# ce-2007-18 to 34

AI24BTECH11020 - Rishika

Q.18 The consistency and flow resistance of bitumen can be determined from the following:

a) Ductitility test
b) Penetration test
c) Softening point test
d) Viscosity test

Q.19 If a two-lane national highway and a two-lane state highway intersect at right angles, the number of potential conflict points at the intersection, assuming that both the roads are two-way is

a) 11
b) 17
c) 24
d) 32

Q.20 In signal design as per Indian Roads Congress specifications, if the sum of the ratios of normal flows to saturation flow of two directional traffic flow is 0.50 and the total lost time per cycle is 10 seconds, the optimum cycle length in seconds is

a) 100
b) 80
c) 60
d) 40

Q.21 TO Q.75 CARRY TWO MARKS EACH.

Q.21 For what values of $\alpha$ and $\beta$ the following simultaneous equations have an infinite number of solutions?
$x + y + z = 5; x + 3y + 3z = 9; x + 2y + \alpha z = \beta$

a) $2, 7$
b) $3, 8$
c) $8, 3$
d) $7, 2$

Q.22 A velocity vector is given as $\overrightarrow{V} = 5xy\overrightarrow{i} + 2y^2\overrightarrow{j} + 3yz^2\overrightarrow{k}$. The divergence of this velocity vector at $(1, 1, 1)$ is

a) 9
b) 10
c) 14
d) 15

Q.23 A body originally at $60°C$ cools down to $40°C$ in 15 minutes when kept in air at a temperature of $25°C$. what will be the temperature of the body at the end of 30 minutes?

a) $35.2°C$
b) $31.5°C$
c) $28.7°C$
d) $15°C$

Q.24 The following equation needs to be numerically solved using the Newton-Raphson method.

$$x^3 + 4x - 9 = 0$$

The iterative equation for this purpose is (k indicates the iteration level)

a) $x_{k+1} = \frac{2x_k^3+9}{3x_k^2+4}$

b) $x_{k+1} = \frac{3x_k^2+4}{2x_k^2+9}$

c) $x_{k+1} = x_k - 3x_k^2 + 4$

d) $x_{k+1} = \frac{4x_k^2+3}{9x_k^2+2}$

Q.25 Evaluate $\int_0^\infty \frac{\sin t}{t} dt$

a) $\pi$

b) $\frac{\pi}{2}$

c) $\frac{\pi}{4}$

d) $\frac{\pi}{8}$

Q.26 Potential function $\phi$ is given as $\phi = x^2 - y^2$. What will be the stream function($\psi$) with the condition $\psi = 0$ at $x = y = 0$?

a) $2xy$

b) $x^2 + y^2$

c) $x^2 - y^2$

d) $2x^2y^2$

Q.27 The inverse of the $2 \times 2$ matrix $\begin{bmatrix} 1 & 2 \\ 5 & 7 \end{bmatrix}$ is,

a) $\frac{1}{3}\begin{bmatrix} -7 & 2 \\ 5 & -1 \end{bmatrix}$

b) $\frac{1}{3}\begin{bmatrix} 7 & 2 \\ 5 & 1 \end{bmatrix}$

c) $\frac{1}{3}\begin{bmatrix} 7 & -2 \\ -5 & 1 \end{bmatrix}$

d) $\frac{1}{3}\begin{bmatrix} -7 & -2 \\ -5 & -1 \end{bmatrix}$

Q.28 Given that one root of the equation $x^3 - 10x^2 + 31x - 30 = 0$ is 5, the other two roots are

a) 2 and 3

b) 2 and 4

c) 3 and 4

d) $-2$ and $-3$

Q.29 If the standard deviation of the spot speed of vehicles in a highway is 8.8 kmph and the mean speed of the vehicles is 33 kmph, the coefficient of variation in speed is

a) 0.1517

b) 0.1867

c) 0.2666

d) 0.3646

Q.30 A metal bar of length 100 mm is inserted between two rigid supports and its temperature is increased by $10°C$. If the coefficient of thermal expansion is $12 \times 10^{-6}$ per $°C$ and the Young's modulus is $2 \times 10^5$ MPa, the stress in the bar is

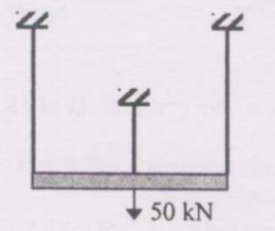
a) zero

b) 12 MPa

c) 24 MPa

d) 2400 MPa

Q.31 A rigid bar is suspended by three rods made of the same material as shown in the figure. The area and length of the central rod are $3A$ and $L$, respectively while that of the two outer rods are $2A$ and $2L$,respectively. If a downward force of 50 kN is applied to the right bar, the forces in the central and each of the outer rods will be




a) 16.67 kN each
b) 30 kN and 15 kN
c) 30 kN and 10 kN
d) 21.4 kN and 14.3 kN

Q.32 The maximum and minimum shear stresses in a hollow circular shaft of outer diameter 20 mm and thickness 2 mm, subjected to a torque of 92.7 N.m will be

a) 59 MPa and 47.2MPa
b) 100 MPa and 80 MPa
c) 118 MPa and 160 MPa
d) 200 MPa and 160 Mpa

Q.33 The shear stress at the neutral axis in a beam of triangular section with a base of 40 mm and height 20 mm, subjected to a shear force of 34 kN is

a) 3 MPa
b) 6 MPa
c) 10 MPa
d) 20 MPa

Q.34 $U_1$ and $U_2$ are the strain energies stored in a prismatic bar due to axial tensile forces $P_1$ and $P_2$,respectively. The strain energy $U$ stored in the same bar due to combined action of $P_1$ and $P_2$ will be

a) $U = U_1 + U_2$
b) $U = U_1 U_2$
c) $U < U_1 + U_2$
d) $U > U_1 + U_2$