Assignment 1

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1) The consistency and flow resistance of bitumen can be determined from the following
(CE 2007)

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

2) 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 both the roads are two-way is
(CE 2007)

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

3) 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
(CE 2007)

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

4) For what values of α and β the following simultaneous equations have an infinite number of solutions?
$x + y + z = 5;\ x + 3y + 3z = 9;\ x + 2y + \alpha z = \beta;$
(CE 2007)

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

5) A velocity vector is given as $\mathbf{V} = 5xy\hat{i} + 2y^2\hat{j} + 3yz^2\hat{k}$. The divergence of this velocity vector at $(1, 1, 1)$ is
(CE 2007)

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

6) A body originally at $60^{\circ}C$ cools down to $40^{\circ}C$ in 15 minutes when kept in air at a temperature of $25^{\circ}C$. What will be the temperature of the body at the end of 30 minutes?
(CE 2007)

a) $35.2^{\circ}C$ b) $31.5^{\circ}C$ c) $28.7^{\circ}C$ d) $15^{\circ}C$

7) 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)
(CE 2007)

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

8) Evaluate $\int_0^{\infty} \frac{\sin t}{t}$
(CE 2007)

a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{8}$

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

(CE 2007)

a) $2xy$ b) $x^2 + y^2$ c) $x^2 - y^2$ d) $2x^2y^2$

10) The inverse of the 2×2 matrix $\begin{pmatrix} 1 & 2 \\ 5 & 7 \end{pmatrix}$ is,

(CE 2007)

a) $\frac{1}{3}\begin{pmatrix} -7 & 2 \\ 5 & -1 \end{pmatrix}$ b) $\frac{1}{3}\begin{pmatrix} 7 & 2 \\ 5 & 1 \end{pmatrix}$ c) $\frac{1}{3}\begin{pmatrix} 7 & -2 \\ -5 & 1 \end{pmatrix}$ d) $\frac{1}{3}\begin{pmatrix} -7 & -2 \\ -5 & -7 \end{pmatrix}$

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

(CE 2007)

a) 2 and 3 b) 2 and 4 c) 3 and 4 d) -2 and -3

12) If the standard deviation of the spot speed of vehicles in a highway is $8.8kmph$ and the mean speed of the vehicles is $33kmph$, the coefficient of variation in speed is

(CE 2007)

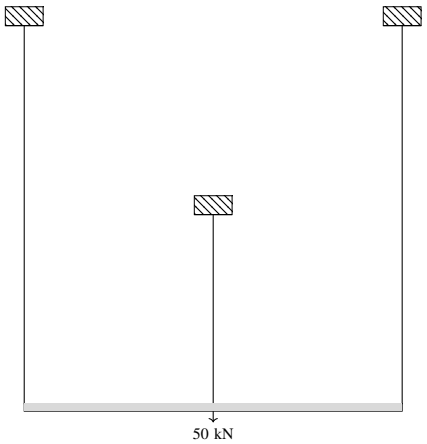
a) 0.1517 b) 0.1867 c) 0.2666 d) 0.3646

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

(CE 2007)

a) 0 b) $12MPa$ c) $24MPa$ d) $2400MPa$

14) 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 $50kN$ is applied to the rigid bar, the forces in the central and each of the outer rods will be



(CE 2007)

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

15) The maximum and minimum shear stresses in a hollow circular shaft of outer diameter 20mm and thickness 2mm, subjected to torque of 92.7Nm will be

(CE 2007)

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

16) The shear stress at the neutral axis in a beam of triangular section with a base of 40mm and height 20mm, subjected to shear force of 3kN is

(CE 2007)

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

17) 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

(CE 2007)

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