



SRM Institute of Science and Technology
Ramapuram Campus

Department of Mathematics

Year / Sem: I / II

Branch: Common to ALL Branches of B.Tech. except B.Tech. (Business Systems)

UNIT II - VECTOR CALCULUS

Part – A

1.	If $\varphi(x, y, z) = xyz$, then $\nabla\varphi =$ (A) $yz\vec{i} + zx\vec{j} + xy\vec{k}$ (B) $xy\vec{i} + yz\vec{j} + xz\vec{k}$ (C) $xz\vec{i} + zy\vec{j} + xy\vec{k}$ (D) $x\vec{i} + y\vec{j} + z\vec{k}$	ANS A	(CLO-2, Apply)
2.	Curl ($\text{grad } \varphi$) = (A) $\vec{0}$ (B) 1 (C) 2 (D) - 1	ANS A	(CLO-2, Remember)
3.	The maximum directional derivative of $\varphi(x, y, z) = x^2 + y^2 + z^2$ at (1, 1, 1) is (A) 0 (B) 3 (C) 2 (D) $2\sqrt{3}$	ANS D	(CLO-2, Apply)
4.	If \vec{r} is the position vector of the point (x, y, z) with respect to the origin, then $\nabla \bullet \vec{r} =$ (A) 0 (B) 1 (C) 2 (D) 3	ANS D	(CLO-2, Apply)
5.	If \vec{u} and \vec{v} are irrotational, then $\vec{u} \times \vec{v}$ is (A) irrotational (B) solenoidal (C) zero vector (D) constant	ANS B	(CLO-2, Remember)
6.	The condition for \vec{F} to be conservative is (A) $\nabla \bullet \vec{F} = 0$ (B) 0 (C) $\nabla \times \vec{F} = \vec{0}$ (D) 1	ANS C	(CLO-2, Remember)

7.	The relation between the surface integral and the volume integral is given by (A) Green's theorem (B) Stoke's theorem (C) Gauss Divergence theorem (D) Cauchy's theorem	ANS C	(CLO-2, Remember)
8.	By Stoke's theorem, $\int_C \vec{F} \cdot d\vec{r} =$ (A) $\iint_S \nabla \times \vec{F} \cdot d\vec{S}$ (B) $\iint_S \nabla \cdot \vec{F} \cdot d\vec{S}$ (C) $\iint_S (\nabla \cdot \vec{F}) \hat{n} \cdot d\vec{S}$ (D) $\iint_S (\nabla \times \vec{F}) \cdot \hat{n} \cdot d\vec{S}$	ANS D	(CLO-2, Remember)
9.	The maximum value of the directional derivative is (A) $ \nabla \phi $ (B) $\text{curl } \phi$ (C) $\text{grad } \phi$ (D) $ \nabla \times \phi $	ANS A	(CLO-2, Remember)
10.	If \vec{F} is irrotational, then $\text{Curl } \vec{F} =$ (A) 1 (B) 2 (C) 3 (D) $\vec{0}$	ANS D	(CLO-2, Apply)
11.	If the divergence of the vector is zero, then the vector is said to be (A) irrotational vector (B) constant vector (C) zero vector (D) solenoidal vector	ANS D	(CLO-2, Remember)
12.	The unit normal vector to the surface $x^2 y + 2 x z = 4$ at the point $(2, -2, 3)$ is (A) $-\frac{1}{3} \vec{i} + \frac{2}{3} \vec{j} + \frac{2}{3} \vec{k}$ (B) $\frac{1}{3} \vec{i} + \frac{2}{3} \vec{j} + \frac{2}{3} \vec{k}$ (C) $-\frac{1}{3} \vec{i} - \frac{2}{3} \vec{j} + \frac{2}{3} \vec{k}$ (D) $\frac{1}{3} \vec{i} - \frac{2}{3} \vec{j} - \frac{2}{3} \vec{k}$	ANS A	(CLO-2, Apply)
13.	If the vector $\vec{F} = (x + 3y) \vec{i} + (y - 2z) \vec{j} + (x + a z) \vec{k}$ is solenoidal, then $a =$ (A) 2 (B) 0 (C) -2 (D) -1	ANS C	(CLO-2, Apply)
14.	The work done by the conservative force when it moves a particle around a closed curve is (A) $\nabla \cdot \vec{F} = 0$ (B) 0 (C) $\nabla \times \vec{F} = 0$ (D) $\nabla \cdot (\nabla \times \vec{F}) = 0$	ANS C	(CLO-2, Remember)

15.	The value of $\int_C x dy - y dx$ around the circle $x^2 + y^2 = 1$ is (A) π (C) 3π	(B) 2π (D) 0	ANS B	(CLO-2, Apply)
16.	By Green's theorem, the area bounded by a simple closed curve is (A) $\int_C x dy - y dx$ (C) $\int_C y dx - x dy$	(B) $\int_C x dy + y dx$ (D) $\frac{1}{2} \left(\int_C x dy - y dx \right)$	ANS D	(CLO-2, Apply)
17.	To be conservative, \vec{F} should be (A) solenoidal (C) rotational	(B) irrotational (D) constant vector	ANS B	(CLO-2, Remember)
18.	The unit normal vector to the surface $x^2 + y^2 - z^2 = 1$ at the point $(1, 1, 1)$ is (A) $\frac{\vec{i} + \vec{j} + \vec{k}}{\sqrt{3}}$ (C) $\frac{\vec{i} - \vec{j} - \vec{k}}{\sqrt{3}}$	(B) $\frac{\vec{i} + \vec{j} - \vec{k}}{\sqrt{3}}$ (D) $\frac{\vec{i} + \vec{j} + \vec{k}}{\sqrt{2}}$	ANS B	(CLO-2, Apply)
19.	If \vec{r} is the position vector of the point (x, y, z) with respect to the origin, then $\text{div } \vec{r} =$ (A) 0 (C) 2	(B) 1 (D) 3	ANS D	(CLO-2, Remember)
20.	If ϕ is a scalar function, then $\nabla \times \nabla \phi =$ (A) $\vec{0}$ (C) irrotational	(B) solenoidal (D) constant	ANS A	(CLO-2, Remember)
21.	The value of line integral $\int_C \vec{F} \cdot d\vec{r}$ where C is the line $y = x$ in XY plane from $(1, 1)$ to $(2, 2)$ is (A) 0 (C) 2	(B) 1 (D) 3	ANS D	(CLO-2, Apply)
22.	Angle between two level surfaces $\phi_1 = C_1$ and $\phi_2 = C_2$ is given by (A) $\sin \theta = \frac{\nabla \phi_1 \cdot \nabla \phi_2}{ \nabla \phi_1 \nabla \phi_2 }$ (C) $\tan \theta = \frac{\nabla \phi_1 \cdot \nabla \phi_2}{ \nabla \phi_1 \nabla \phi_2 }$	(B) $\cos \theta = \frac{\nabla \phi_1 \cdot \nabla \phi_2}{ \nabla \phi_1 \nabla \phi_2 }$ (D) $\tan \theta = \frac{\nabla \phi_1 \times \nabla \phi_2}{ \nabla \phi_1 \nabla \phi_2 }$	ANS B	(CLO-2, Apply)

23.	<p>The condition for a vector \vec{r} to be solenoidal is</p> <p>(A) $\text{div } \vec{r} = 0$ (B) $\text{curl } \vec{r} = 0$ (C) $\text{div } \vec{r} \neq 0$ (D) $\text{curl } \vec{r} \neq 0$</p>	ANS A	(CLO-2, Remember)
24.	<p>The unit normal vector to the surface $x^2 + 2y^2 + z^2 = 7$ at the point $(1, -1, 2)$ is</p> <p>(A) $\frac{\vec{i}-2\vec{j}-2\vec{k}}{3}$ (B) $\frac{\vec{i}-2\vec{j}+2\vec{k}}{3}$ (C) $\frac{\vec{i}+2\vec{j}+2\vec{k}}{3}$ (D) $\frac{\vec{i}-2\vec{j}+2\vec{k}}{3}$</p>	ANS D	(CLO-2, Apply)
25.	<p>If the integral $\int_A^B \vec{F} \cdot d\vec{r}$ depends only on the end points but not on the path C, then \vec{F} is</p> <p>(A) neither solenoidal nor irrotational (B) solenoidal (C) irrotational (D) conservative</p>	ANS D	(CLO-2, Remember)
26.	<p>According to Green's theorem, $\int_C (P dx + Q dy) =$</p> <p>(A) $\iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y} \right) dx dy$ (B) $\iint_R \left(\frac{\partial Q}{\partial y} - \frac{\partial P}{\partial x} \right) dx dy$ (C) $\iint_R \left(\frac{\partial P}{\partial x} - \frac{\partial Q}{\partial y} \right) dx dy$ (D) $\iint_R \left(\frac{\partial P}{\partial y} - \frac{\partial Q}{\partial x} \right) dx dy$</p>	ANS A	(CLO-2, Apply)
27.	<p>By Green's theorem, $\frac{1}{2} \left(\int_C x dy - y dx \right) =$</p> <p>(A) Area of a closed curve (B) $2 \times$ Area of a closed curve (C) Volume of a closed curve (D) $3 \times$ Volume of a closed curve</p>	ANS A	(CLO-2, Apply)
28.	<p>The value of $\iint_S \vec{r} \cdot \vec{n} dS$ where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ is</p> <p>(A) $2\pi a^3$ (B) $3\pi a^3$ (C) $4\pi a^3$ (D) $5\pi a^3$</p>	ANS C	(CLO-2, Apply)
29.	<p>The maximum directional derivative of $\phi(x, y, z) = xyz^2$ at $(1, 0, 3)$ is</p> <p>(A) 9 (B) 1 (C) -9 (D) 0</p>	ANS A	(CLO-2, Apply)
30.	<p>The relation between line integral and double integral is given by</p> <p>(A) Gauss divergence theorem (B) Cauchy's theorem (C) Green's theorem (D) Convolution theorem</p>	ANS C	(CLO-2, Remember)

31.	<p>If $\varphi(x, y, z) = x^2 + y^2 + z^2$, then $\nabla\varphi$ at $(1, 1, 1) =$</p> <p>(A) $2\vec{i} + 2\vec{j} + 2\vec{k}$ (B) $2\vec{i} - 2\vec{j} + \vec{k}$ (C) $\vec{i} + \vec{j} + \vec{k}$ (D) $2\vec{i} - 2\vec{j} - 2\vec{k}$</p>	ANS A	(CLO-2, Apply)
32.	<p>If $\varphi(x, y, z) = xyz$, then $\nabla\varphi$ at $(1, 1, 1)$ is</p> <p>(A) $\vec{i} + \vec{j} + \vec{k}$ (B) $2\vec{i} + 2\vec{j} + 2\vec{k}$ (C) $2\vec{i} - 2\vec{j} + \vec{k}$ (D) $2\vec{i} - 2\vec{j} - 2\vec{k}$</p>	ANS A	(CLO-2, Apply)
33.	<p>The unit normal vector to the surface $\varphi = xy - yz - zx$ at the point $(-1, 1, 1)$ is</p> <p>(A) $-2\vec{j}$ (B) $-\vec{j}$ (C) $3\vec{i}$ (D) $4\vec{i}$</p>	ANS B	(CLO-2, Apply)
34.	<p>$\nabla r^n =$</p> <p>(A) $n\vec{r}$ (B) $n(n-1)\vec{r}$ (C) $n r^{n-2}\vec{r}$ (D) $n r^{n+2}\vec{r}$</p>	ANS C	(CLO-2, Apply)
35.	<p>The directional derivative of $\varphi = 2xy + z^2$ at $(1, -1, 3)$ in the direction of $\vec{i} + 2\vec{j} + 2\vec{k}$ is</p> <p>(A) $\frac{14}{3}$ (B) $-\frac{14}{3}$ (C) $\frac{4}{3}$ (D) $\frac{3}{14}$</p>	ANS A	(CLO-2, Apply)
36.	<p>If $\vec{F} = (3x - 2y + z)\vec{i} + (4x + ay - 2)\vec{j} + (x - y + 2)\vec{k}$ is solenoidal, then $a =$</p> <p>(A) 3 (B) 0 (C) -3 (D) -1</p>	ANS C	(CLO-2, Apply)

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