



SNS COLLEGE OF TECHNOLOGY
Differential Equation and Transforms-VECTOR CALCULUS

PART B

1. Find the Values of 'a' and 'b' so that the surfaces $ax^3 - by^2z = (a + 3)x^2$ and $4x^2y - z^3 = 11$ may cut orthogonally at $(2, -1, -3)$.
2. Prove $\vec{F} = (y^2 \cos x + z^3)\vec{i} + (2y \sin x - 4)\vec{j} + 3xz^2\vec{k}$ is irrotational and find its scalar potential ϕ .
3. Show that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is Irrotational vector and the scalar potential function ϕ Such that $\vec{F} = \nabla\phi$.
4. Find the constants a, b and c so that \vec{F} may be irrotational Where $\vec{F} = (axy + bz^3)\vec{i} + (3x^2 - cz)\vec{j} + (3xz^2 - y)\vec{k}$ and for these values of a, b, c find the scalar potential of \vec{F} .
5. If $\vec{F} = (3x^2 + 6y)\vec{i} + 14yz\vec{j} + 20xz^2\vec{k}$, evaluate $\int_C \vec{F} \cdot d\vec{r}$ from $(0, 0, 0)$ to $(1, 1, 1)$ over the curve $x = t, y = t^2, z = t^3$.
6. Find the work done when a force $\vec{F} = (y + 3)\vec{i} + xz\vec{j} + (yz - x)\vec{k}$, moves a particle from $(0, 0, 0)$ to $(2, 1, 1)$ along the curve $x = 2t^2, y = t, z = t^3$.
7. Evaluate $\iint_S \vec{F} \cdot \vec{n} ds$ where $\vec{F} = 18z\vec{i} - 12\vec{j} + 3y\vec{k}$ as S is the part of the plane $2x + 3y + 6z = 12$ Which is in the first octant?
8. Verify Green's theorem in the plane for $\int (3x^2 - 8y^2)dx - (4y - 6xy)dy$ where C is The boundary of the region defined by $x = y^2, y = x^2$.



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9. Evaluate by Green's theorem, $\int_C (e^{-x} \sin y dx + \cos y dx)$ C being the rectangle

with vertices $(0,0)$, $(\pi,0)$, $(\pi, \pi/2)$ and $(0, \pi/2)$.

10. State Green's theorem. Verify the theorem for $\oint_C (xy^2 - 2xy)dx + (x^2y + 3)dy$

around of C of the region enclosed by $y^2 = 8x$ and $x = 2$.

11. Apply Green's theorem in the plane to evaluate $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$

Where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$.

12. Evaluate $\int [(2xy - x^2)dx - (x + y^2)dy]$ using Green's theorem where C is the

Closed curve formed by $x = y^2$, $y = x^2$.

13. Verify Green's theorem in the plane for $\int (xy + y^2)dx - x^2dy$ where C is the

boundary of the common area between $y = x^2$, $y^2 = x$.

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boundary of the common area between $y = x^2$, $y = x$.

15. Apply Green's theorem in the plane to evaluate $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$



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where C is the boundary of the region defined by $x=0$, $y=0$ and $x + y = 1$.

16. Verify Gauss divergence theorem for $\vec{F} = (x^2 - yz)\vec{i} + (y^2 - zx)\vec{j} + (z^2 - xy)\vec{k}$ taken

Over the rectangular parallelepiped $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c$.

17. Verify Gauss divergence theorem for the function $\vec{F} = y\vec{i} + x\vec{j} + z^2\vec{k}$ where S is the surface of the cuboids formed by the planes $x=0, x=1, y=0, y=2, z=0, z=3$.

18. Verify Gauss divergence theorem for the function $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube $x=0, x=1, y=0, y=1, z=0, z=1$.

19. Verify divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ when S is the closed surface of the Cube formed by $x = 0$, $x=1, y=0, y=1, z=0, z=1$

20. Evaluate by Stoke's theorem $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = \sin z\vec{i} - \cos x\vec{j} + \sin y\vec{k}$ where

C is the boundary of the common area between $y = x^2, y = x$.

21. Verify Stokes's theorem for $\vec{F} = (x^2 + y^2)\vec{i} - 2xy\vec{j}$ taken around the rectangle bounded by the lines $x = \pm a, y = 0, y = b$.

22. Verify Stoke's theorem for $\vec{F} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - xz\vec{k}$ over the open surfaces of the cube $x = 0, y = 0, z = 0, x=1, y=1, z=1$ not included in the XOY plane.



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23. Verify Stoke's theorem for a vector defined by $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ in the rectangular region in the XOY plane obtained by the lines $x=0$, $x=a$, $y=0$ and $y=b$.