

(3 hour)

[Total 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]

- a) Distinguish between Commercial, non-commercial energy sources [4]
- b) Write short note on "Mini energy audit". [4]
- c) What is pinch temperature? What is its significance? [4]
- d) What is Cogeneration system? Give its advantages. [4]
- e) Explain direct and indirect benefit of WHR [4]

Q.2

- a) Explain Energy efficient technology with the help of any industrial process example. [5]
- 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. Also Design a heat exchanger network to achieve the maximum heat recovery.

Stream Type	Stream No	Source Temperature °C	Target Temperature °C	Heat Capacity Rate (CP) W/°C
Hot	H ₁	440	150	2800
Hot	H ₂	520	300	2380
Cold	C ₁	100	430	1600
Cold	C ₂	180	350	3270

[15]

Q.3

- a) State energy policies and energy rules and regulations in India. [05]
- b) A forward feed triple effect evaporator is used to concentrate dilute solution. The steam at 121°C and 4093 kg/hr is used as heating source for 1st effect, however in 2nd and 3rd effect vapour generated in previous effect are used as heating source. The latent heat of steam used in 1st effect is 2200 KJ/Kg.

Calculate

1. Boiling Point in each effect
2. Heat transfer area in each effect and
3. steam economy

Data:

	Effect 1	Effect 2	Effect 3
U [W/m ² K]	3100	2000	1100
ΔT [°C] adjusted for cold feed condition	18	17	34
Vapour Generated [Kg/hr]	2480	2660	2858
λ [Kg/KJ]	2249	2293	2377

[15]

Q.4

- a) State Indian energy demand and supply. [5]
- b) Determine the minimum hot and cold utility requirement and pinch temperature by using composite curve for the process stream having following thermal data

Stream No	Stream Type	Source Temperature °C	Target Temperature °C	Heat Capacity Flowrate (CP) W/°C
1	Hot	180	80	20
2	Hot	130	40	40
3	Cold	60	100	80
4	Cold	30	120	36

[15]

Q.5

- a) State and Explain the 'Heat Integration of MEE evaporator with GCC.
 1. Forward feed Triple effect evaporator.
 2. Backward feed Triple effect evaporator and
 3. Mixed feed Triple effect evaporator
- b) Explain in detail the energy auditor tool box

[10]

[10]

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

[20]

- a) Composite Curve
- b) Waste Heat Recovery Boiler
- c) Bottoming Cycle of Cogeneration
- d) Energy Profile
- e) Fuel Cell