SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai

Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &

Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)

COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF MATHEMATICS

CourseCode:	**23MAT103**
CourseName:	**DIFFERENTIAL EQUATIONS AND TRANSFORMS**
Year/Sem:	**I/II**

QUESTION BANK
UNIT-I VECTOR CALCULUS

Unit-I /Part-A/2Marks				
S.No	**Questions**	**Mark Splitup**	**K – Level**	**CO**
1.	Find $\nabla(r^n)$.	2	K2	CO1
2.	Find $\nabla(logr)$.	2	K2	CO1
3.	Find $grad\phi$ if $\phi=3x^2y-y^3z^2$ at the point $(1,-2,-1)$.	2	K2	CO1
4.	Find the unit normal to the surface $x^2+y^2-z^2=1$ at $(1,1,1)$.	2	K2	CO1
5.	Find the directional derivative of $\phi=x^2yz+4xz^2$ at the Point $(1,-2,-1)$ in the direction of $2\imath\rightarrow-\jmath\rightarrow-2k\rightarrow\rightarrow$.	2	K2	CO1
6.	Prove that $divr\rightarrow\rightarrow=3$ and $curlr\rightarrow\rightarrow=0\vec{\rightarrow}\rightarrow\rightarrow$.	2	K1	CO1
7.	Show that $F\rightarrow\rightarrow\rightarrow=(x+2y)\imath\rightarrow\rightarrow+(y+3z)\jmath\rightarrow\rightarrow+(x^2-2z)k\rightarrow\rightarrow$is solenoidal.	2	K1	CO1
8.	Find a such that $F\rightarrow\rightarrow\rightarrow=(3x-2y+z)\imath\rightarrow\rightarrow+(4x+ay-z)\jmath\rightarrow\rightarrow(x-y+2z)k\rightarrow\rightarrow$ is solenoidal.	2	K2	CO1
9.	Prove that $F\rightarrow\rightarrow\rightarrow=yz\imath\rightarrow\rightarrow+zx\jmath\rightarrow\rightarrow+xyk\rightarrow\rightarrow$ is irrotational.	2	K2	CO1
10.	Find the values of a,b,c so that the vector $F\rightarrow\rightarrow\rightarrow=(x+y+az)\imath\rightarrow\rightarrow+(bx+2y-z)\jmath\rightarrow\rightarrow+(-x+cy+2z)k\rightarrow\rightarrow$is irrotational.	2	K2	CO1
11.	Find the values of a,b,c so that the vector $F\rightarrow\rightarrow\rightarrow=(x+2y+az)\imath\rightarrow\rightarrow+(bx-3y-z)\jmath\rightarrow\rightarrow+(4x+cy+2z)k\rightarrow\rightarrow$ is irrotational.	2	K2	CO1
12.	If $A\rightarrow$and $B\rightarrow\rightarrow$are irrotational, then prove that $A\rightarrow\times B\rightarrow\rightarrow$is solenoidal.	2	K2	CO1
13.	Prove that curl(gradϕ)$=0\vec{\rightarrow}\rightarrow\rightarrow$.	2	K2	CO1
14.	If $F\rightarrow\rightarrow\rightarrow=x^3\imath\rightarrow\rightarrow+y^3\jmath\rightarrow+z^3k\rightarrow\rightarrow$,then find $div(curlF\rightarrow\rightarrow\rightarrow)$.	2	K1	CO1
15.	State Green's theorem.	2	K1	CO1
16.	Find area of a circle of radius a using Green's theorem	2	K2	CO1
17	State Gauss divergence theorem.	2	K1	CO1
18	State Stoke'stheorem.	2	K1	CO1

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DEPARTMENT OF MATHEMATICS

Unit - I / Part - B/ 16, 8 Marks				
S.No	Questions	Marks Splitup	K - Level	CO
1.	Find the angle between the surfaces $x \log z = y^2 - 1$ and $x^2y = 2 - z$ at the point $(1, 1, 1)$.	8	K2	CO1
2.	Find a and b so that the surfaces $ax^3 - by^2z - (a+3)x^2 = 0$ And $4x^2y - z^3 - 11 = 0$ cut orthogonally at the point $(2, -1, -3)$.	8	K2	CO1
3.	Find a and b so that the surfaces $ax^2 - byz = (a+2)x$ and $4x^2y + z^3 = 4$ cut orthogonally at the point $(1, -1, 2)$.	8	K2	CO1
4.	Show that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational vector and find the scalar potential ϕ such that $\vec{F} = \nabla\phi$	8	K2	CO1
5.	Prove that $\vec{F} = (y^2 \cos x + z^3)\vec{i} + (2y \sin x - 4)\vec{j} + 3xz^2\vec{k}$ is irrotational and find its scalar potential.	8	K2	CO1
6.	If $\vec{r}$ is the position vector of the point (x, y, z), Prove that $\nabla^2 r^n = n(n+1)r^{n-2}$. Hence find the value of $\nabla^2\left(\frac{1}{r}\right)$.	8	K2	CO1
7.	If $\vec{A} = (3x^2 + 6y)\vec{i} + 14yz\vec{j} + 20xz^2\vec{k}$, evaluate $\int_C \vec{A} \cdot d\vec{r}$ $(0, 0, 0)$ to $(1, 1, 1)$ over the curve $x = t, y = t^2, z = t^3$ and $\vec{r}$ is the position vector.	8	K3	CO1
8.	Find the work done by the force $\vec{F} = (x^2 - y^2 + x)\vec{i} - (2xy + y)\vec{j}$ which moves a particle in xy plane from $(0, 0)$ to $(1, 1)$ along the parabola $y^2 = x$.	8	K3	CO1
9.	Verify Green's theorem for $\int_C [(xy + y^2)\,dx + x^2\,dy]$ where C is the boundary of the common area between $y = x^2$ and $y = x$.	16	K3	CO1
10.	Verify Green's theorem in a plane for $\int_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$, where C is the boundary of the region defined by $x = y^2$, $y = x^2$.	16	K3	CO1
11.	Verify Green's theorem in a plane for $\int_C [3x - 8y^2)dx + (4y - 6xy)dy]$, where C is the boundary of the region defined by the lines $x = 0$, $y = 0$ and $x + y = 1$.	16	K3	CO1
12.	Verify Gauss Divergence theorem for $\vec{F} = 4xz\,\vec{i} - y^2\,\vec{j} + yz\,\vec{k}$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.	16	K3	CO1
13.	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 parallelopiped bounded by $x = 0, y = 0, z = 0$ and $x = a, y = b, z = c$.	16	K3	CO1

14.	Verify Gauss Divergence theorem for the vector function $\vec{F} = (x^3 - yz)\vec{i} - 2x^2y\vec{j} + 2\vec{k}$ over the cube bounded by $x = 0, y = 0, z = 0$ and $x = a, y = a, z = a$.	16	K3	CO1
15.	Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\vec{i} - 2xy\vec{j}$ taken round the rectangle bounded by the lines $x = \pm a, y = 0, y = b$	16	K3	CO1
16.	Verify Stoke's theorem for $\vec{F} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - xz\vec{k}$ over the cube bounded by $x = 0, y = 0, z = 0$ and $x = 1, y = 1, z = 1$.	16	K3	CO1
17.	Verify Stoke's theorem for $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ taken round the rectangle bounded by the lines $x = 0, x = a, y = 0, y = b$.	16	K3	CO1