

# GATE ASSIGNMENT 1

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EE1030 : Matrix Theory  
Indian Institute of Technology Hyderabad

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- 1) A triangular open channel has a vertex angle of  $90^\circ$  and carries flow at a critical depth of 0.30m. The discharge in the channel is:
- a)  $0.08 \text{ m}^3/\text{s}$       b)  $0.11 \text{ m}^3/\text{s}$       c)  $0.15 \text{ m}^3/\text{s}$       d)  $0.2 \text{ m}^3/\text{s}$
- 2) Flow rate of a fluid (density =  $1000 \text{ kg/m}^3$ ) in a small diameter tube is  $800 \text{ m}^3/\text{s}$ . The length and the diameter of the tube are 2 m and 0.5 mm, respectively. The pressure drop in 2 m length is equal to 2.0 MPa. The viscosity of the fluid is
- a)  $0.025 \text{ N.s/m}^2$       b)  $0.012 \text{ N.s/m}^2$       c)  $0.0092 \text{ N.s/m}^2$       d)  $0.00102 \text{ N.s/m}^2$
- 3) The flow rate in a wide rectangular open channel is  $2.0 \text{ m}^3/\text{s}$  per meter width. The channel bed slope is 0.002. The Manning's roughness coefficient is 0.012. The slope of the channel is classified as
- a) Critical      b) Horizontal      c) Mild      d) Steep
- 4) The culturable command area for a distributary channel is 20,000 hectares. Wheat grown in the entire area and the intensity of irrigation is 50%. The kor period for wheat is 30 days and the kor water depth is 120mm. The outlet discharge for the distributary should be:
- a)  $2.85 \text{ m}^3/\text{s}$       b)  $3.21 \text{ m}^3/\text{s}$       c)  $4.63 \text{ m}^3/\text{s}$       d)  $2.85 \text{ m}^3/\text{s}$
- 5) An isolated 4-hour storm occurred over a catchment as follows:

Time	1st hour	2nd hour	3rd hour	4th hour
Rainfall (mm)	9	28	12	7

The  $\phi$  index for the catchment is 10 mm/h. The estimated runoff depth from the catchment due to the above storm is

- a) 10mm                      b) 16mm                      c) 20mm                      d) 23mm
- 6) Two electrostatic precipitators (ESPs) are in series. The fractional efficiencies of the upstream and downstream ESPs for size  $d_p$  are 80% and 65%, respectively. What is the overall efficiency of the system for the same  $d_p$ ?
- a) 100%                      b) 93%                      c) 80%                      d) 65%
- 7) 50g of  $\text{CO}_2$  and 25g of  $\text{CH}_4$  are produced from the decomposition of municipal solid waste (MSW) with a formula weight of 120g. What is the average per capita green house gas production in a city of 1 million people with a MSW production rate of 500 ton / day?
- a) 104 g/day                      c) 208 g/day  
b) 120 g/day                      d) 313 g/day
- 8) The extra widening required for a two-lane national highway at a horizontal curve of 300 m radius, considering a wheel base of 8m and a design speed of 100kmph is
- a) 0.42m                      b) 0.62m                      c) 0.82m                      d) 0.92m
- 9) While designing a hill road with a ruling gradient of 6%, if a sharp horizontal curve of 50m radius is encountered, the compensated gradient at the curve as per the Indian Roads Congress specifications should be
- a) 4.4%                      b) 4.75%                      c) 5.0%                      d) 5.25%
- 10) The design speed on a road is 60 km/h. Assuming the driver reaction time of 2.5 seconds and coefficient of friction of pavement surface as 0.35, the required stopped distance for two-way traffic on a single lane road is
- a) 82.1m                      b) 102.4                      c) 164.2m                      d) 186.4m
- 11) The width of the expansion joint is 20mm in a cement concrete pavement. The laying temperature is  $20^\circ\text{C}$  and the maximum slab temperature in summer is  $60^\circ\text{C}$ . The coefficient of thermal expansion of concrete is  $10 \times 10^{-6} \text{mm/mm}/^\circ\text{C}$  and the joint filler compresses up to 50% of the thickness. The spacing between expansion joints should be
- a) 20m                      b) 25m                      c) 30m                      d) 40m
- 12) The following data pertains to the number of commercial vehicles per day for the design of a flexible pavement for a national highway as per IRC: 37-1984

Type of commercial vehicle	Number of vehicles per day	Vehicle Damage Factor
Two axle trucks	2000	5
Tandem axle trucks	200	6

Assuming a traffic growth factor of 7.5% per annum for both types of vehicles, the cumulative number of standard axle load repetitions (in million) for a design life of ten years is:

- a) 44.6                      b) 57.8                      c) 62.4                      d) 78.7

13) Match the following tests on aggregate and its properties:

Test	Property
P. Crushing Test	1. Hardness
Q. Los Angeles abrasion test	2. Weathering
R. Soundness test	3. Shape
S. Angularity test	4. Strength

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

14) The plan of a map was photo copied to a reduced size such that a line originally 100mm, measures 90mm. The original scale of the plan was 1 : 1000. The revised scale is

- a) 1:900                      b) 1:11111                      c) 1:1121                      d) 1:1221

15) The following table gives data of consecutive coordinates in respect of a closed theodolite traverse PQRSP.

Station	Northing, m	Southing, m	Easting, m	Westing, m
P	400.75			300.5
Q	100.25		199.25	
R		199.0	399.75	
S		300.0		200.5

The magnitude and direction of error of closure in whole circle bearing are

- a) 2.0m and 450      b) 2.82m and 3150      c) 2.0m and 3150      d) 3.42m and 450

16) The following measurements were made during testing a leveling instrument.

Instrument at	Staff Reading at	
	$P_1$	$Q_1$
P	2.800 m	1.700 m
Q	2.700 m	1.800 m

$P_1$  is close to P and  $Q_1$  is close to Q. If the reduced level of station P is 100.000 m, the reduced level of station Q is

- a) 99.000m                      b) 100.000m                      c) 101.000m                      d) 102.000m

17) Two straight lines intersect at an angle of  $60^\circ$ . The radius of a curve joining the two straight lines is  $600m$ . The length of long chord and mid-ordinates in metres of the curve are

- a) 80.4, 600.00                      b) 600.0, 80.4                      c) 600.0, 39.89                      d) 40, 89,300