



**Isfahan
University of
Technology**

Department of Chemical Engineering

In The Name of God

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Overview

Department of Chemical Engineering is among the oldest departments at IUT, established in 1977, and offers different degrees in various fields. Training qualified and knowledgeable students with the help of proficient professors and academic staff has always been among the key goals of this department.

The Department of Chemical Engineering is active both in undergraduate and graduate levels by having currently about 524 undergraduate students and 153 graduate students (including M.Sc. and Ph.D. students). The department offers the degree of Bachelor of Science (B.Sc.) in Chemical Engineering, Petroleum Engineering and Polymer Engineering. At the graduate level there are M.Sc. of Chemical Engineering, Petroleum Engineering, Polymer Engineering and Biotechnology. The M.Sc. of Chemical Engineering includes three different branches of Transport Phenomena, Processes Design, and Separation. At the Ph.D. level, the department offers only two programs of Chemical and Polymer Engineering.

Website: che.iut.ac.ir

Telephone: **+98 31 3391 2675**

Fax: **+98 31 3391 2577**



Department of Chemical Engineering

Degree Programs

■ **Bachelor's Program**

140 Credits

■ **Master's Program**

23 Credits + Thesis with 6 credits

■ **Doctoral Program**

18 Credits + Thesis with 18 credits

Different Disciplines of the Department of Chemical Engineer-	
B. Sc.	Chemical Engineering
	Polymer Engineering
	Petroleum Engineering
M. Sc.	Chemical Engineering-Transport Phenomena
	Chemical Engineering-Separation
	Chemical Engineering- Processes Design
	Bio Technology
	Petroleum Engineering-Reservoir Engineering
	Polymer Engineering
Ph. D.	Chemical Engineering
	Polymer Engineering

Undergraduate students must take 20 credits in general courses, 25 credits in basic courses, 82 credits in compulsory courses and 10 credits in elective courses (total 140 credits) for B.Sc. in Chemical, Polymer and Petroleum Engineering.

Graduate students must take 15 credits in the required courses, 6 credits from elective courses, 2 credits of seminar and 6 credits of thesis, overall 29 credits to receive M.Sc. degree.

The Ph.D. program consists of 18 units of coursework, 18 credits of thesis and the students must pass the written and oral comprehensive exam after completion of course works.







Reasons to study at this department

- **Industrial Partnership:** Active corporation with outstanding research and industrial centers such as national Iranian Oil Company (NIOC), Research Institute of Petroleum Industry (RIPI), National Petrochemical Company (NPC) Polymer and Biochemical organizations supporting practical and applied research.
- **Scientific Cooperation:** Broad Cooperation with top ranking universities in Iran and around the world and also close collaboration with Isfahan Science and Technology Town to exchange their findings and resolve the most common national and international problems (e.g. Environment, Energy, Natural Resources, Health, ...)
- **Top Ranking Department:** High qualified teaching and research as well as modern laboratory facilities (polymer, bio-chemical, and petroleum and chemical) being resulted in many publications, patents and top qualified graduates. Many of our graduates have achieved successful careers both nationally and internationally.
- **Awards:** Our academic staff and students have achieved many national and international honors and awards.
- **Modern Laboratory:** We have modern laboratory facilities to perform accurate experiments related to chemical, polymer, petroleum and bio-chemical engineering. A computational Fluid Dynamic Centre (CFD Lab) as well as a Computer Centre enables our students to pursue the numerical modeling projects.
- **Supporting Students:** The students are involved directly in practical and novel research projects from Master to PhD, ensuring that students are fully familiar with the latest knowledge. The grants are offered to students conducting their research. We involve students in our community activities – educational and leisure events.

Program Objectives

The undergraduate program is focused on applied science in mathematics and engineering to obtain strong academic background. The computer programming, experimental activities and practical workshops give the students the chance to deeply involve in various practical engineering issues. In the last year of the undergraduate program, students must carry out a Summer Internship and a research project. Hence, students have the chance to work in a team and to identify the real engineering problems and resolve the related challenges. They also learn and practice various applications related to Chemical, Polymer and Polymer engineering. The post-graduate students are required to pass a few advanced courses to strengthen their academic background and after that they are involved in a research project as a dissertation. The post-graduate students are promoted to be involved in a practical project (joint industrial project) to become more familiar with engineering process in industry and resolve real challenges. Students can employ a wide range of up-to-date laboratory equipment to perform their research.





Research Areas

■ Chemical Engineering

- Distillation
- Adsorption
- Separation Processes
- Nanomaterials for Desorbents
- Acid Gas Removal
- Heat and Mass Transfer Enhancement: Application of Nanofluids
- Energy Storage: Phase Change Materials
- Design of Experiment (DOE) in Chemical Engineering
- Computational Fluid Dynamics (CFD)
- Simulation-Mathematical Modeling, and Optimization
- Multiphase Fluid Flow
- Environmental Remediation and Environmental Protection
- Transport Phenomena and Separations
- Reacting Systems and Heterogeneous Catalysis
- Supercritical Fluids (Nanotechnology /Extraction/Reaction)
- Kinetics and Reaction Engineering
- Two Phase Flow in Microchannels and Microfluidics

■ Polymer Engineering

- Polymerization: Polyurethane Synthesis, Vinyl Chloride Suspension Polymerization, Suspension Polymerization (S-PVC) and ...
- Polymer Surfaces and Interfaces: Physicochemical Modification of Polymer Surface, Simulation of Polymer Interfaces
- Crystallization of Polymers
- Polymer Processing, Polymer Blending, Polymer Composites, Polymer Rheology

- Composites and Additives
- Extracting and Isolating Nano-fibers from Natural Resource
- Preparation and Characterization of bio-nanocomposites: Chitosan based composites Developing bio-nanocomposite foams, Starch based nanocellulose composites and foams
- Developing new environmentally friendly composites such as bio-fiber thermoset/thermoplastic composites
- Simulating mechanical behavior of composites for building, construction, and automotive applications
- Gas Separation Membranes
- Polymeric Membranes in CO₂ Capture, Reverse Osmosis, Microfiltration, Ultrafiltration and Nanofiltration
- Study on membrane processes ; Membrane bioreactor process
- Water and wastewater treatment by advanced membrane technology
- Preparation of membranes and bipolar plate of PEM Fuel Cell
- Modeling flow behavior of polymer membranes
- Tissue Engineering
- Microstructure-property relationship of polymers (Physico-Mechanical Properties of polymers)

■ Bio-Technology

- Fermentation Technology
- Bioreactor Design
- Economic Analysis of Bioprocesses
- Bioprocess Development
- Microbial Fuel Cells
- Environmental Bio-technology
- Wastewater Treatment
- Pretreatment of Lignocelluloses
- Synthesizing bio-based polymers from natural resources.
- Cultivation of microalgae and halophiles for the production of high-value products

TD1 FORCED CONVECTION TRANSFER APPARATUS

POSITION OF HOT JUNCTIONS



HEATER

ON



ORIFICE PRESSURE
DROP

TEST LENGTH
PRESSURE DROP

EXIT PRESSURE
DROP



FAN



TEMPERATURE MEASUREMENT

FAN PRESSURE

■ Petroleum Engineering

- Unconventional Reservoir Modeling
- Numerical Methods
- Reservoir Characterization
- Applications of Artificial Intelligence in Petroleum/Chemical Engineering
- Petroleum Reservoir Engineering
- Enhanced Oil Recovery (EOR)
- Fluid Flow in Porous Media
- Thermodynamic of Petroleum Fluids
- Welltesting Analysis



Industrial Projects and Income

The faculty members have always been interested in dealing with practical and industrial challenges in their research career and hence the Department of Chemical Engineering has close collaboration with industry. Over 180 joint industrial projects have been conducted with various industries. In particular, the department has been a pioneer in collaboration with oil and petrochemical industries.

Recently, the Department has signed two mega projects with National Iranian Oil Company (NIOC):

- Scientific and technical investigations regarding Hydrocracking process in petroleum refinery from experiment to pilot study.
- Full filed study of one of the giant oil reservoirs in south of Iran (Marun-Bangestan).

Moreover, the Department of Chemical Engineering is in charge of developing Petroleum Research Park at Isfahan University of Technology with collaboration of the Iranian Petroleum Ministry.

Interdisciplinary Approaches

The Department has close research collaboration with many research and academic centers in Iran. The multidiscipline research projects in the Department are running with partnership of Nano research Center, Bio-Technology Research Center, Departments of Materials Engineering, Chemistry, Computer Engineering, Textile Engineering, Mechanical Engineering and Mining Engineering.

In addition to corporation with many institutes in Iran, our academic members have carried out interdisciplinary projects with the top research centers in other countries like, Sweden, Australia, UK, Canada, USA, Denmark, Norway etc.

A Profile of the Labs

■ Analysis Lab:

There are various equipment in this lab which are used for separation and identification of various components as well as their concentrations in different materials. There are some other instruments used for making homogenized mixtures and solutions. This lab is only used for research work by graduate students. Moreover, the lab services can be delivered to the industry by our expert technicians.

Research Equipment:

- Biochemical Oxygen Demand
- Fourier Transform Infrared Spectroscopy – FTIR
- Gas Chromatography (GC)
- High-Performance Liquid Chromatography (HPLC)
- UV-Visible Spectrophotometer
- Ultrasonic Homogenizer
- Oven (up to 200 C)
- Centrifuge (up to 20000 RPM)
- Ultra-sonic Bath
- Orbital Motion HOLDEKER
- Atomic Absorption Spectroscopy
- Differential Scanning Calorimetry (DSC)
- Conductivity Meter
- Electric Muffle Furnace (up to 1000 C)
- Rotational Viscosity Meter
- Chemical Oxygen Demand (COD)
- Contact Angle Measurement
- High Energy Ball Mil
- Benchtop Refractometer



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■ Chemical Engineering Bio-Technology Research Lab

- Autoclave
- Incubator
- Shaking Incubator
- Chemical Fume Hood
- Laminar Flow Hood
- Freeze Dryer
- Gas Chromatograph Machine
- Microfuge
- High-Performance Liquid Chromatography (HPLC)
- Oven
- Centrifuge
- Furnace
- Supercritical Extraction

■ Heat Transfer Lab:

This lab aids the undergraduate students to understand the principles of heat transfer phenomenon during different processes.

Some tests carried out in this laboratory are as follows:

- Forced Convection Heat Transfer
- Cooling Tower
- Condensation of Compressed Steam
- Water Heat Exchanger
- Radiation
- Boiling
- Extended Surfaces Heat Transfer
- Conduction Heat Transfer
- Plate Heat Exchanger



■ Polymer Lab

- Water Bath, Acrylamide polymerization in water solution
- Water Bath, Emulsion polymerization of vinyl acetate
- Oil Bath, nonlinear polyester
- Characterization (solubility, hydrolysis and flame tests)
- Methyl Methacrylate Polymerization (elucidating the effect of the Inhibitor, accelerator, and initiator)
- Basket Heater, phenol-formaldehyde resin preparation
- Determination of molecular weight via solution viscosity measurement
- Determination test of polymer softening point by Vicat method
- Creep Test
- Hardness Test
- Pressure drop test in pipes and connections
- Mooney-viscosity Test

■ Unit Operation Lab

- Ball Mill, Jaw Crush
- Liquid Extraction
- Climbing Film Evaporator
- Circulation Evaporator
- Drum Drier
- Tray Dryer
- Batch Reactor
- Packed Distillation Column
- Tray Distillation Column
- Gas Absorption



■ Fluid Mechanics Lab

- Pressure Drop in Pipes and Fittings
- Hydrostatic Force and Center of Pressure
- Measuring Air Viscosity
- Fluidized and Fixed Beds
- Determination of pump characteristics and examining pump performance in series and parallel arrangements

■ Downstream Petroleum Lab

- Carbon Residue
- Viscosity of Petroleum Products
- Automatic and Manual Distillation
- Pour Point and Cloud Point
- Corrosion of Copper in Contact with Petroleum Products
- Flash Point and Fire Point
- Bitumen Penetration Determination Device

■ Upstream Petroleum Engineering Lab

- Core-flooding Enhanced Oil Recovery
- Spontaneous Imbibition
- Gas Hydrate
- API and Specific Gravity
- PVT and Fluid property
- Porosity and Permeability Measurement
- Interfacial Tension (IFT)



International Profile

Department of Chemical Engineering has been involved in several international collaborations including research and teaching activities with many countries including, but not limited to, Sweden, Australia, UK, Canada, USA, Denmark, and Norway. Our PhD students can spend part of their study at universities abroad as visiting scholars. The Department of Chemical Engineering has a number of foreign students in undergraduate and post-graduate levels from neighboring countries every year.

Inventions and Innovations

Many national and international patents have been registered so far by the faculty members. The most important of these in the recent years are:

- Synthesis of Laminated graphite and its application to absorb petroleum products from seawater and oceans
- Construction of sulfur dioxide removal device by electric field
- Construction of a device for removing nitrogen oxides (NO_x) by electric field
- Polyethylene functionalized with glycidyl methacrylate monomer in supercritical conditions

US patents:

- HEAVY METAL CATIONS ELIMINATION FROM AQUEOUS MEDIA BY NANOTECHNOLOGY
- Synthesis of tungsten disulfide mineral nanoparticles by inverse micelle method
- Synthesis of tungsten disulfide mineral nanoparticles by quartz tubular reactor method
- Pyrolysis of Recycled Rubbers
- Modification and Enhancement of Properties of Lubricants Using Nano-Particles

- Making formulations with different additives to control the vapor pressure of gasoline mixture and making a gasoline sample with a new non-oxygen additive to increase octane number
- Construction of polymer composite bipolar plate for fuel cell
- Making super gasoline by combining optimal percentages of oxygenated compounds
- Fabrication of polyurethane-silica nanocomposite membrane for separation of hydrocarbons heavier than methane
- Fabrication of polyurethane urea membrane to separate hydrocarbons heavier than methane
- Simultaneous production and separation of furan compounds
- A METHOD FOR EVALUATING PERFORMANCE OF A LIME SOFTENING CLARIFIER
- Production process of zeolite A5 synthesized from kaolin by micro-emulsion method
- Super impact -resistant PVC composites base on calcium carbonate methyl methacrylate-butyl acrylate copolymer core-shell nanoparticles
- Use of structured acne in rotating biological contactors
Suspended polymerization of vinyl chloride by Gradual increase of initiator
- Preparation of the wound dressing urethane film from condensation polymerization reaction
- Quantitative and Qualitative Evaluation of Polymer-Particle interface in Polymer Composites by Gas permeability probing
- Innovative design for single chamber microbial fuel cell capable of assembly in packages of multiple cells and expansionable in 3 spatial dimensions
- Desalination of saline waters by capacitive deionization method
Plasticization-resistant polyurethane membrane and preparation method thereof

Contributions to Sustainable

Development and its Impacts on Society

The Department of Chemical Engineering has always been in close interaction with the society and attempted to understand the real conditions existing in the country and the world. Hence the faculty members have always been committed to direct their practical and principle research towards resolving real challenges and problems involved in the society. In this regards, the Department has focused on the subjects such as Fossil Fuels, Renewable Energy, Water Treatment, Air Pollution, Bio-fuels and Nano-technology.

We would like to express our sincere thanks to the faculty members at the Department of Chemical Engineering, and our colleagues at International Scientific Cooperation Center (ISCC) for sincere assistance in producing this prospectus.

 Tel: **+98 (31) 33912505-6**
 Fax: **+98 (31) 33912511**
 Email: **international@iut.ac.ir**
 Website: **www.international.iut.ac.ir/en**

 Instagram: **IUT_International**
 Telegram: **IUT_International**
 LinkedIn: **Isfahan University of Technology**



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