VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF MATHEMATICS

Topic: Assignment-2(PDE) **MAL-201, B. Tech., III-Semester.**

1. Formulate PDE by eliminating arbitrary constants.
   (i) $z = (x+a)(y+b)$ (ii) $2z = (ax+b)^2 + b$ (iii) $ax^2 + by^2 + z^2 = 1$
   (iv) $(x-a)^2 + (y-b)^2 = z$ (v) $z = ax^2 + 2bxy + cy^2$

2. Formulate PDE by eliminating arbitrary functions.
   (i) $z = xy + f(x^2+y^2)$ (ii) $z = x + y + f(xy)$ (iii) $z = f\left(\frac{xy}{z}\right)$
   (iv) $z = f(x-y)$ (v) $f(x^2+y^2+z^2, z^2-2xy) = 0$ (vi) $z = e^{ny}\phi(x-y), n \in \mathbb{N}$

3. Solve the following PDE's:
   (i) $y\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 4xy$ (ii) $\frac{\partial^2 z}{\partial y \partial x} = 4x\sin(3xy)$ (iii) $u_{xy} = 0$, $u = u(x,y)$

4. Find the general solution of the following PDEs:
   (i) $x^2p + y^2q = (x+y)z$ (ii) $(y-z)\frac{\partial u}{\partial x} + (z-x)\frac{\partial u}{\partial y} + (x-y)\frac{\partial u}{\partial z} = 0$
   (iii) $zy(z-3)p + (2x-z)q = y(2x-3)$ (iv) $px(z-2y^2) = (z-qy)(z-y^2-2x^3)$
   (v) $px(x+y) = qy((x+y)-(x-y)(2x+2y+z)$ (vi) $y^2p - xyq = x(z-2y)$
   (vii) $(y+zx)p - (x+yz)q = x^2 - y^2$ (viii) $x(x^2+3y^2)p - y(3x^2+y^2)q = 2z(y^2-x^2)$
   (ix) $x(y^2-z^2)p - y(z^2+x^2)q = z(x^2+y^2)$ (x) $2xzp + 2yzq = z^2 - x^2 - y^2$
   (xi) $p\cos(x+y) + q\sin(x+y=z)$ (xii) $(mz-ny)p + (nx-lz)q = ly - mx$

5. Find the integral surface of the PDE passing through given curve:
   (i) $x(y^2+z)p - y(x^2+z)q = (x^2-y^2)z$ passing through the curve $x+y=0, z=1$
   (ii) $2y(z-3)p + (2x-z)q = y(2x-3)$ passing through the curve $z=0, x^2+y^2=2x$
   (iii) $(2xy-1)p + (z-2x^2)q = 2(x-yz)$ passing through the curve $x=1, y=0$
   (iv) $y^2(x-y)p + (y-x)x^2q = (x^2+y^2)z$ passing through the curve $xy=a^3, y=0$
   (v) $(x-y)p + (y-x-z)q = z$ passing through $z=1, x^2+y^2=1$
   (vi) $x(z+2a)p + (xz+2yz+2ay)q = z(z+a)$ passing through
   (a) $y=0, z^2=4ax$ (b) $y=0, z^3+x(z+a)^2=0$
   (vii) $(3-2yz)p + x(2z-1)q = 2x(y-3)$ passing through $z=0, x^2+y^2=4$
   (viii) $y(x-z)p + (z^2-xz-x^2)q = y(2x-z)$ passing through $z=0, 2x^2+4y^2=1$

6. Solve the following PDE's:
   (i) $(3D^2+7DD'+2D'^2+7D+4D'+2)z = 0$ (ii) $(2D^2-DD'-D'^2-D+D')z = 0$
   (iii) $(2D^2+3DD'+D'^2+D+D')z = 0$ (iv) $(4D^3-3DD'^2+D'^3)z = 0$

7. Solve the following PDE's:
   (i) $(D^2-4DD'+3D'^2)z = \sqrt{x+3y}$ (ii) $(D^3+D^2D'-DD'^2)z = e^x\cos 2y$
   (iii) $4r-4s+t = 16\log(x+2y)$ (iv) $(D^2+2DD'+D'^2)z = 2\cos y - x\sin y$
   (v) $(D^2+DD'-6D'^2)z = y\cos x$

8. Solve the following PDE's:
   (i) $(D^2-3DD'+2D'^2)z = e^{2x+3y} + \sin(x-2y)$ (ii) $(D^2-DD')z = \cos x\cos 2y$
   (iii) $(D^2+2DD'+D'^2)z = x^2+xy+y^2$ (iv) $(D^3-2D^2D')z =)z = 2e^{2x} + 3x^2y$
   (v) $(D^3-5D^2+6D'^3)z = e^x$ (vii) $(D^3-7DD'^2-6D'^3)z = \sin(x+2y) + e^{2x+y}$