

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR  
DEPARTMENT OF CHEMICAL ENGINEERING

MID SEMESTER EXAMINATION 2016-17 (SPRING)  
COMPUTER AIDED PROCESS ENGINEERING (CH30016)  
Number of students: 76 ; Total time: 2 hrs. Total marks 30

Answer ALL questions

1.

Stream No. and Type	CP (MW/ °C)	T <sub>s</sub> (°C)	T <sub>t</sub> (°C)
1. Hot	0.15	250	50
2. Hot	0.25	200	80
3. Cold	0.20	20	170
4. Cold	0.30	140	220

- (a) From the above stream table find out the Pinch Temperature and the minimum hot and cold utility required for the process. Assume **two cases** of minimum approach temperature between a hot and cold stream ( $\Delta T_{\min}$ ) to be **10 °C and 20 °C**. Compare the values in a Tabular form.
- (b) Place the Heat Exchanger matches taking the above and below the Pinch process separately and then combine them for the overall design for maximum energy recovery (MER).
- (c) Compare and comment on the two cases on the role of  $\Delta T_{\min}$ .

(6 + 6 + 3 = 15)

2.

- (a) What do you understand by “Steady State”, “Lumped parameter” and “Distributed parameter” model ?
- (b) Develop the Lumped parameter model of a jacketed CSTR having a reaction **A + B → C**. State the assumptions, identify the variables and the governing equations and develop the IFD of the solution scheme.
- (c) A **multi-component non-ideal** liquid stream is continuously “flashed” in a drum to get vapour and liquid from the top and bottom of the drum respectively. Develop a lumped parameter model for the system considering heat balance, component balance, VLE and any other relevant phenomena. Draw the Information Flow Diagram highlighting the convergence block.

(3 + 6 + 6 = 15)

NOTE: Do not ask any question at the Examination Hall. If in doubt, make suitable assumptions and proceed. Handwriting and figures should be neat. Parts of a question should be answered together.