Vector Integration

S.No	Questions
	Line Integral
1	Find the work done of the moving partical in the force filed $\bar{F} = 3x^2\hat{\imath} + (2xz - y)\hat{\jmath} + z\hat{k}$ along the line (0, 0,0) to (2,1,3)
2	Evaluate $\int_A^B \left(3xy\,dx - y^2dy\right)$ along the parabola $y = 2x^2$ from $A(0,0)$ to $B(1,2)$. What is the integral if the path is a straight line joining A to B ?
3	Find the work done in moving a particle in the force field $\bar{F} = 3xy\,i - 5z\,j + 10x\,k$ along $x = t^2 + 1, y = 2t^2, z = t^3$ from $t = 1\,to\,t = 2$.
4	Show that $\bar{F} = \left(2xyz^2\right)i + \left(x^2z^2 + z\cos yz\right)j + \left(2x^2yz + y\cos yz\right)k$ is conservative. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$ and hence, find the work done by $\bar{F}$ in displacing a particle from (0,0,1) to (1,π/4,2) along the straight line AB.
5	Prove that $\bar{F} = (2xy + z)\;i + \left(x^2 + 2yz^3\right)\;j + \left(3y^2z^2 + x\right)k$ is irrotational. Find its scalar potential ϕ and evaluate $\int_{(1,2,0)}^{(2,2,1)} \bar{F}.d\bar{r}$ along the straight line .
6	If $\bar{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ be the force field, find the work done in moving a particle from (1,2.-4) to (3,3,2).
7	Prove that $\bar{F} = 2xye^zi + x^2e^zj + x^2ye^zk$ is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$ and hence, find the work done by $\bar{F}$ in displacing a particle from (2,1,1) to (2,0,1) .
8	Prove that $\bar{F} = 3x^2yi + (x^3 - 2yz^2)j + (3z^2 - 2y^2z)k$ is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$ and hence, find the work done by $\bar{F}$ in displacing a particle from (0,0,0) to (1,1,1) .
9	A vector field is given by $\bar{F} = (x^2 - y^2 + x\,)i + (2xy + y)j$ is irrotational. Find its scalar potential and also find the line integral from (1,2) to (2,1)
10	Prove that $\bar{F} = (3x^2yz - 3y)i + (x^3z - 3x)j + (x^3y + 2z)k$ is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$ and hence, find the work done by $\bar{F}$ in displacing a particle from (0,0,0) to (1,1,1) .
11	Find scalar potential of $\bar{F} = (6xy^2 - 2z^3)i + (6x^2y + 2yz)j + (y^2 - 6z^2x)k$ if exists. Also find the work done by $\bar{F}$ in displacing a particle from (1,0,2) to (0,1,1) .
12	Evaluate $\int_c \bar{F}.d\bar{r}$ along the arc of the curve $\bar{r} = (e^t\cos t)i + (e^t\sin t\,j)$ from (1,0) to $(e^{2\pi}, 0)$ where $\bar{F} = \frac{xi+yj}{(x^2+y^2)^{3/2}}$.
13	Find the constants a, b, c such that $\bar{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is a conservative field . Find its scalar potential and work done in moving a particle from (1,20) to (11,-1).
14	Prove that $\int_{(1,2)}^{3,4}(6xy^2 - y^3)dx + (6x^2y - 3xy^2dy$ is independent of the path joining the points (1,2) and (3,4) and hence evaluate it.
15	Find the constant a so that $\bar{F} = (axy - z^3)i + (a - 2)x^2j + (1 - a)xz^2k$ is a conservative field . Find its scalar potential and work done in moving a particle from (1,2.-3) to (1,-4,2).
	GREEN'S Theorem: State GREEN'S Theorem and hence evaluate the following integrals

16	$\int_C \left(2x^2 - y^2\right)dx + \left(x^2 + y^2\right)dy$ where 'c' is the boundary of the surface enclosed by the lines $x = 0,\ y = 0,\ x = 2,\ y = 2$.
17	$\int_C \overline{F} \cdot d\overline{r}$ where $\overline{F} = x^2 i - x\,y\,j$ &'c' is the triangle having vertices (0,2),(2,0),(4,2).
18	$\int_C \left(\frac{1}{y}dx + \frac{1}{x}dy\right)$ where 'c' is the boundary of the region defined by $x = 1, x = 4, y = 1, \& \ y = \sqrt{x}$.
19	$\int_C \left(x^2 - y\right)dx + \left(2y^2 + x\right)dy$ around the boundary of the region defined by $y = 4, \& \ y = x^2$.
20	$\int_c \overline{F} \cdot d\,\overline{r}$ where $\bar{F} = -xy(x\,i - y\,j)$ and c is $r = a\,(1 + cos\theta)$
21	The work done by $\bar{F} = (4x - 2y)i + (2x - 4y)j$ in moving a particle once counter clockwise around the circle $(x-2)^2 + (y-2)^2 = 4$
22	$\int_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ around the boundary in the xy plane enclosed by the x-axis and the semi circle $y = \sqrt{1 - x^2}$.
23	$\int_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where c is the region bounded by $y = \sqrt{x}$ & $y = x$
24	$\int_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where c is the region bounded by $y = \sqrt{x}$ & $y = x^2$
25	$\int_c \overline{F} \cdot d\,\overline{r}$ where $\bar{F} = (x^2 - xy)i + (x^2 - y^2)j$ and c is the region bounded by $x^2 = 2y$ & $x = y$
26	$\int_C \left[\left(x^2 + y^2\right)i + \left(x^2 - y^2\right)j\right] \cdot d\overline{r}$ where 'c' is the boundary of the region enclosed by circles $x^2 + y^2 = 4, \quad x^2 + y^2 = 16$
27	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F} = x^2\, i + x\,y\ j$ and C is the boundary of the rectangle $x = 0, y = 0, x = a, y = b$.
28	$\int_C \left(x\,y\,dx + x\,y^2\,dy\right)$ where C is the square in the xy-plane with vertices $(1,0),(0,1),(-1,0), and\ (0,-1)$
	STOKE'S Theorem: State STOKE'S Theorem and hence evaluate the following integrals
29	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F} = y\,i + z\ j + x\,k$ and C is the boundary of the surface $x^2 + y^2 = 1 - z,\ z > 0$.
30	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F} = \left(2x - y\right)i - y\,z^2\ j - y^2\,z\,k$ and C is the boundary of the hemisphere $x^2 + y^2 + z^2 = a^2$ lying above the xy-plane.
31	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F} = -x\,y\,i + 2\,y\,z\ j + y^2\,k$ and C is the boundary of the sphere $x^2 + y^2 + z^2 = a^2, z = 0.$

32	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F}=(x+y)i+(y+z)\,j-x\;k$ and s is the surface of the plane $2x+y+z=2$ in the first quadrant.
33	Evaluate $\iint_s (\nabla\times\overline{F})\cdot d\bar{s}$ where $\overline{F}=(2x-y+z)i+(x+y-z^2)\,j+(3x-2y+4z)\;k$ and s is the surface of the cylinder $x^2+y^2=4$ bounded by the plane $z=9$ and open at the other end.
34	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F}\;=(x^2+y^2)i+4xyj$ and c is the boundary of the region bounded by the parabola $y^2=4x$ and line $x=4$.
35	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F}\;=(x+y)i+(2x-z)j+(y+z)k$ and c is the boundary of the triangle cutoff by the plane x + 2y + 3z = 6 on the coordinate axes.
36	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F}\;=z^2i+x^2j+y^2k$ and C is the curved surface of the hemisphere $x^2+y^2+z^2=100, z\geq 0$
37	Work done in moving a particle once around the perimeter of the triangle with vertices (2,0,0), (0,3,0) and (0,0,6) under the force $\overline{F}\;=(x+y)i+(2x-z)j+(y+z)k$
38	$\int_C \overline{F}.d\,\overline{r}$ where $\overline{F}\;=zi+xj+yk$ and C is the boundary of the hemisphere $z=\sqrt{1-x^2-y^2}$ in the xy plane
	GAUSS'S DIVERGENCE Theorem: State GAUSS'S DIVERGENCE Theorem and hence evaluate the following
39	$\iint_S \bar{N}.\bar{F}ds$ where $\bar{F}=4xi-2y^2j+z^2k$ and S is the region bounded by $x^2+y^2=4, z=0, z=3$.
40	$\iint_S \bar{N}.\bar{F}ds$ where $\bar{F}=(2x+3z^2)i-(xz^2+y)j+(y^2+2z)k$ and S is the surface of the sphere with centre (3,-14, -17) and radius 3.
41	$\iint_S \bar{N}.\bar{F}ds$ where $\bar{F}=4xzi-y^2j+yzk$ and S is the surface of the cube bounded by the planes $x=0, x=1, y=0, y=1, z=0, z=1$.
42	$\iint_S \bar{F}.d\bar{s}$ where $\bar{F}=xi+yj+zk$ and S is the triangle (1,0,0), (0,1,0) and (0,0,1).
43	$\iint_S \bar{F}.d\bar{s}$ where $\bar{F}=x^3i+y^3j+z^3k$ and S is the surface of the sphere $x^2+y^2+z^2=9$.
44	$\iint_S \bar{F}.d\bar{s}$ where $\bar{F}=xi+yj+zk$ and S is the cylindrical surface bounded by $x^2+y^2=a^2, z=0, z=h$
45	$\iint_S \bar{N}.\bar{F}ds$ where $\bar{F}=2x^2yi-y^2j+4xz^2k$ and S is the region of first octant bounded by $y^2+z^2=9, x=2$
46	By expressing $\iint_S (y^2z^2i+z^2x^2j+x^2y^2k).d\bar{s}$ as volume integral and evaluate over the part of $x^2+y^2+z^2=1$ lying above the xy plane.
47	$\iiint_v \nabla.\bar{F}dv$ where $\bar{F}=4xi-2y^2j+z^2k$ over the cylindrical region $x^2+y^2=a^2, z=0, z=b$.