Course Code: 23BS2T04

BONAM VENKATA CHALAMAYYA INSTITUTE OF TECHNOLOGY & SCIENCE

(AUTONOMOUS)

I - B. Tech II-Semester Regular/Supplementary Examinations (BR23), June – 2025

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS (Common to All Branches)

Time: 3 hours | Max. Marks: 70

Question Paper consists of Part-A and Part-B
*Answer **ALL** the question in **Part-A and Part-B***

PART–A (10X2 = 20M)

		Marks	CO	BL
1. a)	Solve $\frac{ydx-xdy}{x^2}+e^y dy=0$.	(2M)	CO1	L2
b)	State Newton's Law of Cooling and write the differential equation of it.	(2M)	CO1	L1
c)	Solve $(D^2+1)y=0$.	(2M)	CO2	L2
d)	Find the P.I of $(D^2+1)y=e^{2x}$.	(2M)	CO2	L2
e)	Form the partial differential equation by eliminating the arbitrary function f from $z=f(2x+y)$.	(2M)	CO3	L2
f)	Solve the partial differential equation, p + q = 1.	(2M)	CO3	L2
g)	Find the greatest value of the directional derivative of the function $f=x^2+y^2+z^2$ at (1,1,1).	(2M)	CO4	L2
h)	Find $\nabla\times\bar{f}$, where $\bar{f}=z\bar{i}+x\bar{j}+y\bar{k}$.	(2M)	CO4	L2
i)	If $\bar{F}=ax\bar{i}+by\bar{j}+cz\bar{k}$, where a, b, c are constants then find $\iint \bar{F}.\bar{n}\,dS$, where S is the surface of the unit sphere.	(2M)	CO5	L2
j)	State Stoke's theorem.	(2M)	CO5	L1

PART–B (5X10 = 50M)

2.a)	Solve $\frac{dy}{dx}-\frac{2y}{x+1}=(x+1)^2$.	5(M)	CO1	L3
b)	A bacterial culture, growing exponentially, increases from 200 to 500 grams in the period from 6 a.m. to 9 a.m. How many grams will be present at noon.	5(M)	CO1	L3
	(OR)			
3.a)	Solve $x^2ydx-(x^3+y^3)dy=0$.	5(M)	CO1	L3
b)	If the temperature of a body is changing from 100^0C to 70^0C in 15 minutes, find when the temperature will be 40^0C, if the temperature of air is 30^0C.	5(M)	CO1	L3

4.a)	Solve $(D^2 - 4)y = 2cos^2x$.	5(M)	CO2	L2
b)	In an electric circuit, inductance(L) = 0.25 Henries, resistance(R) = 250 Ohms, capacitance(C) = 2×10^{-6} Farads, then find the charge q(t).	5(M)	CO2	L3
	(OR)			
5.	Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x}{1+e^x}$.	10(M)	CO2	L3
6.a)	Form a partial differential equation by eliminating the arbitrary constants h, k from $(x-h)^2 + (y-k)^2 + z^2 = a^2$.	5(M)	CO3	L2
b)	Solve the partial differential equation, $(y-z)p + (x-y)q = (z-x)$.	5(M)	CO3	L3
	(OR)			
7.a)	Form a partial differential equation by eliminating the arbitrary functions $f(x)$ and $g(y)$ from $z = yf(x) + xg(y)$.	5(M)	CO3	L2
b)	Solve the partial differential equation, $\left(D^3 - 7DD'^2 - 6D'^3\right)z = e^{2x+y}$.	5(M)	CO3	L3
8.a)	Find the directional derivative of $\phi = x^2 - 2y^2 + 4z^2$ at (1,1, -1) in the direction of $2\bar{\imath} + \bar{\jmath} - 2\bar{k}$.	5(M)	CO4	L2
b)	Find $curl\,\bar{f}$, where $\bar{f} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$.	5(M)	CO4	L2
	(OR)			
9.	Show that vector $(x^2 - yz)\bar{\imath} + (y^2 - zx)\bar{\jmath} + (z^2 - xy)\bar{k}$ is irrotational and find its scalar potential.	10(M)	CO4	L3
10.a)	Find the line integral $\int(y^2dx - x^2dy)$ round the triangle whose vertices are (1,0), (0,1), (-1,0) in the xy -plane.	5(M)	CO5	L2
b)	Using Gauss Divergence theorem to evaluate, $\iint[(x+z)dydz + (y+z)dzdx + (x+y)dxdy]$ over S, where S is the surface of the sphere $x^2 + y^2 + z^2 = 4$.	5(M)	CO5	L3
	(OR)			
11.	Verify Green's theorem $\int[(2xy - x^2)dx + (x^2 + y^2)\,dy]$ over the curve C, where C is the closed region bounded by the curves: $y = x^2$ and $y^2 = x$.	10(M)	CO5	L5

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