15/05/2025 BE CHEMICAL SEM-VIII C-SCHEME ESD QP CODE: 10085557

[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) What is energy pricing & energy security?
(b) List out the steps involved in energy audit methodology.
(c) Explain any four techniques to make compressed air system energy efficient.
(d) Describe concept of new & renewable energy sources.
(e) What is cogeneration? Explain its benefits.
(f) Explain the concept of Heat integration using Heat exchanger networking.

Q.2. (a) Consider a system where heat is being exchanged among hot & cold streams to meet MER target for which data is given below: **10**

Stream No.	Ts (^{0}C)	Tt (^{0}C)	mCp (kW/^{0}C)
1	180	60	3
2	150	30	1
3	20	135	2
4	80	140	5

If ΔT_{min}= 10^{0}C, find the minimum hot & cold utility requirements as well as the pinch temperature for this system. Also calculate minimum number of heat exchangers required for this system.

(b) Explain energy conservation & its importance; also discuss Indian energy scenario in terms of major energy sources, energy consumption pattern, major problems in energy sector, energy intensive industries. **10**

Q.3. (a) Estimate steam flow rate required to design a heat recovery steam generator. The steam is to be used for power generation & is to be expanded in a 5000 RPM multistage condensing turbine to produce a maximum of 18500 kW. Steam inlet condition is 600 psig. Additional data is given below: **08**
PGC: 18500 kW
Inlet steam: 600 psig
Enthalpy, h_i: 1378.9 Btu/lb
Enthalpy, h_o: 935.0 Btu/lb
Turbine speed: 5000 RPM
Turbine efficiency: 77%

(b) With suitable diagram explain the following waste heat recovery equipments: **12**
i) Heat Pump
ii) Recuperator

Q.4. (a) Design a feasible Heat Exchanger Network (HEN) to satisfy minimum energy requirement for this system where heat is being exchanged among hot & cold streams for which data is given below. ΔT_{min} for this system is 30 °C, Hot pinch temperature is 90 °C and $Q_{H,min}$ and $Q_{C,min}$ are 160 kW and 190 kW respectively. **15**

Data:

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

(b) What is Geothermal energy? Explain its various applications. **05**

Q.5. (a) Explain topping & bottoming cycle in cogeneration system. **10**

(b) What is energy audit? Explain different types of energy audit. **10**

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

(a) Vapour recompression in distillation column.
(b) Instruments used in energy audit.
(c) Basic equation & rules of heat exchanger networking introduced by Linnhoff
(d) Energy efficient practices in Lighting system
(e) Importance of waste heat recovery
(f) Working of Tidal Energy system

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