1T00538 - B.E.(Chemical Engineering)(SEM-VIII)(Choice Base Credit Grading System) (R- 2019-20) (C Scheme) / 52572 - Engineering Stream : Energy System Design (DLOC - V)

QP CODE: 10042535 DATE: 12/12/2023

[3 Hours] **[Total Marks: 80]**

N.B.: (1) Question No 1 is compulsory
(2) Attempt any three questions out of remaining five questions
(3) Assume suitable data if necessary and indicate it clearly.
(4) Figures to the right indicate full marks.

Q.1. Solve the following **(Any Four)** **20**

(a) Discuss any two energy efficient techniques for compressed air system in industry.
(b) What is the importance of heat exchanger networking in process industries?
(c) Explain vapor recompression in distillation column.
(d) Which different energy sub audits are carried out in industry?
(e) Discuss how quality of waste heat can be decided.
(f) What are the applications of wind energy?

Q.2. (a) Discuss various techniques to improve energy efficiency of "Steam system". **10**

(b) Explain how recovery of waste heat helps industries and environment in different ways. **10**

Q.3. (a) Explain different basic terms referred in cogeneration system. **10**

(b) Consider the system where heat is being exchanged among hot & cold streams t o meet MER target for which data is given below: **10**

Stream No.	Ts (^{0}C)	Tt (^{0}C)	mCp (kW/^{0}C)
1	180	40	20
2	160	40	40
3	60	220	30
4	30	180	22

If ΔT_{min}= 10^{0}C, find the minimum hot & cold utility requirements as well as the pinch temperatures for this system.

Q.4. (a) Design a feasible HEN to meet MER target on hot & cold sides of pinch for the p rocess system involving four streams whose data is as below for ΔT_{min}= 30^{0}C: **10**

Stream No.	Ts (^{0}C)	Tt (^{0}C)	mCp (kW/^{0}C)
1	140	70	3
2	100	40	5
3	60	80	6
4	30	120	4

Cold pinch temperature= 60^{0}C
Minimum Hot utility requirement, Q_H= 160kW
Minimum Cold utility requirement, Q_C= 190kW

(b) With help of suitable diagrams, explain "breaking loop method" to design HEN with minimum number of heat exchangers. **10**

Q.5 (a) Explain in detail about "tidal energy system". **10**

(b) A stream 15500 lb/hr of saturated steam at 250 psig (406^0F) is being expanded through a PRV to obtain process steam at 50 psig. Determine the potential for electricity generation if the steam is expanded using a single stage back-pressure turbine generator (3600 RPM). Inlet & outlet enthalpy of steam are 1201.7 & 1090.8 Btu/lb respectively. **10**

Data: Corresponding values of Theoretical Steam Rate (TSR) & Actual steam Rate (ASR) for 3600 RPM turbine:

TSR (lb/kw-hr)	17.5	25.0	30.7	35.0
ASR (lb/hp-hr)	22.5	32.5	38.5	45.0

Q.6. Write short notes on the following (Any Four) **20**

(a) Classification of energy sources
(b) Preliminary or Mini energy audit
(c) Energy efficient cooling towers
(d) Threshold approach temperature difference
(e) Difference between topping and bottoming cycle cogeneration
(f) Benefits of solar energy

****