

# GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Chemical Engineering

Subject Name: **Process Equipment Design - I**

Sr. No	Course Content	Total Hrs.
1.	<b>Process design of piping, Fluid moving devices and Flow meters:</b> Introduction, Process design of piping, NPSHA & NPSHR, Power required by pump, evaluation of Centrifugal pump performance when handling viscous liquids, Power required in Fan, Blower and adiabatic compressor, flow meters, Process design of Orifice meter, Rotameter etc.	10
2.	<b>Process design of Heat exchangers:</b> Shell & Tube heat exchangers, Function of various parts of shell & Tube Heat exchanger, General design method of shell & tube heat exchanger, Criteria of selection among Fixed Tubesheet, U Tube & Floating Head heat exchanger, Process design of without phase change heat exchanger, Process design of condenser, Horizontal and vertical condenser, Condensation with non-condensable, Multi-component condensation, Process design of Kettle type & Thermosyphon Reboilers and vaporizers, Tinker's flow model, Air cooled heat exchangers and air heaters, plate heat exchangers, etc.	20
3.	<b>Process design of Distillation Column:</b> Introduction, Criteria of selection, Selection of equipment for distillation, Distillation column design, Selection of key components for multicomponent distillation, Determination of operating pressure for distillation column, Advantages & disadvantages of vacuum distillation, Determination of nos. of theoretical stages for binary distillation by McCabe Thiele method & Ponchon-Savarit method, Determination of nos. of theoretical stages for multicomponent distillation by Fenske-Underwood-Gilliland's method, Selection of trays, Calculations for tower diameter & pressure drop of sieve tray tower, Checking of conditions for weeping, downcomer flooding, liquid entrainment, etc, tray efficiency, Jet Flooding & downcomer Flooding, Different types of weirs & downcomers of tray tower, their selection criteria, Process design of Batch distillation, simple batch distillation & batch distillation with rectification.	18
4.	<b>Process design of Absorbers:</b> Introduction, Criteria for selection among different types of absorption equipment, Process Design of packed tower type absorber: Determination of actual amount of solvent, Selection of packing, Determination of tower diameter & pressure drop, Determination of $N_{TOG}$ , $H_{TOG}$ & height of packing, Process design & selection criteria of liquid distributors, redistributors & packing support, Process design of Spray chamber or spray tower type absorber, Venturi Scrubber, Process design of falling film absorber.	12

5.	<b>Process design of Extractor:</b> Industrial applications of liquid-liquid extraction, choice of solvent, Process design of counter current multistage extractor, Selection criteria among different types of extractor, Process design of mixer-settler type extractor & packed tower type extractor, Guidelines for the design of other types of extractors	12
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### **Text Book:**

1. "Introduction to Process Engineering and Design" by S B Thakore and B I Bhatt, Tata McGraw Hill, 1<sup>st</sup> Edition, 2007.

### **References Books:**

1. Coulson & Richardson's Chemical Engineering - Vol. 6 by R.K.Sinnott, Asian Book Pvt. Ltd. (publisher)
2. Applied Process Design for Chemical and Petrochemical plants, Vol. 1 to 3 by E.E.Ludwig, Gulf Publishing Company