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 ($grad\ \varphi$) = (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, $\int_C \vec{F} \bullet d\vec{r} =$ (A) $\iint_S \nabla \times \vec{F}\, dS$ (B) $\iint_S \nabla \bullet \vec{F}\, dS$ (C) $\iint_S (\nabla \bullet \vec{F})\, \hat{n}\, dS$ (D) $\iint_S (\nabla \times \vec{F}) \bullet \hat{n}\, dS$	ANS **D**	(CLO-2, Remember)
9.	The maximum value of the directional derivative is (A) $\lvert\nabla \varphi\rvert$ (B) curl φ (C) grad φ (D) $\lvert\nabla \times \varphi\rvert$	ANS **A**	(CLO-2, Remember)
10.	If $\vec{F}$ is irrotational, then $Curl\, \vec{F} =$ (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) $\nabla \bullet \vec{F} = 0$ (B) 0 (C) $\nabla \times \vec{F} = 0$ (D) $\nabla \bullet (\nabla \times \vec{F}) = 0$	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 (B) $2\,\pi$ (C) $3\,\pi$ (D) 0	ANS **B**	(CLO-2, Apply)
16.	By Green's theorem, the area bounded by a simple closed curve is (A) $\int_C \ x\,dy - y\,dx$ (B) $\int_C \ x\,dy + y\,dx$ (C) $\int_C \ y\,dx - x\,dy$ (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 (B) irrotational (C) rotational (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) $\frac{\vec{i}+\vec{j}+\vec{k}}{\sqrt{3}}$ (B) $\frac{\vec{i}+\vec{j}-\vec{k}}{\sqrt{3}}$ (C) $\frac{\vec{i}-\vec{j}-\vec{k}}{\sqrt{3}}$ (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 $div\,\vec{r} =$ (A) 0 (B) 1 (C) 2 (D) 3	ANS **D**	(CLO-2, Remember)
20.	If φ is a scalar function, then $\nabla \times \nabla\varphi =$ (A) $\vec{0}$ (B) solenoidal (C) irrotational (D) constant	ANS **A**	(CLO-2, Remember)
21.	The value of line integral $\int_C \ \vec{F} \bullet d\vec{r}$ where C is the line $y = x$ in XY plane from (1, 1) to (2, 2) is (A) 0 (B) 1 (C) 2 (D) 3	ANS **D**	(CLO-2, Apply)
22.	Angle between two level surfaces $\varphi_1 = C$ and $\varphi_2 = C$ is given by (A) $\sin\theta = \frac{\nabla\varphi_1 \bullet \nabla\varphi_2}{\lvert\nabla\varphi_1\rvert\,\lvert\nabla\varphi_2\rvert}$ (B) $\cos\theta = \frac{\nabla\varphi_1 \bullet \nabla\varphi_2}{\lvert\nabla\varphi_1\rvert\,\lvert\nabla\varphi_2\rvert}$ (C) $\tan\theta = \frac{\nabla\varphi_1 \bullet \nabla\varphi_2}{\lvert\nabla\varphi_1\rvert\,\lvert\nabla\varphi_2\rvert}$ (D) $\tan\theta = \frac{\nabla\varphi_1 \times \nabla\varphi_2}{\lvert\nabla\varphi_1\rvert\,\lvert\nabla\varphi_2\rvert}$	ANS **B**	(CLO-2, Apply)

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

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

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