Bachelor of Engineering in Chemical Engineering (4 Years, 240 ECTS)

A chemical engineering program focused on transforming raw materials into valuable products through safe, efficient, and sustainable processes, blending theory with pilot-scale laboratory practice.

Program Overview

- **Award:** B.Eng. in Chemical Engineering
- **Duration:** 8 Semesters (4 academic years)
- **Total Credits:** 240 ECTS
- **Delivery:** Lectures (L), Tutorials (T), Laboratories (P), Design Studio (S), Internship (I)
- **Workload:** 1 ECTS ≈ 25–30 hours
- **Program Pillars:** Chemical Engineering Thermodynamics • Transport Phenomena • Reaction Engineering • Separation Processes • Process Control • Process Design & Simulation • Safety & Risk Management • Biochemical & Environmental Processes • Sustainability & Ethics
- **Signature Experiences:** pilot-scale unit operations, Aspen-based design, and a plant-style capstone package.

Graduate Learning Outcomes

Graduates will be able to:

1. **Process Fundamentals.** Apply thermodynamics, transport, and kinetics to analyze process units and systems.
2. **Unit Operations.** Design and evaluate separation and purification processes with mass/energy balances.
3. **Reactor Design.** Model and design reactors considering selectivity, conversion, and heat/mass transfer limits.
4. **Process Control.** Implement control strategies and instrumentation for stable, safe operation.
5. **Process Safety.** Identify hazards, perform risk assessment, and apply inherently safer design principles.

6 **Simulation.** Use process simulation tools to model flowsheets and optimize process performance.

7 **Professional Practice.** Work in teams, document engineering decisions, and follow ethical and regulatory norms.

8 **Sustainable Solutions.** Design processes that reduce emissions, waste, and resource intensity across the lifecycle.

Curriculum Structure

Structured across 8 semesters (30 ECTS each). Most courses are 6 ECTS unless otherwise noted.

Year 1

Semester 1 (30 ECTS)

- General Chemistry - 6 ECTS
- Calculus I - 6 ECTS
- Physics for Engineers - 6 ECTS
- Introduction to Chemical Engineering - 6 ECTS
- Engineering Communication - 6 ECTS

Semester 2 (30 ECTS)

- Organic Chemistry (Intro) - 6 ECTS
- Calculus II - 6 ECTS
- Linear Algebra for Engineers - 6 ECTS
- Material & Energy Balances - 6 ECTS
- Engineering Ethics & Safety - 6 ECTS

Year 2

Semester 3 (30 ECTS)

- Chemical Engineering Thermodynamics I - 6 ECTS
- Fluid Mechanics - 6 ECTS
- Heat Transfer - 6 ECTS
- Chemical Engineering Laboratory I - 6 ECTS
- Technical Elective I - 6 ECTS

Semester 4 (30 ECTS)

- Chemical Engineering Thermodynamics II - 6 ECTS
- Mass Transfer - 6 ECTS
- Separation Processes I - 6 ECTS
- Process Measurements & Instrumentation - 6 ECTS
- Technical Elective II - 6 ECTS

Year 3

Semester 5 (30 ECTS)

- Reaction Engineering I - 6 ECTS
- Separation Processes II - 6 ECTS
- Process Control I - 6 ECTS
- Process Simulation (Aspen/HYSYS) - 6 ECTS
- Technical Elective III - 6 ECTS

Semester 6 (30 ECTS)

- Process Safety & Risk Analysis - 6 ECTS
- Biochemical Engineering (Intro) - 6 ECTS
- Industrial Chemistry & Catalysis - 6 ECTS
- Technical Elective IV - 6 ECTS
- Industry Internship - 6 ECTS

Curriculum Structure

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Year 4

Semester 7 (30 ECTS)	• Process Design I (Flowsheets) - 6 ECTS • Advanced Separations (Membranes/Adsorption) - 6 ECTS • Sustainable Process Engineering - 6 ECTS • Technical Elective V - 6 ECTS • Capstone Design I (Project Planning) - 6 ECTS
Semester 8 (30 ECTS)	• Capstone Design II (Design Package & Economics) - 12 ECTS • Plantwide Control & Optimization - 6 ECTS • Engineering Economics for Processes - 6 ECTS • Advanced Seminar & Presentation - 6 ECTS

Technical Elective Tracks

Choose at least 5 electives; focus on one track for specialization.

Track A — Energy & Fuels

- Hydrogen Systems
- Battery Materials (Intro)
- Carbon Capture
- Biofuels Processing

Track B — Pharma & Bioprocess

- Downstream Processing
- Sterile Manufacturing
- Bioreactor Design
- Quality by Design

Track C — Sustainable & Green Processes

- Green Solvents
- Waste-to-Value

- Electrochemical Processes
- Life Cycle Assessment

Track D — Advanced Separations

- Membrane Engineering
- Chromatography (Intro)
- Adsorption Systems
- Crystallization Design

Laboratories & Facilities

Unit Operations Lab

Pilot-scale distillation, absorption, filtration, heat exchangers, and reactor skids.

Process Control Lab

Instrumentation benches with PLC/DCS simulators for control and safety interlocks.

Process Simulation Studio

Workstations with process simulators and economic evaluation tools for design projects.

Safety Training & HAZOP Rooms

Dedicated spaces for hazard analysis workshops and safety case documentation.

Capstone Design Examples

- **CO2-to-Methanol Mini-Plant**
  Design a catalytic process with recycle, heat integration, and safety analysis.
- **Wastewater Resource Recovery**
  Model treatment and recovery of nutrients/biogas with lifecycle impacts.
- **Continuous API Crystallization**
  Develop a continuous crystallization design with control strategy and QA approach.
- **Green Solvent Replacement**
  Evaluate solvent alternatives and redesign separations to reduce emissions and cost.