# GUJARAT TECHNOLOGICAL UNIVERSITY
## M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013

**Subject code: 713903N**                    **Date: 13-06-2013**
**Subject Name: Optimum Utilization of Heat and Power**
**Time: 10.30 am – 01.00 pm**               **Total Marks: 70**
## Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Explain the concept of combined heat and power with suitable example.   **07**
       **(b)** Differentiate heat engines and heat pumps with example of each.   **07**

**Q.2** **(a)** Explain threshold approach temperature and optimum approach temperature.   **07**
       **(b)** For the Heat Exchanger Network Synthesis (HENS) problem following stream   **07**
       information is available:

| Stream | T in °C | Tout °C | FCp kW/°C |
|--------|---------|---------|-----------|
| Liquid, H1 | 430 | 340 | 15 |
| Liquid, C1 | 310 | 395 | 7 |
| Vapor, C2 | 370 | 460 | 32 |

Draw Composite Curve and find out minimum utility targets and pinch point
for ê $T_{min}$ = 10 °C.                    **OR**

**(b)** Two cold streams C1 and C2 are to be heated and two hot streams H1 and H2   **07**
are to be cooled without phase change. Find out minimum utility targets using
temperature interval method. Use $\Delta T_{min} = 10\,°C$.

| Stream | $T^s$ (°C) | $T^t$ (°C) | $m\,C_p\left(\dfrac{kJ}{s\,°C}\right)$ |
|--------|-----------|-----------|----------------------------------------|
| C1 | 120 | 235 | 2 |
| C2 | 180 | 240 | 4 |
| H1 | 260 | 160 | 3 |
| H2 | 250 | 130 | 1.5 |

**Q.3** **(a)** Write a short note on types of prime movers.   **07**
       **(b)** Explain design of heat exchanger networks using Grand Composite Curve.   **07**
                    **OR**
**Q.3** **(a)** What is stream splitting? Explain how stream splitting can help to reduce the   **07**
       number of heat exchangers in heat exchanger network.
       **(b)** Write a short note on retrofit of heat exchanger network.   **07**

**Q.4** **(a)** Briefly describe heat integration of compression refrigeration.   **07**
       **(b)** Write a short note on heat pumping in distillation.   **07**
                    **OR**
**Q.4** **(a)** Write a short note on heat integration characteristics of dryers.   **07**
       **(b)** Write a short note on sources of waste heat. How we can recover waste heat?   **07**

**Q.5** **(a)** Explain in detail Kalina Cycle.   **07**
       **(b)** Write a short note on optimizing steam systems.   **07**
                    **OR**
**Q.5** **(a)** Briefly explain topping, bottoming and combined cycle   **07**
       **(b)** Explain site composite curves.   **07**
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