# **Process Equipment Design**

- 1. Course number and name: 020CEPCS3 Process Equipment Design
- 2. Credits and contact hours: 4 credits, 2x1:15 contact hours
- 3. Name of instructor: Malek Msheik

#### 4. Instructional Materials:

- Chemical Engineering Design (Ray SINOTT)
- Analysis, Synthesis, and Design of Chemical PROCESSES (Richard TURTON)

## 5. Specific course information

## a. Catalog description:

General design procedure, design methodology, stages of design activity, process design and mechanical design, mechanical properties of material, factor of safety, material of construction, selection, economic considerations in the design process. Design of basic machine elements (shafts, keys and belt), design of mechanical components such as shielded and unshielded types of flange couplings. A brief overview of the process design aspects of the pressure vessel (like a reactor for example), head design (flat, hemispherical, torrispherical, elliptical and conical). Design of storage tanks. Study of different types of storage tanks and applications. Atmospheric containers, containers for the storage of volatile and non-volatile liquids, gas storage, losses in storage containers, various types of roofs. Types of heat exchangers, codes and standards for heat exchangers, heat exchanger design (U-tube and fixed tube), i.e. shell, head, tubes. Fouling in the heat exchanger, types of fouling. Safety measures and excessive protective devices in the design of equipment. Risk analysis in the design of equipment, overpressure protection devices such as blowdown, pressure relief valves, bursting disc, steam trap, etc.

- b. Prerequisites: None
- c. Required/ Selected Elective/Open Elective: Required

#### 6. Educational objectives for the course

## a. Specific outcomes of instruction:

This course equips students with the ability to navigate the design process, focusing on mechanical design, material selection, and economic considerations. Students will gain practical skills in designing machine elements, flange couplings, pressure vessels, and storage tanks. The course also covers heat exchanger design, emphasizing codes, safety measures, and risk analysis in equipment design.

PI	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5.1	5.2	7.1	7.2
Covered	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Assessed	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х

#### b. PIs addressed by the course:

## 7. Brief list of topics to be covered

- General design procedure and methodology
- Process design and mechanical design integration
- Factor of safety and material selection
- Economic considerations in design
- Design of mechanical components
- Process design aspects of pressure vessels
- Design of storage tanks
- Atmospheric containers and containers for volatile/non-volatile liquids
- Gas storage and losses in storage containers
- Different types of roofs for storage tanks
- Types of heat exchangers
- Codes and standards for heat exchangers
- Heat exchanger design (U-tube, fixed tube, shell, head, tubes)
- Fouling in heat exchangers and types of fouling
- Safety measures in equipment design
- Excessive protective devices (blowdown, pressure relief valves, bursting disc, steam trap)
- Risk analysis in equipment design.