Unit-2

2022-23 University Paper(EVEN SEM)
Unit-2

1. Classify the equations $r + 2s + (\sin^2 x)t + q = 0$.
2. Write down the two dimensional wave equation.
3. Solve the following partial differential equation by method of separation of variables

$$4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u,\ u(x,0) = 5e^{-y} - e^{-5y}.$$

4. An insulated rod of length l has its ends A and B maintained at 0^0C and 100^0C respectively until steady state prevails . If B is suddenly reduced to 0^0C and maintained at 0^0C, find the temperature at a distance x from A at time t. Solve by the method of separation of variables, the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ $0 < x < 1, t > 1$ subject to the initial and boundary condition $u(x,0) = x - x^2$, $u(0,t) = u(l,t) = 0$
1. A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $y = a\sin^3\frac{\pi x}{l}$. If it is released from rest from this position, find the displacement $y(x,t)$

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1. Classify the equations $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$.
2. Write down the two dimensional wave equation.
3. A string is stretched and fastened to two points l apart . Motion is started by displacing the string in the form $y = A\sin\frac{\pi x}{l}$ from which it is released at time $t = 0$. Show that the displacement at any point at a distance x from one end at a time t is given by $y = A\sin\frac{\pi x}{l}\cos\frac{\pi c t}{l}$
4. Solve by the method of separation of variables, the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ $0 < x < 1, t > 1$ subject to the initial and boundary condition $u(x,0) = x - x^2$, $u(0,t) = u(l,t) = 0$
5. Solve the following Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ $x \in (0,1), y \in (0,1),$ with the conditions $u(x,0) = 0,\ u(x,1) = 0,\ u(0,y) = 0$ *and* $u(1,y) = f(y)$ by using method of separation of variables.

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1. Classify the equations $5\frac{\partial^2 u}{\partial x^2}-9\frac{\partial^2 u}{\partial x \partial t}+4\frac{\partial^2 u}{\partial t^2}=0$.
2. Write down the two dimensional wave equation.
3. Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ where the boundary conditions are $u(0,t)=0,\ u(l,t)=0$ (t>0) and the initial condition $u(x,0)=3\sin\frac{\pi x}{l}$ being the length of bar.
4. Solve the following Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ in a rectangle in the xy-plane with $u(0,y)=0,\ u(l,y)=0,\ u(x,0)=0 \quad and \quad u(x,a)=f(x)$.
5. Solve the following partial differential equation by method of separation of variables

$$\frac{\partial u}{\partial t}-\frac{\partial u}{\partial x}+2u=0,\ u(x,0)=10e^{-x}-6e^{-4x}.$$

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Unit-2

1. Classify the equations $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x \partial y}+\frac{\partial^2 u}{\partial y^2}=0$
2. Write Radio Wave equations.
3. An insulated rod of length l has its ends A and B maintained at 0^0C and 100^0C respectively until steady state prevails . If B is suddenly reduced to 0^0C and maintained at 0^0C, find the temperature at a distance x from A at time t..
4. A string is stretched and fastened to two points l apart . Motion is started by displacing the string in the form $y=A\sin\frac{\pi x}{l}$ from which it is released at time $t=0$. Show that the displacement at any point at a distance x from one end at a time t is given by $y=A\sin\frac{\pi x}{l}\cos\frac{\pi c t}{l}$
5. Solve the following PDE by method of separation of variables $\frac{\partial z}{\partial x}+\frac{\partial^2 z}{\partial y^2}=0$ in a rectangle in the xy-plane with $z(x,0)=0,\ z(x,\pi)=0,\ z(o,y)=4\sin 3y$.

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6. Classify the equations $4\frac{\partial^2 u}{\partial x^2}+4\frac{\partial^2 u}{\partial x\partial y}+\frac{\partial^2 u}{\partial y^2}=0$.
7. Explain Radio equations.
8. Calculate the deflection $u(x,t)$ of a tightly stretched vibrating string of unit length that is initially at rest and whose initial position is given by $\sin \pi x+\frac{1}{3}\sin 3\pi x+\frac{1}{5}\sin 5\pi x \quad 0\le x\le 1$
9. Solve the following Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ in a rectangle in the xy-plane with $u(0,y)=0,\ u(l,y)=0,\ u(x,0)=0 \quad and \quad u(x,a)=\sin\frac{n\pi x}{l}$.
10. An infinitely long plane uniform plate is bounded by 2 parallel edges and end at right angles to them. The breadth is π. This end is maintained at temperature u_0 at all points and the other edges are at zero temperature. Determine the temperature at any point of the plate in the steady state.

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2. Classify the equations $x^2\frac{\partial^2 u}{\partial x^2}+y^2\frac{\partial^2 u}{\partial y^2}=u$
3. Classify the equations $\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial x\partial y}=0$.
4. A rectangular plate with insulated surfaces is 10 cm wide and so long compared to its width that it may be consider infinite in length. If the temperature along one short edge y=0 is given by $u(x,0)=20x,\ 0\le x\le 5;\ 20(10-x)\ \ 5<x<10$ while the two long edges x=0 and x=10 as well as the other short edge are kept at 0°C. Find the steady state temperature at any point of the plate.
5. An insulated rod of length l has its ends A and B maintained at 0^0C and 100^0C respectively until steady state prevails . If B is suddenly reduced to 0^0C and maintained at 0^0C, find the temperature at a distance x from A at time t. Find also the temperature if the change consists of raising the temperature of A to $\mathbf{20^0}$ c and reducing that of B to $\mathbf{80^0}$ c.

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6. A tightly stretched string with fixed end points $x = 0$ 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 $y(x,t)$