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AI24BTECH11002 - K. Akshay Teja

1) The matrix P is the inverse of a matrix Q. If I denotes the identity matrix, which one of the following options is correct?

a) PQ = I but QP ≠ I b) QP = I but PQ ≠ I c) PQ = I and QP = I d) PQ - QP = I

2) The number of parameters in the univariate exponential and Gaussian distributions, respectively, are:

a) 2 and 2 b) 1 and 2 c) 2 and 1 d) 1 and 1

3) Let x be a continuous variable defined over the interval $(-\infty, \infty)$ and $f(x) = e^{-x-e^{-x}}$. The integral $g(x) = \int f(x)\,dx$ is equal to:

a) $e^{e^{-x}}$ b) $e^{-e^{-x}}$ c) $e^{-e^{x}}$ d) e^{-x}

4) An elastic bar of length Z, uniform cross-sectional area A, coefficient of thermal expansion α, and Young's modulus E is fixed at the two ends. The temperature of the bar is increased by T, resulting in an axial stress σ. Keeping all other parameters unchanged, if the length of the bar is doubled, the axial stress would be:

a) σ b) 2σ c) 0.5σ d) $0.25\alpha\sigma$

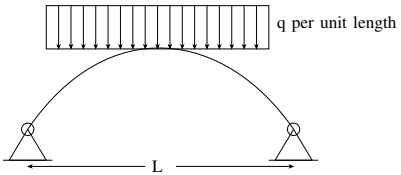
5) Statement: A simply supported beam is subjected to a uniformly distributed load. Which one of the following statements is true?

a) Maximum or minimum shear force occurs where the curvature is zero.
b) Maximum or minimum bending moment occurs where the shear force is zero.
c) Maximum or minimum bending moment occurs where the curvature is zero.
d) Maximum bending moment and maximum shear force occur at the same section.

6) According to IS 456-2000, which one of the following statements about the depth of neutral axis $x_{u,bal}$ for a balanced reinforced concrete section is correct?

a) $x_{u,bal}$ depends on the grade of concrete only.
b) $x_{u,bal}$ depends on the grade of steel only.
c) $x_{u,bal}$ depends on both the grade of concrete and grade of steel.
d) $x_{u,bal}$ does not depend on the grade of concrete and grade of steel.

7) The figure shows a two-hinged parabolic arch of span L subjected to a uniformly distributed load of intensity q per unit length.



The maximum bending moment in the arch is ewual to

a) $\frac{qL^2}{8}$ b) $\frac{qL^2}{12}$ c) zero d) $\frac{qL^2}{10}$

8) Group I lists the type of gain or loss of strength in soils. Group II lists the property or process responsible for the loss or gain of strength in soils.

	Group I		Group II
P.	Regain of strength with time	1.	Boiling
Q.	Loss of strength due to cyclic loading	2.	Liquefaction
R.	Loss of strength due to upward seepage	3.	Thixotropy
S.	Loss of strength due to remolding	4.	Sensitivity

The correct match between group I and group II is

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

9) A soil sample is subjected to a hydrostatic pressure, σ. The Mohr circle for any point in the soil sample would be:
a) a circle of radius σ and center at the origin
b) a circle of radius σ and center at a distance σ from the origin
c) a point at a distance σ from the origin
d) a circle of diameter σ and center at the origin

10) A strip footing is resting on the ground surface of a pure clay bed having an undrained cohesion C_u. The ultimate bearing capacity of the footing is equal to:

a) $2\pi C_u$ b) πC_u c) $(\pi + 1)\, C_u$ d) $(\pi + 2)\, C_u$

11) A uniformly distributed line load of 500 kN/m is acting on the ground surface. Based on Boussinesq's theory, the ratio of vertical stress at a depth 2 m to that at 4 m, right below the line of loading, is:

a) 0.25 b) 0.5 c) 2.0 d) 4.0

12) For a steady incompressible laminar flow between two infinite parallel stationary plates, the shear stress variation is:

a) linear with zero value at the plates c) quadratic with zero value at the plates
b) linear with zero value at the center d) quadratic with zero value at the center

13) Statement: The reaction rate involving reactants A and B is given by $-k[A]^{\alpha}[B]^{\beta}$. Which one of the following statements is valid for the reaction to be a first-order reaction?

a) $\alpha = 0$ and $\beta = 0$ b) $\alpha = 1$ and $\beta = 0$ c) $\alpha = 1$ and $\beta = 1$ d) $\alpha = 1$ and $\beta = 2$