# GateAssignment-2

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
   a) $z^2\mathbf{i} - 3y\mathbf{k}$
   b) $z^2\mathbf{j} + 3y\mathbf{k}$
   c) $z^2\mathbf{i} + 3y\mathbf{j}$
   d) $-z^2\mathbf{i} + 3y\mathbf{k}$
2) Which of the following functions is periodic?
   a) $f(x) = x^2$
   b) $f(x) = \log x$
   c) $f(x) = e^x$
   d) $f(x) = \text{const.}$
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
   a) $(1, 2, 3)$
   b) $(0, 0, 0)$
   c) $(3, 2, 1)$
   d) $(1, 1, 3)$
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
   a) $\left(=\right) 2 - 5$
   b) $\left(=\right) 1 - 5$
   c) $\left(=\right) -0.73 - 6.73$
   d) $\left(=\right) 2 - 4$
5) Two simultaneous equations given by $y = \pi + x$ and $y = x - \pi$ have
   a) a unique solution
   b) infinitely many solutions
   c) no solution
   d) 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
   a) 3, 3 and 3
   b) 6, 3 and 3
   c) 6, 6 and 3
   d) 6, 3 and 6

7) An Euler-Bernoulli beam in bending is assumed to satisfy
   a) both plane stress as well as plane strain conditions
   b) plane strain condition but not plane stress condition
   c) plane stress condition but not plane strain condition
   d) neither plane strain condition nor plane stress condition

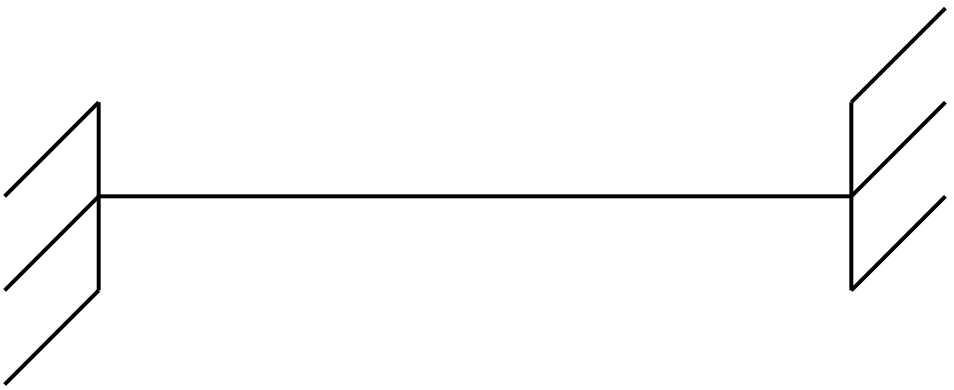
8) A statically indeterminate frame structure has
   a) same number of joint degrees of freedom as the number of equilibrium equations
   b) number of joint degrees of freedom greater than the number of equilibrium equations
   c) number of joint degrees of freedom less than the number of equilibrium equations
   d) 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
   a) $\frac{2\pi c}{\sqrt{4mk-c^2}}$
   b) $\frac{\pi c}{\sqrt{4mk-c^2}}$
   c) $\frac{2\pi c}{\sqrt{mk-c^2}}$
   d) $\frac{2\pi c}{\sqrt{mk-4c^2}}$

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
   a) $k_1$
   b) $2k_1$
   c) $\frac{k_1}{4}$
   d) $4k_1$

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