

## DESING OF PROCESS EQUIPMENT

### 1.1. Identification

University:	Alma Mater Studiorum – Università di Bologna										
School:	School of Engineering										
Course:	Design of process equipment										
ECTS:	9										
Semester:	<i>Winter</i>					<i>Summer</i>				X	
Category	<i>Fundamental course</i>				X	<i>Specialisation course</i>					
Module	<i>MFI</i>	X	<i>MFII</i>		<i>MFIII</i>		<i>MSI</i>		<i>MSII</i>		<i>MSIII</i>
Teachers:	Valerio Cozzani										
Language:	<i>English</i>	X	<i>Italian</i>	X	<i>Swedish</i>		<i>Spanish</i>				

### 1.2. Learning-outcomes

- knowledge about the design of process equipment
- knowledge about the fundamentals of basic plant design

### 1.3. Competencies

#### ▪ General

- to have critical understanding of technical and scientific tools
- to work and manage teams
- communication skills (both written and oral)
- to work in an international context

#### ▪ Specific

- to understand the application of transport phenomena and unit operations to equipment design
- to understand the fundamentals of process equipment design
- to perform the design of simple process equipment
- to understand the activities of basic engineering design
- to understand the fundamentals of basic design documents

### 1.4. Contents

1. Basic design activities and documents: differences among conceptual design, basic design, detailed desing; block diagrams, PFDs, P&IDs, equipment data-sheets, sketches. Analysis of PFD and P&ID. Examples.
2. Basic design of process equipment: activities, general patterns, rules, degrees of freedom, project variables and boundary conditions. Analysis and compilation of equipment data sheets and sketches. Examples.
3. Desing of heat exchangers: double pipe, shell and tube, plate, spiral, air coolers.
4. Design of condensers: of pure vapors, of mixtures, in the presence of uncondensable gases, in the presence of unmixable liquids. Control of condensers depending on operating pressure.
5. Design of reboilers and vaporizers: kettles, chillers, shell and tube natural convection and forced convection recirculating units, film evaporators.
6. Design of absorption columns: operating line, theoretical number of stages, HETP, transfer units; design of plate and packed towers
7. Design of distillation columns: operating line, theoretical number of stages; columns with multiple feeds and sidestreams, intercoolers or pump-arounds; design of plate and packed towers

### **1.5. Teaching Methodology**

- Lectures
- Practical sessions: "cooperative work" for solving problems (desing of process units)

### **1.6. Evaluation**

- written text
- oral examination

### **1.7. Bibliography**

D. Kern: "Process heat transfer", Mc Graw - Hill  
R.E. Treybal: "Mass transfer operations", Mc Graw - Hill  
J.M. Coulson, J.F. Richardson: "Chemical Engineering", Pergamon Press  
J.D. Seader, E.J. Henley: "Separation process principles", J.Wiley