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IMPORTANT QUESTIONS

UNIT-4

Sem-3 , Sub: Engg. Mathematics -II, BE-301 , Name of the faculty: Akhilesh jain

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[PARTIAL DIFFERENTIAL EQUATION & IT'S APPLICATIONS]

Q 1. From the partial differential equation by eliminating the arbitrary function from the following

(1) $z = f(x^2 - y^2)$ (2) $z = y^2 + 2f(\frac{1}{x} + \log y)$ (3) $z = f(x+iy) + g(x-iy)$ **[RGPV 2006]**

LAGRANGE'S LINEAR EQUATIONS

Q 2. Solve (1) $y^2zp + x^2zq = xy^2$ **[RGPV DEC.. 2005,2007,JUNE 2008, APRIL 2009, FEB. 2010]**

(2) $yzp + xzq = xy$ **RGPV DEC. 2006]**

(3) $(z^2 - 2yz - y^2)p + (xy + zx)q = xy - zx$ **[RGPV JUNE 2004, DEC. 2004]**

(4) $y^2p - xyq = x(z - 2y)$ **[RGPV JUNE 2003, DEC. 2005]**

(5) $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ **[RGPV DEC. 2002, 2003, JUNE 2007, 2008]**

(6) $(\frac{y-z}{yz})p + (\frac{z-x}{zx})q = \frac{x-y}{xy}$ **[RGPV JUNE 2009]**

(7) $(x^2 - y^2 - z^2)p + 2xyq = 2xz$ **[RGPV JUNE 2004,JAN. 2006, Dec. 2007]**

(8) $pz - qz = z^2 + (x+y)^2$ **[RGPV DEC. 2005, JUNE 2007, DEC. 2010]**

(9) $pzx - qyz = y^2 - x^2$

(10) $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ **[RGPV DEC. 2008]**

(11) $x(y-z)p + y(z-x)q = z(x-y)$ **[RGPV JUNE. 2007]**

(12) $(y+z)p + (z+x)q = (x+y)$ **[RGPV SEP. 2009]**

NON –LINEAR EQUATIONS

Q 3. Solve (1) $x^2p^2 + y^2q^2 = z^2$ **[RGPV DEC.. 2002, Feb. 2010]**

(2) $(x+y)(p+q)^2 + (x-y)(p-q)^2 = 1$ **[RGPV. JUNE 20006]**

(3) $2(z + xp + yq) = yp^2$ (4) $z^2(p^2 + q^2) = x^2 + y^2$

(5) $z^2(p^2x^2 + q^2) = 1$ **[RGPV DEC.. 2008]**

(6) $q - p = y - x$

Q 4. Solve by using the Charpit's method

(1) $(p^2+q^2)y = qz$ **[RGPV JUNE 2007]** (2) $px+qy = pq$ **[RGPV JAN 2007]**

(3) $2z + p^2 + qy + 2y^2 = 0$ (4) $p^2 + qy = z$ (5) $2(z + xp + yq) = yp^2$

(6) $z = px + qy + p^2 + q^2$ **[RGPV JUNE 2001]**

LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF THE HIGHER ORDER

Q 5. Solve $r + t = \cos mx \cos ny$ **[RGPV Dec. 2008]**

Q 6. Solve $(D^2 - DD' - 2D'^2)z = (y-1)e^x$

Q 7. Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$

Q 8. Solve $(D^2 + 3DD' + 2D'^2)z = 12xy$

Q 9. Solve $(D^2 - DD')z = \sin x \cos 2y$ **[RGPV Dec. 2005, 2007]**

Q 10. Solve $(D^2 - DD')z = \cos x \cos 2y$ **[RGPV Dec. 2008]**

Q 11. Solve $(D^2 - DD')z = \cos(x+2y)$

Q 12. Solve $(D^3 - 4D^2 D' + 5DD'^2 - 2D'^3)z = e^{2x+y}$

Q 13. Solve $(D^2 - 6DD' + 9D'^2)z = 12x^2 + 36xy$

Q 14. Solve $(D^2 - 2DD' + D'2)z = e^{x+y}$ **[RGPV June . 2007]**

Q 15. Solve $(D^3 + D^2 D' - DD'^2 - D'^3)z = e^{2x+y} + \cos(x+y)$ **[RGPV Jan . 2007]**

Q 16. Solve $(D^2 + 3DD' + 2D'^2)z = x + y$

Q 17. Solve $(D^2 + 2DD' + D'^2)z = x^2 + y^2 + xy$ **[RGPV Sep.. 2009]**

Q 18. Solve $(D^2 + DD' - 6D'^2)z = y \cos x$ **[RGPV Dec. 2002, June 2004 ,June . 2006]**

Q 19. Solve $r - s - 2t = (y-1)e^x$ **[RGPV Jan.2006, Feb.. 2010]**

SEPERATION OF VARIABLE METHOD

Q 20. Solve $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$ by the method of separation of variables. **[RGPV Dec. 2008]**

Q 21. Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ by the method of separation of variables where $u(x,0)=6e^{-3x}$

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Q 22. Find the solution of the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ such that $y = p_0 \cos pt$ (p_0 is a constant) when x=l and y=0 when x=0

[RGPV June 2004]

Q 23. A string is stretched and fastened to two points l apart Motion is started by displacing the string in the $y = a \sin \frac{\pi x}{l}$. From which it is released at a time t=0.Show that the displacement of any point at a distance x from one end at time t is Given by $y(x,t) = a \sin(\frac{\pi x}{l}) \cos(\frac{\pi ct}{l})$

Q 24. A tightly stretched string with fixed end points x=o and x=l is initially in a position given by $y = y_0 \sin^3(\frac{\pi x}{l})$. If it is released from rest from this position, find the displacement *y(x,t).*

[RGPV Dec. 2004, June 2006]

Q 25. A string is stretched between the fixed points (0,0) and (l,0) and released at rest from the initial deflection given by $f(x)=\begin{cases} \frac{2kx}{l} & 0<x<\frac{l}{2} \\ \frac{2k(l-x)}{l} & \frac{l}{2}<x<l \end{cases}$. Find the deflection of the string at any time *t*.

[RGPV Dec. 2006]

Q 26. Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ subject to the boundary conditions *U(0,t)=0, u(l,t)=0(t>0)*and the initial condition *u(x,0)=x* , *l* being the length of the bar.

[RGPV Dec. 2001, Sep. 2009]

Q 27. Find the solution of $h^2 \frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ for which u(0,t)=u(l,t)=0, $u(x,o) = \sin \frac{\pi x}{l}$ by method of variables separable.

Q 28. A homogeneous rod of conducting material of length 100cm has its ends kept at zero temperature and the temperature initially is $u(x,o)= \begin{matrix} x; & 0 \le x \le 50 \\ 100-x; & 50 \le x \le 100 \end{matrix}$. Find the temperature *u(x,t)* at any time.

[RGPV June 2007]

Q 29. The ends A and B of a rod of length 20cm. has its ends at zero temperature and the temperature initially is $u(x,0) = \begin{matrix} x; & 0 \le x \le 10 \\ 20-x; & 10 \le x \le 20 \end{matrix}$ Find the temperature *u(x,t)*at any time.

[RGPV Dec. 2003]