```
%Define Variables
L=1;
W=1; %Length of the Rod
nx=20; %Number of grid points
ny=20;
dx=L/(nx-1);
dy=W/(ny-1); %Grid Spacing
alpha= 0.000113; %Thermal diffusivity
dt=1; %Time Step

%Maximum number of time step
Max_time_steps=3000;

%Initial tempearture vector

T=zeros(nx,ny);

x=linspace(0,L,nx);
y=linspace(0,W,ny);
Th = 1;
Tl = 0;
%boundary conditions
T(:,1) = Tl; %left boundary
T(1,2:ny-1) = Th; % right
T(1,ny) = Tl; %upper
T(2:nx,ny) =Tl; %lower

% Initialize probe points
probe_points = [5,5; 10,10; 10,5; 12,12];
probe_temps = zeros(Max_time_steps+1, size(probe_points,1));

% Set tolerance for steady state
probe_tol = 0.1;

%Iterate over time steps
for t=0:Max_time_steps
for i=2:nx-1
for j=2:ny-1;
      Tn=T(i,j+1);
    Ts=T(i,j-1);
    Tl=T(i-1,j);
    Tc=T(i,j);
    Tr=T(i+1,j);
    T(i,j) = Tc+alpha*dt*(dy^2*(Tl-2*Tc+Tr)+dx^2*(Tn-2*Tc+Ts))/(dx^2*dy^2);
  end

end

% Store probe temperatures
for k=1:size(probe_points,1)
    i = probe_points(k,1);
    j = probe_points(k,2);
    probe_temps(t+1,k) = T(i,j);
end
end
```

```
%Plot the Graph
contourf(x,y,T);
colorbar
xlabel('x');
ylabel('y');
title('Temperature vs distance graph for steady State');

% Plot probe temperatures with respect to time
figure
plot(0:dt:t*dt, probe_temps(1:t+1,:));
xlabel('Time');
ylabel('Temperature');
ylim([0 1]);
xlim([-500 4000]);
legend('Point 1', 'Point 2', 'Point 3', 'Point 4');
title('Probe Temperatures vs Time');
```