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EE24BTECH11006 - Arnav Mahishi

1) For steady incompressible flow through a closed-conduit of uniform cross-section, the direction of flow will always be

a) from higher to lower elevation
b) from higher to lower pressure
c) from higher to lower velocity
d) from higher to lower pizometric head

2) A circular pipe has a diameter of 1 m, bed slope of 1 in 1000, and Manning's roughness coefficient equal to 0.01. It may be treated as an open channel flow when it is flowing just full, i.e., the water level just touches the crest. The discharge in this condition is denoted by Q_{full}. Similarly, the discharge when the pipe is flowing half-full, i.e., with a flow depth of 0.5 m, is denoted by Q_{half}. The ratio $\frac{Q_{full}}{Q_{half}}$ is

a) 1
b) $\sqrt{2}$
c) 2
d) 4

3) The two columns below show some parameters and their possible values

Parameter	Value
P-Gross Command Area	I-100$\frac{\text{hectares}}{\text{cumec}}$
Q-Permanent Wilting Point	II-6°C
R-Duty of canal water	III-1000 hectares
S-Delta of wheat	IV-1000cm
	V-40cm
	VI-0.12

a) P-I,Q-II,R-III,S-IV
b) P-III,Q-VI,R-I,S-V
c) P-I,Q-V,R-VI,S-II
d) P-III,Q-II,R-V,S-IV

4) Total Kjeldahl Nitrogen (TKN) concentration $\left(\frac{mg}{L}\text{as N}\right)$ in domestic sewage is the sum of concentrations of

a) organic and inorganic nitrogen in sewage
b) organic nitrogen and nitrate in sewage
c) organic nitrogen and ammonia in sewage
d) ammonia and nitrate in sewage

5) Solid waste generated from and industry contains only two components X and Y as shown in the table below Assuming $(c_1 + c_2) = 100$, the composite density of the solid waste (ρ) is given by:

Component	Composition (%weight)	Density$\left(\frac{kg}{m^3}\right)$
X	c_1	ρ_1
Y	c_2	ρ_2

a) $\frac{100}{\left(\frac{c_1}{\rho_1}+\frac{c_2}{\rho_2}\right)}$
b) $100\left(\frac{\rho_1}{c_1}+\frac{\rho_2}{c_2}\right)$
c) $100\,(c_1\rho_1 + c_2\rho_2)$
d) $100\left(\frac{\rho_1\rho_2}{c_1\rho_1+c_2\rho_2}\right)$

6) The penetration value of a bitumen sample tested at $25°C$ is 80. When this sample is heated to $60°C$ and tested again, the needle of the penetration test apparatus the bitume sample by $d$mm. The value of d CANNOT be less than

a) 80mm b) 100mm c) 120mm d) 90mm

7) Which of the following statements CANNOT be used to describe free flow speed $\left(u_f\right)$ of a traffic stream?
   a) u_f is the speed when flow is negigible
   b) u_f is the speed when density is negigible
   c) u_f is affected by geometry and surface conditions of road
   d) u_f is the speed at which flow is maximum and density is optimum

8) Which of the the following statements is FALSE
   a) Plumb line is along the direction of gravity
   b) Mean sea level (MSL) is used as a reference surface for establishing the horizontal control
   c) Mean sea level (MSL) is a simplification of the Geoid
   d) Geoid is an equi-potenital surface of gravity

9) In a closed loop traverse of 1km total length, the closing errors in departure and latitude are 0.3m and 0.4m, respectively. The relative precision of this traverse will be:

a) 1 : 5000 b) 1 : 4000 c) 1 : 3000 d) 1 : 2000

10) The smallest and largest Eigen values of the following matrix are: $\begin{pmatrix} 3 & -2 & 2 \\ 4 & -4 & 6 \\ 2 & -3 & 5 \end{pmatrix}$

a) 1.5 and 2.5 b) 0.5 and 2.5 c) 1.0 and 3.0 d) 1.0 and 2.0

11) The quadratic equation $x^2 - 4x + 4 = 0$ is to be solved numerically, starting with the initial guess $x_0 = 3$. The Newton-Raphson method is applied once to get a new estimate and then the Secant method is applied once using the initial guess and this new estimate. The estimated value of the root after the application of the Secant method is _____

a) 2.1 b) 2.33 c) 3.33 d) 2.0

12) Consider the following differential equation: $x\,(ydx + xdy)\cos\frac{y}{x} = y\,(xdy - ydx)\sin\frac{y}{x}$ Which of the following is the solution of the above equation (c is an arbitrary constant)

a) $\frac{x}{y}\cos\frac{y}{x} = c$ b) $\frac{x}{y}\sin\frac{y}{x} = c$ c) $xy\cos\frac{y}{x} = c$ d) $xy\sin\frac{y}{x} = c$

13) Consider the following complex function $f(z) = \frac{9}{(z-1)(z+2)^2}$ Which of the following is one of the residues of the above function?

a) -1 b) $\frac{9}{16}$ c) 2 d) 9