

GateAssignment-2

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EE24BTECH11048-NITHIN.K

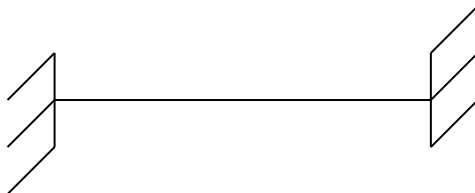
1 Q.1-Q.25 CARRY ONE MARK EACH

- 1) Consider x, y, z to be right-handed Cartesian coordinates. A vector function is defined in this coordinate system as $\mathbf{v} = 3x\mathbf{i} + 3xy\mathbf{j} - yz^2\mathbf{k}$, where \mathbf{i}, \mathbf{j} and \mathbf{k} are the unit vectors along x, y and z axes, respectively. The curl of \mathbf{v} is given by
- $z^2\mathbf{i} - 3y\mathbf{k}$
 - $z^2\mathbf{j} + 3y\mathbf{k}$
 - $z^2\mathbf{i} + 3y\mathbf{j}$
 - $-z^2\mathbf{i} + 3y\mathbf{k}$
- 2) Which of the following functions is periodic?
- $f(x) = x^2$
 - $f(x) = \log x$
 - $f(x) = e^x$
 - $f(x) = \text{const.}$
- 3) The function $f(x_1, x_2, x_3) = x_1^2 + x_2^2 + x_3^2 - 2x_1 - 4x_2 - 6x_3 + 14$ has its minimum value at
- $(1, 2, 3)$
 - $(0, 0, 0)$
 - $(3, 2, 1)$
 - $(1, 1, 3)$
- 4) Consider the function $f(x_1, x_2) = x_1^2 + 2x_2^2 + e^{-x_1 - x_2}$. The vector pointing in the direction of maximum increase of the function at the point $(1, -1)$ is
- $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$
 - $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$
 - $\begin{pmatrix} -0.73 \\ -6.73 \end{pmatrix}$
 - $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$
- 5) Two simultaneous equations given by $y = \pi + x$ and $y = x - \pi$ have
- a unique solution
 - infinitely many solutions
 - no solution
 - a finite number of multiple solutions
- 6) In three-dimensional linear elastic solids, the number of non-trivial stress-strain relations, strain-displacement equations and equations of equilibrium are, respectively
- 3, 3 and 3
 - 6, 3 and 3
 - 6, 6 and 3
 - 6, 3 and 6

- 7) An Euler-Bernoulli beam in bending is assumed to satisfy
- both plane stress as well as plane strain conditions
 - plane strain condition but not plane stress condition
 - plane stress condition but not plane strain condition
 - neither plane strain condition nor plane stress condition
- 8) A statically indeterminate frame structure has
- same number of joint degrees of freedom as the number of equilibrium equations
 - number of joint degrees of freedom greater than the number of equilibrium equations
 - number of joint degrees of freedom less than the number of equilibrium equations
 - unknown number of joint degrees of freedom, which cannot be solved using laws of mechanics
- 9) Consider a single degree of freedom spring-mass-damper system with mass, damping and stiffness of m , c and k , respectively. The logarithmic decrement of this system can be calculated using
- $\frac{2\pi c}{\sqrt{4mk - c^2}}$
 - $\frac{\sqrt{4mk - c^2}}{\pi c}$
 - $\frac{2\pi c}{\sqrt{mk - c^2}}$
 - $\frac{\sqrt{mk - c^2}}{2\pi c}$
- 10) Consider a single degree of freedom spring-mass system of spring stiffness k_1 and mass m which has a natural frequency of 10 rad/s. Consider another single degree of freedom spring-mass system of spring stiffness k_2 and mass m which has a natural frequency of 20 rad/s. The spring stiffness k_2 is equal to
- k_1
 - $2k_1$
 - $\frac{k_1}{4}$
 - $4k_1$
- 11) Consider a simply supported two-dimensional beam



If the beam is converted into a fixed-fixed beam as



then the degree of static indeterminacy will

- a) increase by 3
- b) increase by 2
- c) decrease by 1
- d) decrease by 3

- 12) An impulsive launch of a rocket minimizes the loss of burn-out velocity due to
- a) aerodynamic drag force only
 - b) gravitational force only
 - c) both aerodynamic drag and gravitational forces
 - d) reaction jet control force
- 13) Multi-staging in rockets improves the burn-out performance by increasing mainly stage-wise
- a) payload mass ratios
 - b) structural mass efficiencies
 - c) propellant masses
 - d) control system masses