, as $0.12mm$, yields an average shear stress at the pipe boundary = 600 N/m^2. The value of k_s/δ (δ being the thickness of laminar sub-layer) for this pipe is [Gate 2008]

a) 0.25
b) 0.50
c) 6.0
d) 8.0

3) A river reach of 2.0 km long with maximum flood discharge of 1000 m^3/s is to be physically modeled in the laboratory where maximum available discharge is 0.20 m^3/s. For a geometrically similar model based on equality of Froude number, the length of the river reach (m) in the model is [Gate 2008]

a) 26.4
b) 25.0
c) 20.5
d) 18.0

4) An outlet irrigates an area of 20 ha. The discharge (l/s) required at this outlet to meet the evaporation transpiration requirement of 20 mm occurring uniformly in 20 days neglecting other field losses is [Gate 2008]

a) 2.52
b) 2.31
c) 2.01
d) 1.52

5) A wastewater sample contains $10^{-5.6}$ $mmol/l$ of OH^- ions at $25°C$. The pH of this sample is [Gate 2008]

a) 8.6
b) 8.4
c) 5.6
d) 5.4

6) Group I lists estimation methods of some of the water and wastewater quality parameters. Group II lists the indicators used in the estimation methods. Match

the estimation method (Group *I*) with the corresponding indicator (Group *II*) [Gate 2008]

Group *I*	Group *II*
P Azide modified Winkler method for dissolved oxyzen	1 Erichrome Black T
Q Dichromate method for chemical oxyzen demand	2 Ferrion
R EDTA titrimetric method for hardness	3 Potassium chromate
S Mohr or Argentometric method for chlorides	4 Starch

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

7) Determine the correctness or otherwise of the following **Assertion** [*a*] and the **Reason** [*r*]
Assertion: The crown of the outgoing larger diameter sewer is always matched with the crown of incoming smaller diameter sewer.
Reason: It eliminates backing up of sewage in the incoming smaller diameter sewer. [Gate 2008]

a) Both [*a*] and [*r*] are true and [*r*] is the correct reason for [*a*].
b) Both [*a*] and [*r*] are true and [*r*] is not the correct reason for [*a*].
c) Both [*a*] and [*r*] are false
d) [*a*] is true but [*r*] is false

8) The 5-day BOD of a wastewater sample is obtained as 190 mg/l (with k = 0.01 h^{-1}). The ultimate oxyzen demand (mg/l) of the sample will be [Gate 2008]

a) 3800
b) 475
c) 271
d) 190

9) A water treatment plant is required to process 28800 m^3/d of raw water (density = 1000 kg/m^3, kinematic viscosity = 10^{-6} m^2/s). The rapid mixing tank imparts a velocity gradient of $900s^{-1}$ to blend 35 35 mg/l of alum with the flow for a detention time for 2 minutes. The power input (W) required for rapid mixing is [Gate 2008]

a) 32.4
b) 36
c) 324
d) 32400

10) Match the Group *I* (Terminology) with Group *II* (Defination/Brief Description) for wastewater treatment systems [Gate 2008]

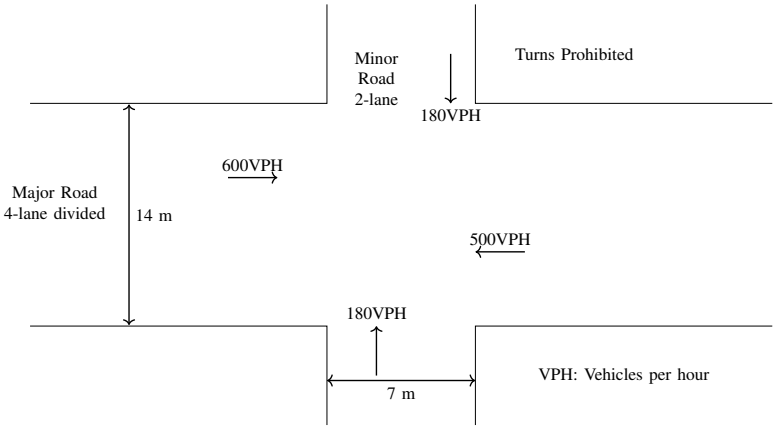
Group *I*	Group *II*
P Primary treatment	1 Contaminant removal by physical forces
Q Secondary treatment	2 Involving biological and/or chemical reaction
R Unit operation	3 Conversion of soluble organic matter to biomass
S Unit process	4 Removal of solid materials from incoming wastewater

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

11) A roundabout is provided with an average entry width of 8.4 *m*, width of weaving section as 14 *m*, and length of the weaving section between channelizing islands as 35 *m*. The crossing traffic and the total traffinc on the weaving section are 1000 and 2000 *PCU* per hour respectively. The nearest rounded capacity of the roundabout(in *PCU* per hour) is [Gate 2008]

a) 3300
b) 3700
c) 4500
d) 5200

12) Design parameters for a signalized intersection are shown in the figure below. The green time calculated for major and minor roads are 34 and 18 *s*, respectively



The critical lane volume on the major road changes to 440 vehicles per hour per lane and the critical lane volume on the minor road remains unchanged. The green time will [Gate 2008]

a) increase for the major road and remain same for the minor road
b) increase for the major road and decrease for the minor road
c) decrease for both the roads
d) remain unchanged for both the roads

13) It is proposed to widen and strengthen an existing 2-lane NH section as a divided highway. The existing traffic in one direction is 2500 commercial vehicles(*CV*) per day. The construction will take 1 year. The design *CBR* of soil subgrade is found to be 5 percent. Given: traffic growth rate for *CV* = 8 percent, vehicle damage factor = 3.5 (standard axels per *CV*), design life = 10 years and traffic distribution factors = 0.75. The cumulative standard axels (*msa*) computed are [Gate 2008]

a) 35
b) 37
c) 65
d) 70

14) A linear relationship is obserevd between speed and density on a certain section of a highway. The free flow is obserevd to be 80 *km* per hour and the jam density is estimated as 100 vehicles per *km* length. Based on the above relationship,the maximum flow expected at this section and the speed at the maximum flow will respectively be [Gate 2008]

a) 8000 vehicles per hour and 80 *km* per hour
b) 8000 vehicles per hour and 25 *km* per hour
c) 2000 vehicles per hour and 80 *km* per hour
d) 2000 vehicles per hour and 40 *km* per hour

15) The plan of a survey plotted to a scale of 10 *m* to 1 *cm* is reduced in such a way that a line originally 10 *cm* long now measures 9 *cm*. The area of the reduced plan is measured as 81 cm^2. The actual area (m^2) of the survey is [Gate 2008]

a) 10000
b) 6561
c) 1000
d) 656

16) The lengths and bearings of a closed traverse *PQRSP* are given below

Line	Length (*m*)	Bearing (WCB)
PQ	200	0°
QR	1000	45°
RS	907	180°
SP	?	?

The missing length and bearing, respectively of the line SP are [Gate 2008]

a) 207 m and 270°
b) 707 m and 270°
c) 707 m and 180°
d) 907 m and 270°

17) The focal length of the object glass of a tachometer is 200 *mm*, the distance between the vertical axis of the optical centre of the object glass is 100 *mm* and the spacing between the upper and lower line of the diaphragm axis is 4 *mm*. With the line of collimation perfectly horizontal, the staff intercepts are 1 *m* (top), 2 *m* (middle), and 3 *m* (bottom). The horizontal distance (*m*) between the staff and the instrument station is [Gate 2008]

a) 100.3
b) 103.0
c) 150.0
d) 153.0