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

QUESTION BANK
UNIT III - PARTIAL DIFFERENTIAL EQUATIONS

PART- A			
Q.No.	**Question**	**Bloom's Taxonomy Level**	**Domain**
1.	Form a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax^2 + by^2$. **Solution** p=2ax, q=2by a= p/2x, b=q/2y therefore PDE is 2z=px+qy.	BTL -4	Analyzing
2.	Eliminate the arbitrary function from $z = f(y/x)$ and form the partial differential equation **Solution:** px+qy=0	BTL -4	Analyzing
3.	Form the PDE from $(x-a)^2 + (y-b)^2 + z^2 = r^2$. **Solution** Differentiating the given equation w.r.t x &y, $z^2[p^2+q^2+1]=r^2$.	BTL -3	Applying
4.	Find the complete integral of p+q=pq. **Solution** p=a, q=b therefore z=$ax + \frac{a}{a-1}y + c$.	BTL- 4	Analyzing
5.	Form the partial differential equation by eliminating the arbitrary constants a, b from the relation log(az 1) x ay b. **Solution:** $\log(az-1) = x + ay + b$ Diff. p.w.r.t x&y, $\frac{ap}{az-1} = 1 - eqn1$ & $\frac{aq}{az-1} = a - eqn2$ $\frac{Eqn1}{Eqn2} \Rightarrow q = ap\ Sub\ in\ a(z-p) = 1 \Rightarrow q(z-p) = p$	BTL -4	Analyzing
6.	Form the PDE by eliminating the arbitrary constants a,b from the relation $z = ax^3 + by^3$. **Solution:** Differentiate w.r.t x and y $p = 3ax^2$, $q = 3by^2$ therefore 3z = px+qy.	BTL -4	Analyzing
7.	Form a p.d.e. by eliminating the arbitrary constants from z = $(2x^2+a)(3y-b)$. **Solution:** p = 4x(3y-b), q = $3(2x^2+a)$ 3y – b = p /4x $(2x^2+a)$ = q/3. Therefore 12xz = pq.	BTL -4	Analyzing
8.	Form the partial differential equation by eliminating arbitrary function ϕ from $\phi(x^2 + y^2, z\text{-}xy)$ 0 **Solution:** u = x^2+y^2 and v= z-xy. Then = 2x, u_y = 2y; v_x = p –y;	BTL -4	Analyzing
	v_y = q-x. $\begin{vmatrix} u_x & u_y \\ v_x & v_x \end{vmatrix} = 0 \Rightarrow 2xq - 2x^2 - 2yp + 2y^2 = 0$		

9.	Form the partial differential equation by eliminating arbitrary constants a and b from $(x-a)^2+(y-b)^2+z^2=1$ **Solution**: Differentiating the given equation w.r.t x &y, $z^2[p^2+q^2+1]=1$	BTL -4	Analyzing
10.	Solve [D -8DD' -D D'+12D']z = 0 **Solution:** The auxiliary equation is $m^3-m^2-8m+12=0$; m =2,2,-3 The solution is $z = f_1(y+x)+f_2(y+2x)+xf_3(y+2x)$.	BTL -3	Applying
11.	Find the complete solution of $q = 2px$ **Solution** Find the complete solution of $q = 2px$ **Solution:** Let q= a then p = a/2x dz= pdx +qdy 2z = alogx+2ay+2b.	BTL -3	Applying

12.	Find the complete solution of p+q=1 **Solution** Complete integral is z = ax + F(a) y +c Put p = a, q = 1-a. Therefore z = px + (1-a) y +c	BTL -3	Applying
13.	Find the complete solution of $p^3-q^3=0$ **Solution** Complete integral is z = ax + F(a) y +c Put p = a, q = a. Therefore z = px + q y +c	BTL -3	Applying
14.	Solve $[D^3+DD'^2-D^2D'-D'^3]z = 0$ **Solution** The auxiliary equation is $m^3-m^2+m-1=0$ m =1,-i, i ⇒ The solution is $z = f_1(y+x)+f_2(y+ix)+f_3(y-ix)$.	BTL -3	Applying
15.	Solve (D-1)(D-D'+1)z = 0. **Solution** $z = e^x f_1(y)+e^{-x}f_2(y+x)$	BTL -3	Applying
16.	Solve $\frac{\partial^2 z}{\partial x^2}-\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial z}{\partial x}=0$. **Solution:** A.E: D[D-D'+1] = 0 h=0, h=k-1 $z = f_1(y)+e^{-x}f_2(y+x)$	BTL -3	Applying
17.	Solve $(D^4-D'^4)z = 0$. **Solution:** A.E : $m^4-1=0$, m=±1, ±i. Z=C.F=$f_1(y+x)+f_2(y-x)+f_3(y+ix)+f_4(y-ix)$.	BTL -3	Applying
18.	Solve $(D^2-DD'+D'-1)Z=0$. **Solution:** The given equation can be written as $(D-1)(D-D'+1)Z=O$ $z=e^x f_1(y)+e^{-x}f_2(y+x)$	BTL -3	Applying
19.	Solve xdx + ydy = z.	BTL -3	Applying
	Solution The subsidiary equation is $\frac{dx}{\quad}=\frac{dy}{\quad}=\frac{dz}{\quad}$		

	$x \quad y \quad z$ $\frac{dx}{x} = \frac{dy}{y} \Rightarrow \log x = \log y + \log u$ $u = \frac{x}{y}$ Similarly $v = \frac{x}{z}$.		
20.	Form the p.d.e. by eliminating the arbitrary constants from z= ax +by +ab **Solution:** z= ax+by+ab p = a & q=b The required equation z= px+qy+pq.	BTL -3	Applying

	PART – B		
1.(a)	Find the PDE of all planes which are at a constant distance 'k' units from the origin.	BTL -4	Analyzing
1. (b)	Find the singular integral of $z = px + qy + 1 + p^2 + q^2$	BTL -2	Understanding
2. (a)	Form the partial differential equation by eliminating arbitrary function Φ from $\Phi(x^2 + y^2 + z^2, ax + by + cz) = 0$	BTL -4	Analyzing
2.(b)	Find the singular integral of $z = px + qy + p^2 + pq + q^2$	BTL -2	Understanding
3. (a)	Form the partial differential equation by eliminating arbitrary functions f and g from z = x f(x/y) + $y\, g(x)$	BTL -4	Analyzing
3.(b)	Find the singular integral of $z = px + qy + \sqrt{1 + p^2 + q^2}$.	BTL -3	Applying
4. (a)	Solve (D -7DD' -6D')z=sin(x+2y) .	BTL -3	Applying
4.(b)	Form the partial differential equation by eliminating arbitrary function f and g from the relation $z = xf(x+t) + g(x+t)$	BTL -4	Analyzing
5. (a)	Solve $(D^2-2DD')z=x^3y+e^{2x-y}$.	BTL -3	Applying
5.(b)	Solve x(y-z)p+y(z-x)q=z(x-y).	BTL -3	Applying
6. (a)	Find the singular integral of $px+qy+p^2-q^2$	BTL -2	Understanding
6.(b)	Find the general solution of $z = px + qy + p^2 + pq + q^2$.	BTL -3	Applying
7. (a)	Find the complete solution of $z^2(p^2 + q^2 + 1) = 1$	BTL -4	Analyzing

7. (b)	Find the general solution of $(D^2 + 2DD' + D'^2)z = 2\cos y - x\sin y$	BTL -2	Understanding
8. (a)	Find the general solution of $(D^2 + D'^2)z = x^2 y^2$	BTL -2	Understanding
8.(b)	Find the complete solution of $p^2 + x^2 y^2 q^2 = x^2 z^2$	BTL -2	Understanding
9. (a)	Solve $(D^2 - 3DD' + 2D'^2)\, z = (2 + 4x)e^{x+2y}$	BTL -3	Applying
9.(b)	Obtain the complete solution of $z = px + qy + p^2 - q^2$	BTL -2	Understanding
10.(a)	Solve $x(y^2 - z^2)\, p + y(z^2 - x^2)q = z(x^2 - y^2)$	BTL -3	Applying
10.(b)	Solve $(D^2 - 3DD' + 2D'^2)z = \sin(x + 5y)$	BTL -3	Applying
11(a)	Solve the Lagrange's equation $(x + 2z)\, p + (2xz - y)q = x^2 + y$	BTL -3	Applying
11(b)	Solve $(D^2 - DD' - 2D'^2)z = 2x + 3y + e^{2x+4y}$	BTL -3	Applying
12(a)	Solve $(D^2 + DD' - 6D'^2)z = y\cos x$	BTL -3	Applying
12(b)	Solve the partial differential equation $(x^2 - yz)p + (y^2 - xz)q = z^2 - xy$	BTL -3	Applying
13(a)	Solve $(D^2 - DD' - 20D'^2)\, z = e^{5x+y} + \sin(4x - y)$.	BTL -3	Applying
13(b)	Solve $(2D^2 - DD' - D'^2 + 6D + 3D')z = xe^{y}$	BTL -3	Applying
14(a)	Solve $(D^2 - 2DD')z = x^3 y + e^{2x-y}$	BTL -3	Applying
14(b)	Solve $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x + 2y)$	BTL -3	Applying

15(a)	Form the PDE by eliminating the arbitrary function from the relation $z = y^2 + 2f\left(\frac{1}{x} + logy\right)$.	BTL -4	Analyzing
15(b)	Solve the Lagrange's equation (x+2z)p+(2xz-y) = x +y.	BTL -3	Applying
16(a)	Solve $x^2p^2+y^2q^2 = z^2$.	BTL -3	Applying
16(b)	Solve $(D^2+DD'-6D'^2)z = y\cos x$	BTL -3	Applying