Matlab Assignment on Steady State Heat Conduction

1) 1D Steady State Heat Conduction

Matlab Code

```
% 1D steady state conduction
% Input parameter
L = 100; %(m)
N = 6; % Number of nodes
dx = L/(N-1); %distance between consecutive nodes
tol = 1e-4;
% Domain discretization
T_new = zeros(N,1); %Initialising the domain
x = linspace(0,L,N);
%BC
for i=1:N
T_new(1,1)=100;
end
%Main Loop - Logic
error = 1;iter = 0;
while(error>tol)
iter = iter + 1;
T = T_new;
for i = 2:N-1
T_new(i) = (T(i+1)+T(i-1))/2;
end
error = max(max(abs(T-T_new)));
figure(2);
%plotting
plot(T_new); shading flat; colorbar;
xlabel('Position');
ylabel('Temperature (C)');
title('Temperature profile in 1D steady state heat conduction');
grid on;
end
```

Results

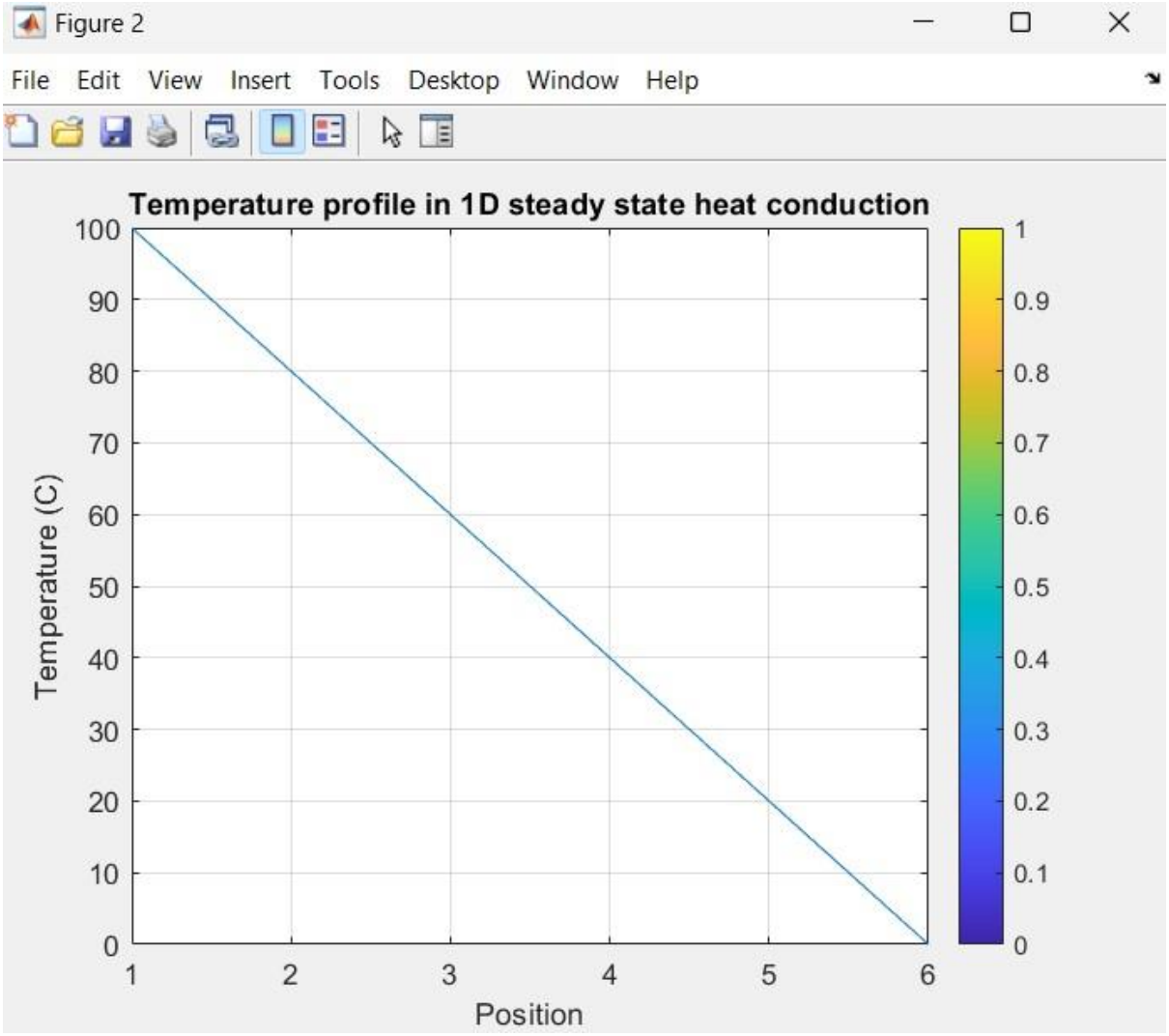


Figure 2
File Edit View Insert Tools Desktop Window Help
Temperature profile in 1D steady state heat conduction
Temperature (C)
Position
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0

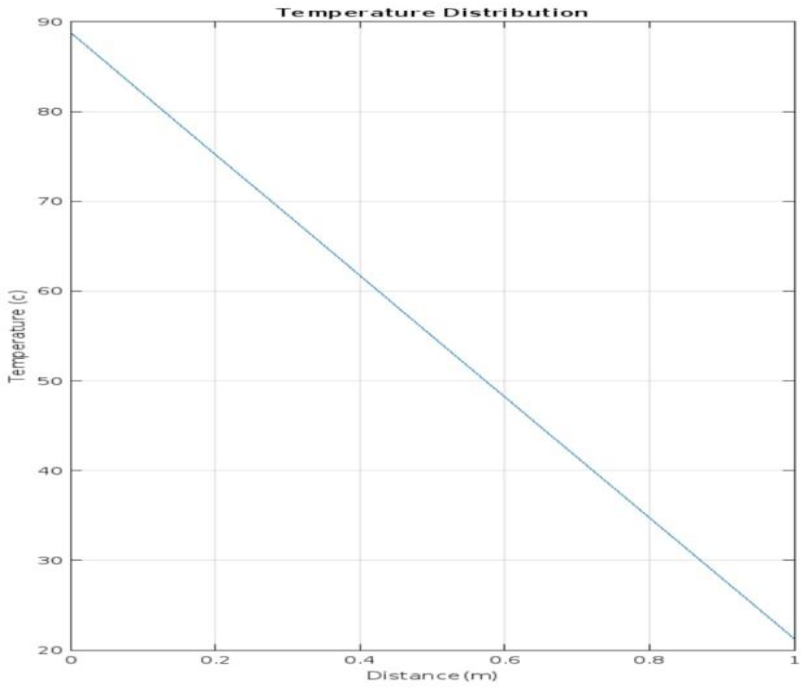
2) 1D Steady State Conduction Using Matrix Solver

Matlab Code

```
L=1;
Nx=7;
dx=L/(Nx-1);
% k = 1;
Q = 0;
A = zeros(Nx,Nx);
A(1,1) = 2;
A(Nx,Nx)=2;
A(7,6)=-1;
for i = 2:Nx-1
    A(i,i-1) =-1;
    A(i,i) = 2;
    A(i,i+1) =-1;
    A(i-1,i) = -1;
end
disp(A)
b = zeros(Nx,1);
b(1) = 100;
b(Nx) = 10;
T= A\b;
x = linspace(0,L,Nx);
plot(x,T);
xlabel('Distance(m)');
ylabel('Temperature (c)');
title('Temperature Distribution')
grid on;
```

Results

Figure 1: L=1; Nx=7; dx=L/(Nx-1); % k = 1; Q = 0; A = zeros(Nx,Nx);...



3) 2D Heat Conduction in Flat Plate

Matlab Code

```
% Explicit method for 2D heat equation in flat plate
% Input Parameters
L = 0.75; %(m)
dx = 0.05; %(m)
dy = 0.05; %(m)
N = L/dx+1; %Number of Nodes
tol = 1e-4;
dt = 0.00015;
% Domain Discretisation
T_new = zeros(N,N); %Initialising the Domain
x = linspace(0,dx,N); %x-coordinate
y = linspace(0,dy,N); %y-coordinate S
% Boundary Condition
for i=1:N
for j=1:N
T_new(1,j) =150;
T_new(i,1) =200;
T_new(N,j)=100;
T_new(i,N)=250;
end
end
%Main Loop - Logic
error =1;iter=0;
while(error > tol)
iter=iter+1;
T = T_new;
for i=2:N-1
for j =2:N-1
T_new(i,j) = dt*((T(i+1,j)-2*T(i,j)+T(i-1,j))/dx^2 +(T(i,j+1)
2*T(i,j)+T(i,j-1))/dy^2) + T(i,j);
end
end
error = max(max(abs(T-T_new)));
figure(2);
%plotting
contourf(T_new); shading flat;colorbar;
xlabel('x');ylabel('y')
pause(0.1);
end
```

Results

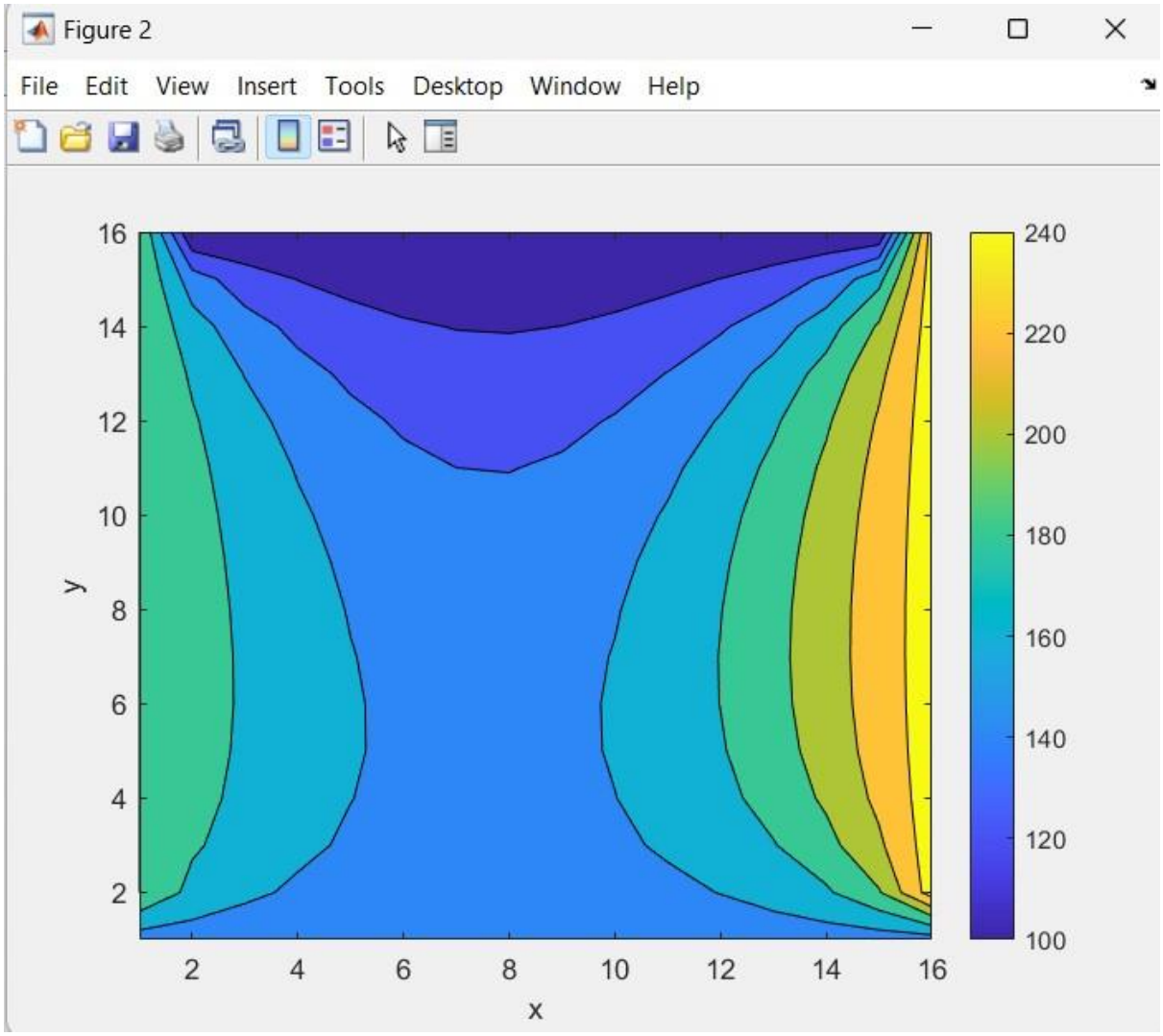


Figure 2
File Edit View Insert Tools Desktop Window Help
16
14
12
10
8
6
4
2
y
2 4 6 8 10 12 14 16
x
240
220
200
180
160
140
120
100