H.T No										

Sreenidhi Institute of Science and Technology
(An Autonomous Institution)

Regulations: **A22**

Code No: 9HC12 **Date: 28-Aug-2023 (FN)**

B.Tech I-Year II- Semester External Examination, Aug/Sept-2023 (Regular)
ADVANCED CALCULUS (Common to All)

Time: 3 Hours **Max.Marks:60**

Note: *a) No additional answer sheets will be provided.*
b) All sub-parts of a question must be answered at one place only, otherwise it will not be valued.
c) Missing data can be assumed suitably.

Bloom's Cognitive Levels of Learning (BCLL)

Remember	L1	Apply	L3	Evaluate	L5
Understand	L2	Analyze	L4	Create	L6

Part - A **Max.Marks: 6x2=12**
ANSWER ALL QUESTIONS, EACH QUESTION CARRIES 2 MARKS.

		BCLL	CO(s)	Marks
1	Find $\frac{\partial u}{\partial x}$ where $u = x^2 tan^{-1}\frac{y}{x} - y^2 tan^{-1}\frac{x}{y}$.	L2	CO1	[2M]
2	Evaluate the integral $\int_1^2 \int_{-3}^4 \int_1^3 (x + xy + z^2) dzdydx$.	L3	CO2	[2M]
3	Form the differential equation for $z = (x-a)^2 + (y-b)^2$ where a and b are arbitrary constants.	L3	CO3	[2M]
4	Write Dirichlet's conditions.	L1	CO4	[2M]
5	Calculate divergence of the vector function $\vec{F} = 2x^2yi - xy^2j + 3z^2k$ at (1,1,1).	L3	CO5	[2M]
6	State Stoke's theorem.	L1	CO6	[2M]

Part – B **Max.Marks: 6x8=48**
ANSWER ALL QUESTIONS. EACH QUESTION CARRIES 8 MARKS.

			BCLL	CO(s)	Marks
7.	a)	If $u = f(r)$ where $r = \sqrt{x^2+y^2+z^2}$ then show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = f''(r) + \frac{2}{r}f'(r)$	L3	CO1	[8M]
		OR			
	b)	Examine for extreme values, if any, of the function f(x, y) = $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$	L3	CO1	[8M]
8.	a)	i) Evaluate the integral $\iint_R x^2 dxdy$ over the region 'R' bounded by	L4	CO2	[4M]
		$x = 0, y = 0, x + y = 2$	L3	CO2	[4M]
		ii) Evaluate the integral $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x \, dzdxdy$			
		OR			
	b)	Change the order of integration to evaluate $\int_0^1 \int_{x^2}^{2-x} xydydx.$	L4	CO2	[8M]
9.	a)	i) Find the solution of the differential equation $(z - px - qy)(p^2 + q^2) = 1$	L3	CO3	[4M]
		ii) Solve the Lagrange equation $xp - yq = xy$.	L3	CO3	[4M]
		OR			
	b)	Solve the differential equation $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.	L3	CO3	[8M]

10.	a)	Find Fourier series expansion of the function $f(x) = x - x^2$ in $[-\pi,\pi]$ Hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots \dots. = \frac{\pi^2}{12}$.	L4	CO4	[8M]
		OR			
	b)	i) Express $f(x) = x$ as a half range cosine series in the interval [0,2] .	L4	CO4	[4M]
		ii) Obtain Fourier series expansion of the function f(x) = x in [-1,1].	L3	CO4	[4M]
11.	a)	i) Find the directional derivative of f(x,y,z) = $xy^2 + xyz + zx$ along the direction of the vector $i + 2j + 2k$ at the point (1, 2, 0).	L3	CO5	[4M]
		ii) Show that the vector function $\bar{F} = (2x + yz)i + (2y + xz)j + (2z + xy)k$ is irrotational.	L2	CO5	[4M]
		OR			
	b)	i) Verify whether the vector field $\vec{F} = (x + 3y)i + (y - 3z)j + (x - 2z)k$ is solenoidal or not.	L4	CO5	[4M]
		ii) Find Unit normal vector to the surface $f = x^2 + xyz + z^2$ at (1,0,-2)	L3	CO5	[4M]
12.	a)	Verify Gauss's divergence theorem for $\bar{F} = (x^3 - yz)i - 2x^2yj + 2k$, taken over the cube bounded by the planes $x = 0, x = a, y = 0, y = a, z = 0,$ and $z = a$	L4	CO6	[8M]
		OR			
	b)	Verify Green's theorem for $\bar{F} = (x + y)i + 2x^2j$ where 'c' is closed curve in xy-plane bounded by $y = x^2$ and $x = y^2$.	L4	CO6	[8M]

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