SPPU In-Sem OfflineExamination-April 2022

Class: TE Branch: Chemical Semester: II

Subject: Chemical Reaction Engineering I(Code: 309348)

Maximum Marks: 30 Duration: 60 Minutes Date: 04/04/2022

Special Instruction:

- Attempt Q 1 or Q 2, Q 3 or Q 4.
- Each question carries equal marks.
- Neat diagrams must be drawn wherever necessary.
- Assume suitable data, if necessary.

Q.No.	Question / Description	Marks	CO	BL	PI
1a	Differentiate between molecularity and order of reaction with example.	5	1	2,3	1.4.1, 2.2.4
1b	Decomposition of a acetone dicarboxylic acid is a first order reaction: $CO(CH_2COOH)_2 \rightarrow CO(CH_3)_2 + 2CO_2$ Following is the data for the same	10	1	2,3	1.4.1, 2.1.3

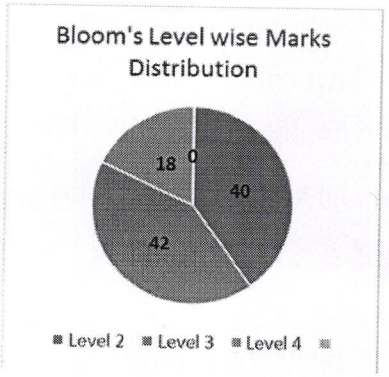
T,K	273	293	313	333
$K_1, (s)^{-1}$	2.46 X 10^5	47.5X 10^5	576 X 10^5	5480 X 10^5

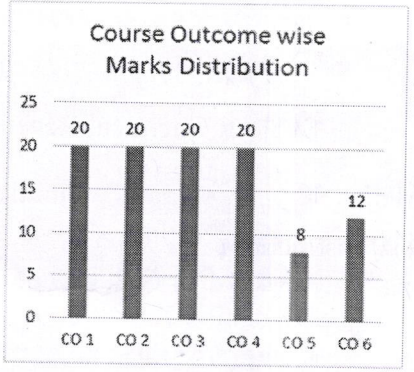
Or

2a	On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order.	5	1	2,3	1.4.1, 2.1.3
2b	Derive the Temperature dependency of rate constant from Arrhenius law.	10	1	2,3,4	1.4.1, 2.1.3
3a	What are different methods of analysis of kinetic data? Explain any one in detail.	10	2	2,3	1.4.1, 2.2.4
3b	Half life for certain first order reaction is 2500 sec. How long will it take for $1/4^{th}$ of the reactant to be left behind?	5	2	2,3	1.3.1, 2.1.3

Or

4a	Derive integrated rate equation for zero order reaction for variable volume system.	10	2	2,3	1.3.1, 2.1.2
4b	In case of first order reaction, show that time required for 75% conversion is double the time required for 50% conversion.	5	2	2,3	1.4.1, 2.1.3





BL – Bloom's (Revised)Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

SPPU In-Sem OfflineExamination-April 2022

Class: TE Branch: Chemical Semester: II

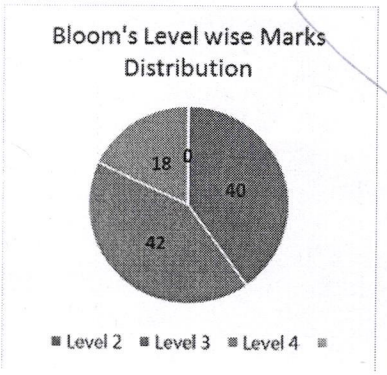
Subject: Transport Phenomena(Code: 309350)

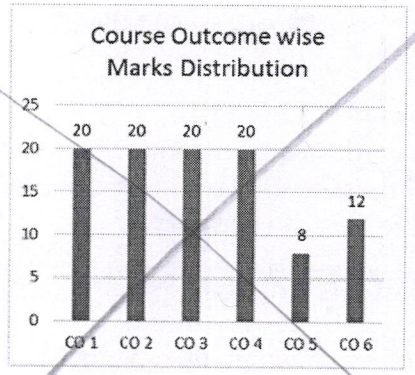
Maximum Marks: 30 Duration: 60 Minutes Date: 07/04/2022

Special Instruction:

- Attempt Q 1 or Q 2, Q 3 or Q 4.
- Each question carries equal marks.
- Neat diagrams must be drawn wherever necessary.
- Assume suitable data, if necessary.

Q.No.	Question / Description	Marks	CO	BL	PI
1a	Derive expression of momentum flux, velocity, maximum velocity, average velocity, discharge and thickness for flow of fluid along an inclined plate.	10	1	3,4	1.4.1, 2.1.2
1b	Find radius of capillary from the following data Length of capillary= 50.02cm Kinematic viscosity of fluid= $4.03 \times 10^{-5} m^2/s$ Density of fluid $=0.9552 \times 10^3$ kg/m^3 Pressure drop across horizontal capillary tube= $4.829 \times 10^5 N/m^2$ Mass flow rate through tube = 2.997×10^{-3} kg/s	5	1	3,4	1.2.1, 2.4.1
	Or				
2a	Explain stepwise procedure to solve viscous (momentum) flow problems.	5	1	2,3	1.3.1, 2.1.1
2b	A viscous fluid is in a laminar flow in a slit formed by two vertical parallel walls a distance 2B apart. Make a differential momentum balance and derive expression of momentum flux, velocity distribution, maximum and average velocity.	10	1	3,4	1.4.1, 2.1.2
3a	Explain thermal energy balance equation.	5	2	2,3	1.3.1, 2.1.1
3b	Derive expression of temperature distribution for viscous heat source.	10	2	3,4	1.4.1, 2.1.2
	Or				
4a	Derive expression of heat flux and temperature distribution for nuclear heat source.	10	2	3,4	1.4.1, 2.1.2
4b	A copper wire has a radius 2 mm and length 5 m. For what voltage drop would the temperature rise at the wire axis be 10^0 C if the surface temperature of the wire is 20^0 C? (For copper, Lorenz number is 2.23×10^{-8} volt^2 K^{-2}).	5	2	3,4	1.2.1, 2.4.1





BL – Bloom's (Revised)Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

100

SPPU In-Sem OfflineExamination-April 2022

Class:T.E Branch : Chemical Semester: II

Subject :Mass Transfer: II (Code: 309349)

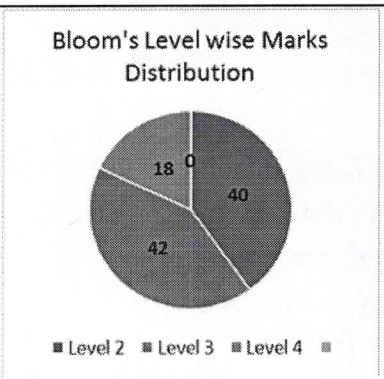
Maximum Marks: 30 Duration: 60 Minutes Date : 05/04/2022

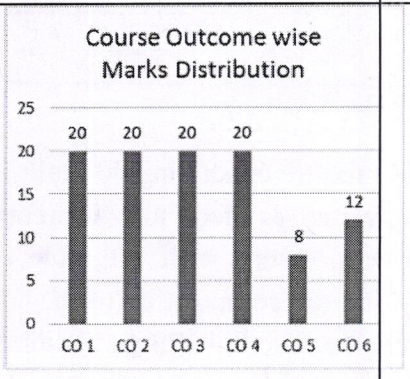
Special Instructions:
(I) Neat digram must be drawn wherever necessary.
(II) Assume Suitable data, if necessary.
(III) Use of Electronic calculator is allowed.
(IV) Solve Question 1 or 2 and 3 or 4
(V) Each question carries equal marks

<table>
<tr><th>Q. No.</th><th>Question / Description</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1</td><td>(a) What is Relative Volatility and explain its significance.</td><td>5</td><td>1</td><td>4</td><td>1.4.1</td></tr>
<tr><td></td><td>(b) Explain Simple distillation operation with neat diagram</td><td>5</td><td>1</td><td>2</td><td>1.4.1</td></tr>
<tr><td></td><td>(c) A feed of 50 % hexane and 50 mole % octane is fed to a pipe still through a pressure reducing valve and then into a flash disengaging chamber. The vapour and liquid leaving the chamber are assumed to be in equilibrium. If the fraction of the feed converted to vapour is 0.5, find the equilibrium composition. Use following data
<table>
<tr><td>Mole fraction of hexane in liquid (x)</td><td>1</td><td>0.69</td><td>0.4</td><td>0.192</td><td>0.045</td><td>0</td></tr>
<tr><td>Mole fraction of hexane in vapour (y)</td><td>1</td><td>0.932</td><td>0.78</td><td>0.538</td><td>0.1775</td><td>0</td></tr>
</table></td><td>5</td><td>1</td><td>5</td><td>1.2.1, 1.3.1, 1.4.1</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>(a) Derive Rayleigh equation.</td><td>5</td><td>1</td><td>2</td><td>1.3.1</td></tr>
<tr><td></td><td>(b) Liquid mixture containing 40 mole % methanol and 60 mole % water is fed to differential distillation at atmospheric pressure with 60 mole% of the liquid is distilled. Find the composition of the composited distillate and the residue. Use following equilibrium data
<table>
<tr><td>x</td><td>0.05</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td><td>0.5</td></tr>
</table></td><td>10</td><td>1</td><td>4</td><td>1.3.1, 1.4.1</td></tr>
</table>

	y 0.27 0.42 0.57 0.66 0.73 0.78				
3	(a) What is reflux ratio? Explain optimum reflux ratio with neat diagram. (b) Partially vaporized feed of composition 42 mole% heptanes and 58 mole% ethyl benzene is to be fractionated at 1 atm to give distillate containing 95 mole % heptanes and bottom containing 95 mole % ethyl benzene. The feed is 40% liquid and 60% vapour (all in mole basis) calculate i) Value of q and slope of q-line, ii) min. reflux ratio, iii) Number of plates at R = 2.5, the equilibrium data is:	5 10	1,2 1,2	2 4	1.4.1, 1.3.1, 1.4.1
	OR				
4	a) Explain Fractionating distillation column with neat diagram. b) A mixture of benzene and toluene containing 40 mole % of benzene is to be separated to give a product of 90 mole % benzene using average of 2.4 for the volatility of benzene relative to toluene. Calculate the number of theoretical plates required at total reflux. Also calculate the minimum reflux ratio if the feed is liquid at its bubble point.	5 10	1,2 1,2	2 4	1.3.1, 1.3.1, 1.4.1

x	0	0.08	0.25	0.485	0.79	1
y	0	0.23	0.514	0.730	0.904	1





BL – Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

SPPU In-Sem Offline Examination- April 2022

Class: T. E. **Branch:** Chemical **Semester:** VI

Subject: Elective-II: Process Instrumentation and Control **Code:** 309351

Maximum Marks: 30 **Duration:** 60 Minutes **Date:** 08/04/2022

Instructions:

- Attempt Q 1 **or** Q 2, Q 3 **or** Q 4.
- Each question carries equal marks.
- Neat diagrams must be drawn wherever necessary.
- Assume suitable data, if necessary.

Que.No.	Question	Marks	BL	CO	PI
1a	Explain the static and dynamic characteristics of the instruments.	10	2	1	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1
1b	Explain the classification of instruments in detail.	5	3	1	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1
	or				
2a	Explain in details the functional Elements of an instrument.	10	2	1	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1
2b	Explain the difference between accuracy and precision.	5	2	1	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1
3a	Describe operating principle, construction and working of Bimetallic thermometer with neat schematic diagram.	10	3	1,2	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1,2.1.1, 2.1.2,2.1.3
3b	Define temperature and give classification of temperature measuring instruments.	5	2	1,2	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1,2.1.1, 2.1.2,2.1.3
	or				
4a	Describe operating principle, construction and working of Resistance Temperature Detector with neat schematic diagram.	10	2	1,2	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1,2.1.1, 2.1.2,2.1.3
4b	Write a short note on mechanical temperature sensors.	5	2	1,2	1.1.1,1.1.2, 1.2.1,1.3.1, 1.4.1,2.1.1, 2.1.2,2.1.3

CO – Course Outcomes PO – Program Outcomes

BL – Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)