PVP 23

Code: 23BS1201

I B.Tech - II Semester – Regular / Supplementary Examinations MAY 2025

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS
(Common for ALL BRANCHES)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Find the integrating factor that makes the equation $y(x^2y^2+2)dx+x(2-x^2y^2)dy=0$ exact.	L2	CO1
1.b)	Solve $xdy-ydx=xy^2dx$.	L3	CO2
1.c)	Find the particular integral of $\left(D^2+4\right)y=\cos 2x$.	L3	CO2
1.d)	Find the solution of $\left(D^2+D+1\right)y=0$.	L2	CO1
1.e)	Form the partial differential equation by eliminating the arbitrary function from $z=f(x^2-y^2)$.	L3	CO2
1.f)	Solve $2\frac{\partial^2 z}{\partial x^2}+5\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial^2 z}{\partial y^2}=0$.	L2	CO1
1.g)	Calculate the maximum value of the directional derivative of $\phi=x^2yz$ at (1, 4, 1).	L3	CO3
1.h)	Calculate the unit normal to the surface $xy=z^2$ at (4, 1, 2).	L3	CO3

1.i)	State Gauss divergence's theorem.	L1	CO1
1.j)	Given $F(t) = (5t^2 - 3t)\,i + 6t^3\,j - 7t\,k$, then evaluate $\int_{t=2}^{4} F(t)\,dt$.	L3	CO3

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	Solve the differential equation $\frac{dy}{dx} + \frac{y}{x} = y^2 x \sin x$.	L3	CO2	5 M
	b)	If the air is maintained at 30^0C and the temperature of the body cools from 80^0C to 60^0C in 12 minutes, find the temperature of the body after 24 minutes.	L4	CO4	5 M
OR					
3	a)	Solve $(x^2 y - 2xy^2)dx - (x^3 - 3x^2 y)dy = 0$.	L3	CO4	5 M
	b)	Bacteria in a culture growing exponentially so that the initial number has doubled in three hours. How many times the initial number will be present after 9 hours.	L4	CO4	5 M
UNIT-II					
4	a)	Solve $(D^2 + 2D + 2)y = e^{-x} + \sin 2x$.	L3	CO2	5 M
	b)	Solve $(D^2 - 3D + 2)y = x e^x$.	L3	CO2	5 M
OR					

5		Using method of variation of parameters, solve $\left(D^2+1\right)y=\cos x$.	L4	CO4	10 M
UNIT-III					
6	a)	Form the partial differential equation by eliminating the arbitrary function from $z=f\,(x^2+y^2)+x+y$.	L3	CO2	5 M
	b)	Solve $(x^2-y^2-z^2)p+2xyq=2xz$.	L3	CO2	5 M
OR					
7	a)	Solve the partial differential equation $(D^2-2DD'+D'^2)z=\sin x$.	L4	CO4	5 M
	b)	Solve the partial differential equation $\frac{\partial^2 z}{\partial x^2}-2\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial^2 z}{\partial y^2}=e^{x+y}$.	L4	CO4	5 M
UNIT-IV					
8	a)	Find the directional derivative of $\phi=xy^2+yz^2$ at (2, -1, 1) in the direction of $\bar{\imath}+2\bar{\jmath}+2\bar{k}$.	L4	CO5	5 M
	b)	Find the angle between surfaces $xy^2z=3x+z^2$ and $3x^2-y^2+2z=1$ at (1,-2, 1).	L3	CO3	5 M
OR					
9	a)	A vector field is given by $\bar{f}=2xyz^3\bar{i}+x^2z^3\bar{j}+3x^2yz^2\bar{k}$, then show that the field is irrotational and find its scalar potential function.	L4	CO5	5 M

	b)	If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ and $r = \lvert\bar{r}\rvert$ then find $div\left(\frac{\bar{r}}{r^3}\right)$.	L3	CO3	5 M
UNIT-V					
10	a)	Calculate $\int_S \bar{F}.\bar{n}\, ds$ where $\bar{F} = z\bar{i} + x\bar{j} - 3y^2 z\bar{k}$ and 'S' is $x^2 + y^2 = 1$ in the first octant between $z = 0$ to $z = 2$.	L3	CO5	5 M
	b)	Apply the Stoke's theorem for $\int_C [(x+y)dx + (2x-z)dy + (y+z)dz]$ where 'C' is the boundary of the triangle with the vertices (2, 0, 0), (0, 3, 0) and (0, 0,6).	L3	CO5	5 M
OR					
11	Verify the Green's theorem in the plane for $\int_C (x^2 - xy^3)dx + (y^2 - 2xy)dy$ where 'C' is a square with vertices (0, 0), (2, 0), (2, 2), (0, 2).		L4	CO5	10 M