Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2170507 **Date: 03/12/2018**

Subject Name: Computer Aided Process Synthesis

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.**

MARKS

Q.1 **(a)** Calculate the number of possible sequences for separation by ordinary distillation for 7, 8 and 10 number of products. **03**

(b) Explain the ethical role of engineer in design of process. **04**

(c) Determine the minimum utility target for following stream data : Take ΔT min=10 ^{o}C **07**

stream	Tin (K)	Tout (K)	mCp (KW/K)
H1	650	370	10
H2	590	370	20
C1	410	650	15
C2	353	500	13

Q.2 **(a)** Define : Minimum approach temperature, Threshold approach temperature, Optimum approach temperature. **03**

(b) Explain the generalized rules for stream splitting on both sides of the pinch to satisfy MER requirements. **04**

(c) Explain the step wise procedure for construction of attainable region. **07**

OR

(c) Derive the equation to construct attainable region for steam reforming of methane. Consider following reactions dominate in process. **07**
$CH_4 + 2H_2O \leftrightarrow CO_2 + 4H_2$, $CH_4 + H_2O \leftrightarrow CO + 3H_2$,
$CO + H_2O \leftrightarrow CO_2 + H_2$

Q.3 **(a)** Compare flowshop plant and jobshop plant. **03**

(b) Describe any four environmental factors to be considered in process design. **04**

(c) Define overlapping and non overlapping operation and show by any suitable example that overlapping operation is more efficient. **07**

OR

Q.3 **(a)** Compare various transfer policies. **03**

(b) Draw the algorithm of Detailed Process Synthesis-Algorithmic Methods. **04**

(c) Calculate the cycle time using following processing time data for ZW, NIS and UIS: **07**

product	Stage 1	Stage 2	Stage 3
A	6	4	3
B	3	2	2

Q.4 **(a)** Explain node and saddle point in residue curve map. **03**

(b) Design heat exchanger network on hot side of pinch for following :Take ΔT min= 10°C, Hot pinch = 90 °C, Qhu= 80 KW **04**

stream	Tin °C	Tout °C	mCp (KW/°C)
H1	180	60	3
H2	150	30	1
C1	30	135	2
C2	80	140	5

(c) Explain the positioning of heat pump with reference to pinch temperature. **07**

OR

Q.4 **(a)** Derive the equation for construction of residue curve. **03**

(b) Design heat exchanger network on cold side of pinch for following :Take ΔT min= 10°C, Hot pinch = 90 °C, Qcu= 50 KW **04**

stream	Tin °C	Tout °C	mCp (KW/°C)
H1	180	60	3
H2	150	30	1
C1	30	135	2
C2	80	140	5

(c) Explain the heat integration in distillation column using heat pumping, vapor recompression and Reboiler flashing. **07**

Q.5 **(a)** Draw the superstructure for one cold stream and two hot streams. **03**

(b) Explain GCC briefly. **04**

(c) Draw the complex and thermally coupled distillation column configurations for ternary distillation. **07**

OR

Q.5 **(a)** Draw the superstructure for one hot stream and two cold streams. **03**

(b) Compare condensed transshipment model and expanded transshipment model. **04**

(c) Draw the possible sequences for 3 number of products and explain heuristics for determining favorable sequences. **07**

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