Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER 2013

Subject Code: 181406 **Date: 09/05/2013**

Subject Name: Food Engineering Computation and Numerical Analysis

Time: 10:30 am TO 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use log-log and semi-log paper wherever necessary.**

Q.1 **(a)** Create the spreadsheet programming and calculate the total mass balance and component mass balance for mixing ingredients to make 25 kg of beef sausage having a fat content of 30%. Typically beef meat contains protein 18%, fat 12% and water 68% and beef fat contains 78% fat, 12% water and 5% protein. **07**

(b) What do mean by interpolation? When is single and double interpolation of data necessary? **07**

Calculate the specific volume (m^3/kg) of superheated steam at 200 kPa and 300°C using the following data from steam table.

Pressure (kPa)	Temperature (^{o}C)		
	150	250	360
100	1.9364	2.406	2.917
150	1.2853	1.6012	1.9432
400	0.4708	0.5951	0.7257

Q.2 **(a)** What do you understand by output formats in MATLAB? Write the steps to calculate the following quantities in MATLAB; **07**

e^3, $\ln(e^3)$

(b) Write the steps to solve the following linear algebraic equations in MATLAB; **07**

5x = 3y ï 2z + 10x
8y + 4z = 3x + 20
2x + 4y ï 9z = 9

OR

(b) Write the details of the following commands in 2-D plots in MATLAB. **07**

1. area
2. bar
3. barh
4. comet
5. contour
6. contourf
7. loglog

Q.3 **(a)** What the different types are of file for storing the data or programme in MATLAB, explain in detail. **07**

(b) Write the shortcut commands of the followings in EXCEL; **07**

1. Cancel action
2. Select entire column
3. Display file menu
4. Display Edit menu
5. Display view menu
6. Hide column
7. Format style

OR

Q.3 **(a)** Define the followings in MATLAB; **07**

1. Command window
2. Current directory
3. Command History

(b) What do you understand by curve fitting and interpolation in MATLAB? Give the steps to draw the straight line (linear) fit of the following data; **07**

X	5	10	20	50	100
Y	15	33	53	140	301

Q.4 **(a)** Using Gauss-Seidel method, solve the following system of equations. **07**

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22$$

Start with $x = y = z = 0$.

(b) With help of a representative diagram **07**

(i) Express the Cartesian co-ordinate $(-4, 3)$ as polar co-ordinate, correct to 2 decimal places, in both degree and radian.

(ii) Express the polar co-ordinate (4.5, 5.16 rad) as Cartesian co-ordinate, correct to 3 decimal places.

OR

Q.4 **(a)** Solve the system of equations using Gauss-elimination method. **07**

$$10x - 2y + 3z = 23$$
$$2x + 10y - 5z = -33$$
$$3x - 4y + 10z = 41$$

When Gauss-elimination method fails?

(b) Find the approximate root of the equation $2x - \log x = 6$ by Regula-falsi method correct to 3 decimal places. **07**

Q.5 **(a)** The Power Law model of Non-Newtonian fluid is given by **07**

$$\sigma = K\gamma^{n}$$

where, ů = shear stress in the fluid (Pa); K = consistency coefficient ($Pa.s^n$); n = flow behaviour index (no units); ɔ = shear rate (1/s)

What are the constants and variables in this equation? Is this a linear equation in ů? If not, can linearization of this equation possible?

A 15% solid peach puree yielded the following rheological information:

Shear rate (s^{-1})	100	300	500	1000	2000	4000
Shear stress (Pa)	32	50	61	80	105	140

Determine the consistency coefficient and flow behaviour index.

(b) What are the two types of errors involving in numerical computations? Explain with suitable examples. **07**

OR

Q.5 **(a)** The decay of microorganisms are modeled with a general equation of the form **07**

$$N = N_0 e^{-kt}$$

where, N = final population of microorganisms at time t, no.

N_0 = initial population of microorganism, no.

k = rate constant affecting the rate of decay (s^{-1})

t = time (s)

Can you write the above equation in linear form?

The following data were obtained from a thermal resistance experiment conducted on a spore suspension at 112°C:

Time (min)	0	4	8	12
No. of Survivors	10^6	1.1×10^5	1.2×10^4	1.2×10^3

Calculate the rate constant, k.

(b) A Food Processor wants to operate a process at a certain temperature to maximize the rate of heat transfer. The thermal conductivity, k of the food varies with temperature as follows **07**

$k = 0.57109 + 0.0017625T$ ï $6.7306 \times 10^{-6} T^2$

where T is in °C and k is in W/(m°C). Find the temperature that yield the maximum k over the range of temperature from 50°C to 150°C.

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