U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Chemical Engineering **Duration: 3 hrs.**

Course Code: 23CH5PELA1 / 22CH5PELA1 **Max Marks: 100**

Course: Computer interface in Chemical Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)	What are variables and keywords in python programing? Give examples.		*CO1*	*PO1*	**08**
	b)	There is a cylindrical storage vessel used for storing of aviation fuel with the dimensions, radius of the tank is 10m and height is 10m. Calculate the liquid volume in the tank if the aviation fuel is pumped for 30 mins with a volumetric flow rate of 100m^3/min. Analyse whether the tank is over filled or not using a python programming. Give the output of the program.		*CO1*	*PO1*	**12**
		OR				
2	a)	Write a python program to read the length and breadth of a rectangle from a user and display the area of the rectangle. Calculate the area for a site of 30×40 in ft^2. Give the output.		*CO1*	*PO1*	**10**
	b)	Write a python program that prompts a user to enter the element of a list and add the element to a list. Write a function maximum(Lst) and minimum(Lst) to find the maximum and minimum number from the list. Data: Lst = [12,34,45,77]		*CO1*	*PO1*	**10**
		UNIT - II				
3	a)	Using a python code to evaluate the root of the equation (linear equation) using function and derivative function $y = x^3 - x^2 + 2.$ The value of error may be assumed as 0.001.		*CO2*	*PO2*	**12**
	b)	Write a python program to solve Ordinary Differential equation (ODE) for Runge Kutta fourth order method. Assume the number of iterations =4.		*CO2*	*PO2*	**08**
		OR				
4	a)	Using a python code to evaluate the root of the equation (linear equation) using function and derivative function $y = 2x^3 - 4x^2 + 6$ The value of error may be assumed as 0.001.		*CO2*	*PO2*	**12**
	b)	Explain the non-linear algebraic equation using Newton Raphson method give examples.		*CO2*	*PO2*	**08**

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<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Explain Dew point temperature and bubble point temperature.</td><td>CO1</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td></td><td>b)</td><td>Write a python code to calculate the Dew-point temperature (°C) for the vapor phase composition of Component A and B. The Antoine equation constants are given below.
<table>
<tr><td>Antoine equation constants</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Component A</td><td>8.0434</td><td>1554.3</td><td>222.65</td></tr>
<tr><td>Component B</td><td>7.4316</td><td>1554.3</td><td>214.02</td></tr>
</table></td><td>CO3</td><td>PO4</td><td>12</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>Write the python program using a function code and main program to calculate the heat transfer rate and outlet temperatures of the hot and cold fluids in a double pipe heat exchanger. Assume the Log Mean Temperature Difference (LMTD) for counter current flow, the following data is available:
Temperature inlet Hot Fluid= 80°C and
Temperature outlet Hot Fluid= 30°C
Temperature inlet Cold Fluid=25°C
Specific heat of Hot fluid=4128 J/kgK
Specific heat of Cold fluid=2 kJ/kgK
Mass flow rate =0.1 kg/s</td><td>CO4</td><td>PO6</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Write a python program for a plug flow reactor (PFR) and to plot the concentration profile of the PFR</td><td>CO4</td><td>PO6</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>The following table shows the time versus pressure variation readings from a vacuum pump. Fit a curve, $p = p_0 \times e^{-\frac{t}{\tau}}$, through the data and determine the unknown constants p_0 and τ. Write a MATLAB program for
i. Plot the data on a linear scale plot
ii. Plot the data on a semi log plot
Data:
<table>
<tr><td>Time t (sec)</td><td>0</td><td>0.5</td><td>1.0</td><td>5.0</td><td>10</td><td>20</td></tr>
<tr><td>Pressure P (mmHg)</td><td>760</td><td>625</td><td>528</td><td>85</td><td>14</td><td>0.16</td></tr>
</table></td><td>CO1</td><td>PO1</td><td>12</td></tr>
<tr><td></td><td></td><td>b)</td><td>What is a Scalar and matrix in MATLAB programming?</td><td>CO1</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Write a MATLAB program to determine whether a given year is a leap year (try to change the given value of n year and observe the outcome).</td><td>CO1</td><td>PO1</td><td>07</td></tr>
<tr><td></td><td></td><td>b)</td><td>Describe the various output and input statement used in MATLAB.</td><td>CO1</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>Explain how polynomial plot can be represented in MATLAB?</td><td>CO1</td><td>PO1</td><td>07</td></tr>
</table>

			UNIT - V			
	9	a)	Write the MATLAB program for the design of a Shell and Tube heat exchange (STHE) and calculate the area as well as duty for the STHE. Given data. Mass Flow rate of Hot fluid: 1000 kg/hour Mass Flow rate of Cold fluid: 800 kg/hour Hot Fluid Inlet temperature: 150°C Hot Fluid Outlet Temperature: 70°C Cold Fluid Inlet temperature: 20°C Cold Fluid Outlet Temperature: 60°C Cp Value of the hot & Cold liquid: 4.18 kJ/kg °C. Overall HTC= 300 W/m^2°C Request the user for the input for the above data in the program and the output should display duty and the area of the shell and tube heat exchanger	*CO4*	*PO6*	**12**
		b)	Components A and C are fed to a plug-flow reactor in equimolar amounts, and the reaction 2A → B takes place in the reactor. The mass balance on each species yields, $v_0 \frac{dC_A}{dV} = -2kC_A^2, \quad v_0 \frac{dC_B}{dV} = kC_A^2, \quad v_0 \frac{dC_C}{dV} = 0$ where v0 = 0.5 m/sec and k = 0.3 m^3/kmol/sec. The initial concentration of each species is CA0 =2 kmol/m^3, CB0 = 0 and CC0 = 2 kmol/m^3, and the volume of the reactor represented as the total reactor length is V_f = 2.4 m. Plot the concentration, change of each species, as a function of the reactor volume (represented in length) V using MATLAB Program.	*CO4*	*PO6*	**08**
			OR			
	10	a)	Use the trapz function of Matalab and explain the same function, Table given below shows a series of time spot measurements of the velocity of a falling sphere. Determine the distance travelled when t = 2.5 sec. Find the cumulative distance traveled at each time spot. Time (s) **0** 0.5 1.2 1.6 2.5 3.1 4.8 6.9 Velcoity (m/s) 0 5 12 15 23 28 38 47	*CO4*	*PO6*	**10**
		b)	Consider a system of three CSTR connected in series and the rate of the reaction is of the second order. Calculate the concentration of each reactor when the outlet concentration of the first tank is 2 mole/Liter. The volume of the four-reactor connected in the series are equal. Write the MATLAB program to estimate the Concentration of each tank. Data: Reaction rate constant = *k* = 0.2 mole /Ls. & Time constant is 10 mins	*CO4*	*PO6*	**10**

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