

M.Tech. Second Semester (Chemical Engineering) (CBS)
13013 : Process Design & Plant Utilities : 2 CE 3

P. Pages : 1

Time : Three Hours



AV - 3392

Max. Marks : 80

- Notes :
1. All question carry marks as indicated.
 2. Answer **any six** questions.
 3. Question No. 1 is compulsory.
 4. Assume suitable data wherever necessary.
 5. Diagrams and chemical equations should be given wherever necessary.
 6. Use of slide rule logarithmic tables, Steam tables, Mollier's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.

1. Discuss the laws of heat integration analysis. Explain the heat integration technique in distillation column with example. **15**
2. Explain the application of vacuum pumps in chemical industry and discuss its design features in detail. **13**
3. Describe the features of CHEM-CAD software and explain its uses in process plant design. **13**
4. Explain the term Heat Exchanger Network and also give details about the steps involved in designing the Heat Exchanger Network System. **13**
5. Discuss the various cryogenic and non-cryogenic methods for the production of inert gas and also mention its applications in food & pharmaceutical industry. **13**
6. Discuss the Heat and mass transfer in fluidised bed reactor. **13**
7. Explain the various parameters consider in Technical Evaluation of Project. **13**
8. Explain Heat regenerators and discuss its types with thermal efficiency calculations. **13**
9. A chemical solution available at 90°C is to be cooled in a parallel flow heat exchanger by using water as a cooling medium. Inlet temperature of cooling water is 15°C. A heat exchanger with effective heat transfer area 10 m^2 is available. Overall heat transfer coefficient is $700\text{ W/m}^2\text{ }^\circ\text{C}$. Flow rate of chemical solution is 3kg/sec. Flow rate of cold water is 4.2 kg/sec. Estimate.
i) The outlet temperature of chemical solution & water.
ii) Effectiveness of heat exchanger. If the counter flow condition are used how much heat transfer area will be required?
Data: Specific heat of chemical solution = 3650 J/kg°C
Specific heat of water = 4180 J/kg°C. **13**
10. Feed containing 50 mole % A and 50 mole % B is to be distilled in a fractionating column to get top product containing 99 mole % and bottom product containing 10 mole % A. The relative volatility of the binary mixture is 2.5. The reflux ratio 2kg mole per kg mole of product is used. The feed enters at its bubble point.
Estimate the number of plates required in rectifying section, stripping section and the total number of plates. **13**
