2007-GATE-CE

AI24BTECH11016 - Jakkula Adishesh Balaji

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1) The minimum and the maximum eigen values of the matrix $\begin{pmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{pmatrix}$ are -2 and 6, respectively. What is the other eigen value?
   a) 5
   b) 3
   c) 1
   d) -1
2) The degree of the differential equation $\frac{d^2x}{dt^2} + 2x^3 = 0$ is
   a) 0
   b) 1
   c) 2
   d) 3
3) The solution for the differential equation $\frac{dy}{dx} = x^2y$ with the condition that $y = 1$ at $x = 0$ is
   a) $y = e^{\frac{1}{2x}}$
   b) $\ln(y) = \frac{x^3}{3} + 4$
   c) $\ln(y) = \frac{x^2}{2}$
   d) $y = e^{\frac{x^3}{3}}$
4) An axially loaded bar is subjected to a normal stress of 173 MPa. The shear stress in the bar is
   a) $75MPa$
   b) $86.5MPa$
   c) $100MPa$
   d) $122.3MPa$
5) A steel column, pinned at both ends, has a buckling load of 200 kN. If the column is restrained against lateral movement at its mid-height, its buckling load will be
   a) $200kN$
   b) $283kN$
   c) $400kN$
   d) $800kN$
6) The stiffness coefficient k_{ij} indicates
   a) force at i due to a unit deformation at j
   b) deformation at j due to a unit force at i
   c) deformation at i due to a unit force at j

d) force at j due to a unit deformation at i

7) For an isotropic material, the relationship between the Young's modulus (E), shear modulus (μ) is given by
   a) $G = \frac{E}{2(1+\mu)}$
   b) $E = \frac{G}{2(1+\mu)}$
   c) $G = \frac{E}{1+2\mu}$
   d) $G = \frac{E}{2(1-\mu)}$
8) A clay soil sample is tested in a triaxial apparatus in consolidated-drained conditions at a cell pressure of 100 $\frac{kN}{m^2}$. What will be the pore water pressure at a deviator stress of 40 $\frac{kN}{m^2}$
   a) 0 $\frac{kN}{m^2}$
   b) 20 $\frac{kN}{m^2}$
   c) 40 $\frac{kN}{m^2}$
   d) 60 $\frac{kN}{m^2}$
9) The number of blows observed in a Standard Penetration Test (STP) for different penetration depths are given as follows:

Penetration of Sampler	Number of Blows
0-150 mm	6
150-300 mm	8
300-450 mm	10

   The observed N value is
   a) 8
   b) 14
   c) 18
   d) 24
10) The vertical stress at some depth below the corner of a $2m \times 3m$ rectangular footing due to a certain load intensity is 100 $\frac{kN}{m^2}$. What will be the vertical stress in $\frac{kN}{m^2}$ below the centre of a $4m \times 6m$ rectangular footing at the same depth and same load intensity?
    a) 25
    b) 100
    c) 200
    d) 400
11) There is a free overfall at the end of a long open channel. For a given flow rate, the critical depth is less than the normal depth. What gradually varied flow profile will occur in the channel for this flow rate?
    a) M_1
    b) M_2
    c) M_3
    d) S_1

12) The consecutive use of water for a crop during a particular stage of growth is 2.0 mm/day. The maximum depth of available water in the root zone is 60 mm. Irrigation is required when the amount of available water is 50 % of the maximum available water in the root zone. Frequency of irrigation should be
   a) 10 days
   b) 15 days
   c) 20 days
   d) 25 days

13) As per the Lacey's method for design of alluvial channels, identify the **TRUE** statement from the following:
   a) Wetted perimeter increases with an increase in design discharge
   b) Hydraulic radius increases with an increase in silt factor
   c) Wetted perimeter decreases with an increase in design discharge
   d) Wetted perimeter increases with an increase in silt factor

14) At two points 1 and 2 in a pipeline the velocities are V and $2V$, respectively. Both the points are at the same elevation. The fluid density is ρ. The flow can be assumed to be incompressible, inviscid, steady and irrotational. The difference is pressures P_1 and P_2 at points 1 and 2 is
   a) $0.5\rho V^2$
   b) $1.5\rho V^2$
   c) $2\rho V^2$
   d) $3\rho V^2$

15) The presence of hardness in excess of permissible limit causes
   a) cardio vascular problems
   b) skin discolouration
   c) calcium deficiency
   d) increased laundry expenses

16) The dispersion of pollutants in atmosphere is maximum when
   a) environmental lapse rate is greater than adiabatic lapse rate.
   b) environmental lapse rate is less than adiabatic lapse rate.
   c) environmental lapse rate is equal to adiabatic lapse rate.
   d) maximum mixing depth is equal to zero.

17) The alkalinity and the hardness of a water sample are 250 mg/L and 350 mg/L as $CaCO_3$, respectively. The water has
   a) 350 mg/L carbonate hardness and zero non-carbonate hardness.
   b) 250 mg/L carbonate hardness and zero non-carbonate hardness.
   c) 250 mg/L carbonate hardness and 350 mg/L non-carbonate hardness.
   d) 350 mg/L carbonate hardness and 100 mg/L non-carbonate hardness.