St. JOSEPH'S COLLEGE OF ENGINEERING, CHENNAI – 119

St.JOSEPH'S INSTITUTE OF TECHNOLOGY, CHENNAI – 119

SUB NAME & CODE: TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS - MA 6351

ASSIGNMENT -II

UNIT- III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

PART-A

1. **Write down the partial differential equation governing one dimensional wave equation?**
2. **Write all possible solutions of the transverse vibration of the string in one dimension.**
3. **State Fourier law of heat conduction.**
4. **In steady state condition derive the solution of one dimension heat flow equation.**
5. **An insulated rod of length 60 cm has its ends A and B maintained at 20^oC and 80^oC respectively. Find the steady state temperature in the rod.**
6. **The boundary value problem governing the steady state temperature distribution in a flat thin plate is given by** $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ **,** $u(x,0)=0$ **,** $u(0,y)=0$ **,** $u(a,y)=0$ **and** $u(x,a)=4\sin^3\left[\frac{\pi x}{a}\right]$**.**

   Find C_n when the most general solution is $u(x,y)=\sum_{n=1}^{\infty} c_n \sin\frac{n\pi x}{a}\sinh\frac{n\pi y}{a}$.
7. **Given the boundary conditions on a square or rectangular plate, how will you identify the proper solutions?**
8. **An infinitely long plate is bounded by two parallel edges and an end at right angles to them. The breadth of the edge y = 0 is π and it is maintained at constant temperature u_0 at all points and the other edges are kept at zero temperatures. Formulate the boundary value problem to determine the steady state temperature.**

PART-B

1. **A uniform string is stretched and fastened to two points ' *l* ' apart. Motion is started by displacing the string into the form of the curve *y* = k*x*(*l* – *x*) and then releasing it from this position at time** $t=0$**. Find the displacement of the point of the string at a distance** x **from one end at time** t**.**

2. **If a string of length *l* is initially at rest in its equilibrium position and each of its points is given a velocity** v **such that** $v=\begin{cases} cx;\ 0<x<\frac{l}{2} \\ c(l-x);\ \frac{l}{2}<x<l \end{cases}$ **, find the displacement at any time** t**.**

3. **The ends A and B of a rod *l* cm long have their temperatures kept at $30^{\circ}C$ and $80^{\circ}C$, until steady state conditions prevail. The temperature of the end B is suddenly reduced to $60^{\circ}C$ and that of A is increased to $40^{\circ}C$. Find the steady state temperature distribution in the rod after time t.**

4. **A square plate is bounded by the lines x = 0, y = 0 and x = y =20, its faces are insulated. The temperature along upper horizontal line is given by u(x,20) = x (20–x) where 0< x<20. While other 3 edges are kept at 0^{o} C. Find the steady state temperature in the plate.**