

Time: 3 Hours

Marks: 80

N.B.:

1. Question No.1 is compulsory and attempt any four questions from remaining
2. Assume data if necessary and specify the assumptions clearly
3. Draw neat sketches wherever required

Q.1 [Compulsory Question]

Marks [04X05=20]

- a) Compare the energy scenario of India with any other developed countries with respect to per capita energy generation, consumption and Transmission & Distribution loss.
- b) State the steps of energy audit.
- c) Explain the concept of “optimum approach temperature difference (ΔT_{opt})” in heat exchanger networking.
- d) Write down the advantages, disadvantages and application of Nuclear energy.

Q.2

Marks [02x10=20]

- a) Explain how to make “motor, belts and drives system” of process plant more efficient
- b) Explain in detail about concept and methodology of energy Audit.

Q.3

Marks [02x10=20]

- a) A triple effect evaporator is concentrating a liquid that has no appreciable elevation in boiling point. The temperature of steam to the first effect is 108°C, and the boiling point of the solution in the last effect is 52°C. The overall heat transfer coefficients, in W/m²K are 2500 in the first effect, 2000 in the second effect and 1500 in the third effect. At what temperatures will the liquid boil in the first and second effects?
- b) Determine the pinch temperature and the minimum utility requirement for the stream set out in the table below for a minimum temperature difference between the streams of 20 °C.

Stream	T ^s (K)	T ^t (K)	C (KW/K)
1	350	250	2
2	430	380	5
3	430	250	1
4	240	420	4

Q.4

Marks [02x10=20]

- a) Determine the pinch temperature and the minimum hot and cold utility requirement, number of heat exchanger and pinch temperature for given stream $\Delta T_{\min} = 10^{\circ}\text{C}$

Stream	Type	T ^s (K)	T ^t (K)	C (KW/K)
1	Hot	623	433	3.2
2	Hot	673	373	3.0
3	Hot	383	333	8.0
4	cold	323	523	4.5
5	cold	343	593	2.0
6	cold	373	573	3.0

- b) The potential for electricity generation (PGC) for a steam turbine system is 18,500 kW. The saturated steam is being expanded through a PRV to obtain process steam

Determine:

- I. Theoretical steam rate (TSR) in lb/kW-hr
- II. Steam flow rate (Ws) in lb/hr

Data :

Inlet enthalpy of steam (hi)= 1378.9 Btu/lb
 Outlet enthalpy of steam (ho)= 935.0 Btu/lb
 Efficiency of turbine generator ($\eta_{\text{tg}} = 0.77$)

Q.5

Marks [02x10=20]

- a) State and Explain the gas turbine gas turbine cogeneration system also write down its advantages, disadvantages and application.
- b) List out various techniques of Waste heat recovery and Explain any two technique in details

Q.6. Write Short Note on any four of the following

Marks [04x05=20]

- a) Grant Composite Curve
- b) Energy Profile
- c) Pinch Technology
- d) Global Energy Scenario