

# 2007-GATE-CE

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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  $173MPa$ . 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  $200kN$ . 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 ( $\mu$ ) is given by
- $G = \frac{E}{2(1+\mu)}$
  - $E = \frac{G}{2(1+\mu)}$
  - $G = \frac{E}{1+2\mu}$
  - $G = \frac{E}{2(1-\mu)}$
- 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  $40 \frac{kN}{m^2}$
- $0 \frac{kN}{m^2}$
  - $20 \frac{kN}{m^2}$
  - $40 \frac{kN}{m^2}$
  - $60 \frac{kN}{m^2}$
- 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

- 8
  - 14
  - 18
  - 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?
- 25
  - 100
  - 200
  - 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?
- $M_1$
  - $M_2$
  - $M_3$
  - $S_1$

- 12) The consecutive use of water for a crop during a particular stage of growth is  $2.0\text{mm/day}$ . 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
- 10 days
  - 15 days
  - 20 days
  - 25 days
- 13) As per the Lacey's method for design of alluvial channels, identify the **TRUE** statement from the following:
- Wetted perimeter increases with an increase in design discharge
  - Hydraulic radius increases with an increase in silt factor
  - Wetted perimeter decreases with an increase in design discharge
  - 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  $\rho$ . The flow can be assumed to be incompressible, inviscid, steady and irrotational. The difference in pressures  $P_1$  and  $P_2$  at points 1 and 2 is
- $0.5\rho V^2$
  - $1.5\rho V^2$
  - $2\rho V^2$
  - $3\rho V^2$
- 15) The presence of hardness in excess of permissible limit causes
- cardio vascular problems
  - skin discolouration
  - calcium deficiency
  - increased laundry expenses
- 16) The dispersion of pollutants in atmosphere is maximum when
- environmental lapse rate is greater than adiabatic lapse rate.
  - environmental lapse rate is less than adiabatic lapse rate.
  - environmental lapse rate is equal to adiabatic lapse rate.
  - maximum mixing depth is equal to zero.
- 17) The alkalinity and the hardness of a water sample are  $250\text{mg/L}$  and  $350\text{mg/L}$  as  $\text{CaCO}_3$ , respectively. The water has
- $350\text{mg/L}$  carbonate hardness and zero non-carbonate hardness.
  - $250\text{mg/L}$  carbonate hardness and zero non-carbonate hardness.
  - $250\text{mg/L}$  carbonate hardness and  $350\text{mg/L}$  non-carbonate hardness.
  - $350\text{mg/L}$  carbonate hardness and  $100\text{mg/L}$  non-carbonate hardness.