# INDUSTRIAL CHEMISTRY

## 1.1. Identification

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| University: | Alma Mater Studiorum Università di Bologna | | | | | | | | | | | | | | |
| School: | School of Engineering | | | | | | | | | | | | | | |
| Course: | Industrial Chemistry | | | | | | | | | | | | | | |
| ECTS: | 6 | | | | | | | | | | | | | | |
| Semester: | *Winter* | | | | | X | *Summer* | | | | | | | | |
| Category | *Fundamental course* | | | | | X | *Specialisation course* | | | | | | | | |
| Module | *MFI* | X | *MFII* | | *MFIII* | | *MSI* | | *MSII* | | *MSIII* | | | | |
| Teachers: | Franco Magelli | | | | | | | | | | | | | | |
| Language: | *English* | | *Italian* | X | *Swedish* | | *Spanish* | | | | | | | | |

## 1.2. Learning-outcomes

- knowledge about selected processes of the petrochemical industry
- introduction to and training in the critical analysis of chemical processes from an engineering point of view
- refreshing and implementing knowledge in thermodynamics, kinetics, heat transfer, equipment selection (reactors and separation processes)
- concerted application of skills in the mentioned technical areas in an economical framework while considering constraints like environmental, raw-materials and energy availability, etc.

## 1.3. Competences

- **General**
  - developing skills in the analysis of chemical processes
  - critical understanding of chemical processes
  - to work in an international context

- **Specific**
  - discovering the key aspects affecting the industrial feasibility of a process
  - understanding the implications of a multiple-choice approach
  - selecting equipment and operating conditions in an optimal way
  - to determine the parameters that allow the design of industrial processes

## 1.4. Contents

1. Raw materials and production lines; chemicals; structure of the petrochemical industry.

2. Homogeneous and heterogeneous catalysts; kinetics vs. mass transport in heterogeneous catalysts; pressure drops in porous media; main reactor types; role of micromixing; multifunctional reactors.
3. Separation processes: azeotropic and extractive distillation, 'trains' of distillation columns for the separation of multicomponent mixtures, reactive distillation, adsorption.
4. Syngas: steam reforming and partial oxidation of hydrocarbons (refresher), partial oxidation of coal and biomass; methanol synthesis; formaldehyde, MTBE; discussion on MTG, MOGD, MTO; Fischer-Tropsch process.
5. Steam cracking for the production of alkenes and co-products, product separation. Some uses of products from steam cracking: Wacker process, acrylonitrile, ethylbenzene and styrene, terephtalic acid and dimethylterephtalate.
6. Polymerisation processes: polymers properties, main polymerisation mechanisms and processes, polymerisation reactors; synthesis of polyethylene (LDPE, HDPE, LLDPE); synthesis of nylon.

### 1.5. Teaching Methodology

- Lecture sessions
- Problem sessions and discussions

### 1.6. Evaluation

- oral exams (including the solution of specific problems)

### 1.7. Bibliography

- A. Moulijn, M. Makkie, A. van Diepen, '*Chemical Process Technology*', Wiley, 2001.
- K. Weissermel, H.J. Arpe, '*Industrial Organic Chemistry*', 5^ ed., Verlag Chemie, Weinheim, 2001.
- I. Pasquon, G.F. Pregaglia, '*Principi della Chimica Industriale. Vol. 5: Prodotti e Processi dell'Industria Chimica*'. Città Studi, 1994.