GATE ASSIGNMENT 1

EE1030 : Matrix Theory
Indian Institute of Technology Hyderabad

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1) A triangular open channel has a vertex angle of 90° and carries flow at a critical depth of 0.30m. The discharge in the channel is:

a) 0.08 m^3/s b) 0.11 m^3/s c) 0.15 m^3/s d) 0.2 m^3/s

2) Flow rate of a fluid (density = $1000 kg/m^3$) in a small diameter tube is 800 m^3/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) $0.025\, N.s/m^2$ b) $0.012\, N.s/m^2$ c) $0.0092\, N.s/m^2$ d) $0.00102\, N.s/m^2$

3) The flow rate in a wide rectangular open channel is 2.0 m^3/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 m^3/s b) 3.21 m^3/s c) 4.63 m^3/s d) 2.85 m^3/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 ϕ 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 CO_2 and 25g of 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
b) 120 g/day
c) 208 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°C and the maximum slab temperature in summer is 60°C. The coefficient of thermal expansion of concrete is $10 \times 10^{-6} mm/mm/°C$ 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
b) P-4, Q-2, R-3, S-1
c) P-3, Q-2, R-1, S-4
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°. The radius of a curve joining the two straight lines is 600*m*. 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