Indian Institute of Information Technology Ranchi Jharkhand-834010

Department of Mathematics

Assignment-V

Course Name: Mathematics-I, **Course Code:** MA1001

Instruction: Solve all the questions systematically and submit it **by 5:00PM** on **14th** March, 2023.

1. Form the PDE for the given relations:
   (i) $z = f(x^2 + y^2)$.
   (ii) $f(xyz,\ x^2 + y^2 + z^2) = 0$.
   (iii) $ax^2 + by^2 + z^2 = 1$.
   (iv) $(x-h)^2 + (y-k)^2 + z^2 = a^2$.
   (v) $xyz = g(x + y + z)$.
   (vi) $g\left(\frac{1}{x} - \frac{1}{y},\ \frac{xy}{z}\right) = 0$.
2. Classify the following PDEs as **Linear, Semi Linear** and **Quasilinear:**
   (i) $p + q = xyz + x$.
   (ii) $xp + yq = zx + yx$
   (iii) $xp + y^2q = xz^2 + xy$.
   (iv) $xzp + yq = xyz + y^2$.
3. Classify the following PDEs as **Hyperbolic, Parabolic** and **Elliptic**:
   (i) $x^2\frac{\partial^2 u}{\partial t^2} - \frac{\partial^2 u}{\partial x^2} = u$.
   (ii) $tu_{tt} + 2u_{xt} + xu_{xx} + u_x = 0$.
   (iii) $xu_{tt} + tu_{xt} + u_{tt} = 0$.
   (iv) $x^2u_{tt} + 3u_{xt} + xu_{xx} + 17u_t = 100u$.
   (v) $u_{tt} + tu_{xt} + xu_{xx} + 2u_t + u_x + 6u = 0$.
4. Solve the first order **Quasilinear** PDEs:
   (i) $p\ tanx + q\ tany = tanz$.
   (ii) $(y-z)p + (x-y)q = z - x$.
   (iii) $p + 3q = 5z + \tan(y - 3x)$
   (iv) $xp - yq + x^2 - y^2 = 0$.
   (v) $(z^2 - 2yz - y^2)p + (xy + zx)q = xy - zx$.
5. Solve the first order non-linear PDEs:
   (i) $q - p + x - y = 0$.
   (ii) $\sqrt{p} + \sqrt{q} = 2x$.
   (iii) $p^2 + q^2 = z(x + y)$.
   (iv) $z = px + qy + p^2 + q^2$.
   (v) $x^2p^2 + y^2q^2 = z^2$.
   (vi) $pq = 1$.
   (vii) $p^2 + q^2 = 1$.

6. Solve the higher order PDEs:

(i) $(D^3 - 4D^2D' + 3DD'^3)z = 0.$

(ii) $(D^4 - 2D^3D' + 2DD'^3 - D'^4)z = 0.$

(iii) $(D^4 + D'^4)z = 0.$

(iv) $(D^4 + D'^4 - 2D^2D'^2)z = 0.$

(v) $(D + D' - 2)(D + 4D' - 3)z = 0.$

(vi) $(D + 3D' + 4)^2z = 0.$

(vii) $r - t + p - q = 0.$

(viii) $(D^2 - 4DD' + 4D'^2)z = e^{2x+y}.$

(ix) $(D^2 - D'^2 - 2D + 2D')z = e^{2x+3y}.$

(x) $(D^2 + 2DD' + D'^2)z = \sin(2x + 3y).$

(xi) $(D + 1)(D + D' - 1)z = \sin(x + 2y).$

(xii) $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x + 2y) + e^{3x+y}.$

(xiii) $(4D^2 - 4DD' + D'^2)z = 16\log(x + 2y).$

(xiv) $(D^2D' - 2DD'^2 + D'^3)z = x^{-2}.$

(xv) $(D^3 - D'^3)z = x^3y^3.$

(xvi) $(D^2 + 2DD' + D'^2)z = x^2 + xy + y^2.$

(xvii) $r - 4t = \frac{4x}{y^2} - \frac{y}{x^2}.$

(xviii) $(D^2 - D'^2 + D + 3D' - 2)z = x^2y.$

(xix) $(D^2 + DD' - 6D'^2)z = x^2\sin(x + y).$

**********Do Smile**********