H.T No										

Sreenidhi Institute of Science and Technology
(An Autonomous Institution)

Regulations: A22

Code No:9HC12 **Date: 31-August-2024 (FN)**

B.Tech I-Year II- Semester External Examination, August-2024 (Regular & Supplementary)

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	Calculate the first order partial derivatives $\frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}$ where $u(x,y) = ye^{-2x} + x\log(xy) - x^2$	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 $z = f(x-y) + g(x+y)$ where f and g are arbitrary functions.	L3	CO3	[2M]
4	Define Fourier Series.	L1	CO4	[2M]
5	Calculate $curl(grad\ u)$ where $u(x,y,z) = xy + yz + zx$	L2	CO5	[2M]
6	State Gauss divergence theorem.	L1	CO6	[2M]

Part – B **Max.Marks: 6x8=48**

ANSWER ALL QUESTIONS. EACH QUESTION CARRIES 8 MARKS.

		BCLL	CO(s)	Marks
7.	If $U = \frac{1}{\sqrt{x^2+y^2+z^2}}$, $x^2+y^2+z^2 \neq 0$, then prove that $\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} + \frac{\partial^2 U}{\partial z^2} = 0$	L3	CO1	[8M]
	OR			
8	Examine for extreme values, if any, of the function $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$	L4	CO1	[8M]
9.	i) Evaluate the integral $\iint_R x^2 dxdy$ over the region 'R' bounded by $x = 0, y = 0, x + y = 2$	L3	CO2	[8M]
	ii) Evaluate the integral $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x\, dzdxdy$	L3		
	OR			
10	Evaluate the triple integral $\int_0^1 \int_1^2 \int_2^3 x^2y^2z^3\, dx\, dy\, dz$	L3	CO2	[8M]
11	i). Form the partial differential equation by eliminating the arbitrary constants from $z = a\log\left\{\frac{b(y-1)}{1-x}\right\}$	L3	CO3	[8M]
	ii). Solve Lagrange's linear equation $x(y-z)p + y(z-x)q = z(x-y)$	L3		
	OR			
12	Solve the differential equation $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.	L3	CO3	[8M]

13	Find Fourier series expansion of the function $f(x) = x - x^2$ in $[-\pi, \pi]$ Hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots \ldots = \frac{\pi^2}{12}$.	L3	CO4	[8M]
	OR			
14	Obtain Half range Fourier cosine series expansion of $f(x) = x \sin x, 0 < x < \pi$ and hence show that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - - - - -- = \frac{\pi - 2}{4}$	L3	CO4	[8M]
15	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). ii) Show that the vector function $\bar{F} = (2x + yz)i + (2y + xz)j + (2z + xy)k$ is irrotational.	L3 L3	CO5	[8M]
	OR			
16	Show that the vector field defined by $F = yz\boldsymbol{i} + zx\boldsymbol{j} + xy\boldsymbol{k}$ is irrotational and find its scalar potential.	L3	CO5	[8M]
17	Make use of Green's theorem in a plane to evaluate the line integral $\oint_C (xy + y^2)dx + x^2 dy$, where C encloses the region bounded by $y = x$ and $y = x^2$	L4	CO6	[8M]
	OR			
18	Verify Stoke's theorem for $\bar{f} = (x^2 + y^2)i - 2xyj$ taken round the rectangle bounded by the lines x=±a, y=0 and y=b.	L4	CO6	[8M]

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