Assignment1

EE24BTECH11007 - Arnav Makarand Yadnopavit

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

2) Flow rate of a fluid $\left(\text{density} = 1000kg/m^3\right)$ in a small diameter tube is $800mm^3/s$. The length and the diameter of the tube are $2m$ and $0.5mm$, respectively. The pressure drop in $2m$ length is equal to $2.0MPa$. The viscosity of the fluid is

   a) $0.025N.s/m^2$ b) $0.012N.s/m^2$ c) $0.00192N.s/m^2$ d) $0.00102N.s/m^2$

3) The flow rate in a wide rectangular open channel is $2.0m^3/s$ 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 is 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) $2.85m^3/s$ b) $3.21m^3/s$ c) $4.63m^3/s$ d) $5.23m^3/s$

5) An isolated 4-hour storm occurred over a catchment as follows

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

   The ϕ index for the catchment is $10mm/h$. 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 $500ton/day$?

   a) $104g/day$ b) $120g/day$ c) $208g/day$ d) $313g/day$

8) The extra widening required for a two-lane national highway at a horizontal curve of $300m$ 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 $60kmph$. Assuming the driver reaction time of 2.5 seconds and coefficient of friction of pavement surface as 0.35, the required stopping distance for two-way traffic on a single lane road is

a) $82.1m$ b) $102.4m$ 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-considering the number of lanes	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 the 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-3

14) The plan of a map was photocopied 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) 1:1111 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

a) 2.0m and 45° b) 2.0m and 315° c) 2.82m and 315° d) 3.42m and 45°

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

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

P_1 is close to P and Q_1 is close to Q. If the reduced level of station P is 100.000m, 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 600m. The length of long chord and mid-ordinates in meters of the curve are

a) 80.4, 600.0 b) 600.0, 80.4 c) 600.0, 39.89 d) 49.89, 300.0