

- 1) Water emerges from an ogee 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 = $10^{-6} \text{ m}^2/\text{s}$) 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 $1000 \text{ m}^3/\text{s}$ is to be physically modeled in the laboratory where maximum available discharge is $0.20 \text{ m}^3/\text{s}$. 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 $10^{-5.6} \text{ mmol/l}$ 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 oxygen	1 Erichrome Black T
Q Dichromate method for chemical oxygen demand	2 Ferrion
R EDTA titrimetric method for hardness	3 Potassium chromate
S Mohr or Argentometric method for chlorides	4 Starch

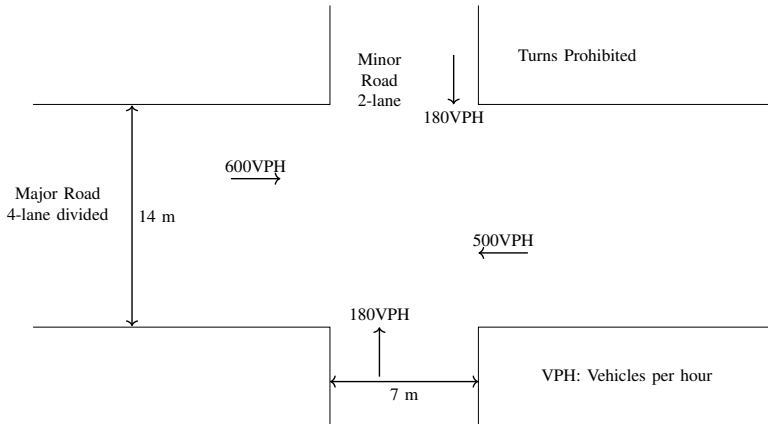
a) 3300

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 observed between speed and density on a certain section of a highway. The free flow is observed 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]

