Solution

a) The augumented matrix (1)

$$\tilde{A}^{(1)} = \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 2 & -1 & 1 & 2 & 1 & -3 & 20 \\ 1 & 3 & -3 & -1 & 2 & 1 & -15 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

$$\tilde{A}^{(2)} = \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -1.5 & 2.5 & 0 & -2.5 & -0.5 & 6 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 0 & -0.6 & 1.8 & -1.2 & -2.6 & 1.2 & -4.6 \\ 0 & -0.667 & 1.333 & -2 & -3.333 & 0 & -9.333 \\ 0 & -0.25 & 2.25 & -2.5 & -3.75 & 0.5 & -10.75 \end{array}\right]$$

$\frac{E_2}{2} - E_1 \Rightarrow$ $E_3 - E_1 \Rightarrow$ $\frac{E_4}{5} - E_1 \Rightarrow$ $\frac{E_5}{-3} - E_1 \Rightarrow$ $\frac{E_6}{4} - E_1 \Rightarrow$

Divide through E_3 by 2 and swap (pivot) wi

$$\hat{A}^{(2)} = \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & -1.5 & 2.5 & 0 & -2.5 & -0.5 & 6 \\ 0 & -0.6 & 1.8 & -1.2 & -2.6 & 1.2 & -4.6 \\ 0 & -0.667 & 1.333 & -2 & -3.333 & 0 & -9.333 \\ 0 & -0.25 & 2.25 & -2.5 & -3.75 & 0.5 & -10.75 \end{array}\right]$$

from E_1;

$T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4$

$T_1 = 4 - (-1.996) + 2(3.002) - 4.002 - 3(1.999) + (-1.002)$

$T_1 = 0.999 \approx 1$ //

$\therefore T_1 = 1, \quad T_2 = -2, \quad T_3 = 3$

$T_4 = 4, \quad T_5 = 2 \quad \& \quad T_6 = -1.$

b.) Excel file attached to zip folder.

c.) Matlab file attached to zip folder.

MATLAB PROGRAM CODE

```
function C = assign3(A,B)
A = [1 1 -2 1 3 -1; 2 -1 1 2 1 -3; 1 3 -3 -1 2 1;
     5 2 -1 -1 2 1; -3 -1 2 3 1 3; 4 3 1 -6 -3 -2];
B = [4; 20; -15; -3; 16; -27];
i = 1;
x = [A B];
[m n] = size(x);
while i<=m
    if X(i,i)==0
```

$A^{n(4)} =$

1	1	-2	1	3	-1	4
0	1	-0.5	-1	-0.5	1	-9.5
0	0	1	-1.2	-1.933	1.2	-6.867
0	0	0	1	0.222	-1.831	6.280
0	0	0	-1.468	-1.734	-0.533	-8.805
0	0	0	-0.094	0.109	-0.847	0.691

$A^{n5} =$

1	1	-2	1	3	-1	4
0	1	-0.5	-1	-0.5	1	-9.5
0	0	1	-1.2	-1.933	1.2	-6.867
0	0	0	1	0.222	-1.831	6.280
0	0	0	0	0.959	2.194	-0.282
0	0	0	0	-1.382	10.842	-13.631

$\frac{E_5}{-1.468} - E_4$

$\frac{E_6}{-0.094} - E_4$

Divide through E_5 by 0.959

$A^{n(5)} =$

1	1	-2	1	3	-1	4
0	1	-0.5	-1	-0.5	1	-9.5
0	0	1	-1.2	-1.933	1.2	-6.867
0	0	0	1	0.222	-1.831	6.280
0	0	0	0	1	2.288	-0.294
0	0	0	0	-1.382	10.842	-13.631

$\tilde{A}^{(3)} =$

	1	1	-2	1	3	-1	4
	0	1	-0.5	-1	-0.5	1	-9.5
$\frac{E_3}{1.5} + E_2 \Rightarrow$	0	0	1.167	-1	-2.167	0.667	-5.5
$\frac{E_4}{0.6} + E_2 \Rightarrow$	0	0	2.5	-3	-4.833	3	-17.167
$\frac{E_5}{0.667} + E_2 \Rightarrow$	0	0	1.499	-3.999	-5.497	1	-23.493
$\frac{E_6}{0.25} + E_2 \Rightarrow$	0	0	8.5	-11	-15.5	3	-52.5

Divide through E_4 by 2.5 and swap with E_3

$A^{\sim(3)} =$

	1	1	-2	1	3	-1	4
	0	1	-0.5	-1	-0.5	1	-9.5
	0	0	1	-1.2	-1.933	1.2	-6.867
	0	0	1.167	-1	-2.167	0.667	-5.5
	0	0	1.499	-3.999	-5.497	1	-23.493
	0	0	8.5	-11	-15.5	3	-52.5

$\tilde{A}^{(4)} =$

	1	1	-2	1	3	-1	4
	0	1	-0.5	-1	-0.5	1	-9.5
	0	0	1	-1.2	-1.933	1.2	-6.867
$\frac{E_4}{1.167} - E_3 \Rightarrow$	0	0	0	9.343	0.076	-0.628	2.154
$\frac{E_5}{1.499} - E_3 \Rightarrow$	0	0	0	-1.468	-1.734	-0.533	-8.805
$\frac{E_6}{8.5} - E_3 \Rightarrow$	0	0	0	-0.094	0.109	-0.547	0.691

Divide through E_4 by 0.343

```
9-          disp ('Diagonal element zero')
10-         return
11-       end
12-       X = elimination (X,i,i);
13-       i = i + 1;
14-   end
15-   C = X (:,n);

16- function X = elimination(X, i, j)
17- [m n] = size (X);
18- a = X (i, j);
19-  X(i,:) = X(i,:)/a;
20- for  k = 1:m
21-       if  k == i
22-           continue
23-       end
24-       X(k,:) = X(k,:) - X(i,:) * X(k,j);
25- end
```

d.) Excel file attached to Zip folder

Q. Matlab file attached to zip file

MATLAB PROGRAM CODE.

```
Commandwindow
Commandwindow
clear
clc
close all
A = [1 1 -2 1 3 -1; 2 -1 1 2 1 -3; 1 3 -3 -1 2 1;
     5 2 -1 -1 2 1; -3 -1 2 3 1 3; 4 3 1 -6 -3 -
x = [4; 20; -15; -3; 16; -27]
n = inv(A)
b = inv(A) * x
```

$$\tilde{A}^{(6)} = \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 1 & 0.222 & -1.831 & 6.280 \\ 0 & 0 & 0 & 0 & 1 & 2.288 & -0.294 \\ 0 & 0 & 0 & 0 & 0 & -10.133 & 10.157 \end{array}\right]$$

$\frac{E_6}{-1.38^2} - E_5$

Backward Substitution

$A^{(6)}$ from E_6 ; $-10.133\,T_6 = 10.157$

$T_6 = -1.002 \approx -1$ //

from E_5 ; $T_5 + 2.288\,T_6 = -0.294$

$T_5 = -0.294 - 2.288(-1.002)$

$T_5 = 1.999 \approx 2$ //

from E_4 ; $T_4 + 0.222\,T_5 - 1.831\,T_6 = 6.280$

$T_4 = -0.222(1.999) + 1.831(-1.002) + 6.280$

$T_4 = 4.002 \approx 4$ //

from E_3 ; $T_3 - 1.2\,T_4 - 1.933\,T_5 + 1.2\,T_6 = -6.867$

$T_3 = +1.2(4.002) + 1.933(1.999) - 1.2(-1.002) - 6.867$

$T_3 = 3.002 \approx 3$ //

from E_2 ; $T_2 - 0.5\,T_3 - T_4 - 0.5\,T_5 + T_6 = -9.5$

$T_2 = 0.5(3.002) + 4.002 + 0.5(1.999) + (-1.002)$ $\quad -9.5$

$T_2 = -1.996 \approx -2$ //

ASSIGNMENT II

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Mechanical Engineering
16/ENG06/059

13/03/2019

ENG382: Engineering Mathematics IV

Question:

If the model of a system having thermocouples ~~maximum~~ percentage absolute ~~error~~ measuring temperatures, T(°C), at its different point is given by the set of expressions is given by the set of expressions in Equation estimate the values of the temperature using;

1. Gauss elimination method manually (with the aid of calcul
2. Gauss elimination method with the aid of Microsoft Excel
3. Gauss elimination method with the aid of MATLAB
4. Matrix Inverse method with the aid of Microsoft Excel, and
5. Matrix Inverse method with the aid of MATRIX

$$\begin{cases} T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4 \\ 2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20 \\ T_1 + 3T_2 - 3T_3 - T_4 + 2T_5 - T_6 = -15 \\ 5T_1 + 2T_2 - T_3 - T_4 - 2T_5 + T_6 = -3 \\ -3T_1 - T_2 - 2T_3 - 3T_4 + T_5 + 3T_6 = 16 \\ 4T_1 + 2T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = 27 \end{cases}$$