



# Chemical Engineering

What it means to be a Chemical Engineer!

**Gajendra Circle Initiative (GCI) from IIT Madras Alumni Association and The Hindu Group**

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## What it means to be a Chemical Engineer!

### Introduction

Chemical Engineering is the branch of engineering that deals with the application of physical science (e.g. chemistry and physics), and life science (e.g. biology, microbiology and biochemistry) with mathematics, to the process of converting raw materials or chemicals into more useful or valuable forms. In addition to producing useful materials, modern chemical engineering is also concerned with pioneering valuable new materials and techniques - such as nano technology, fuel cells and biomedical engineering. Chemical engineering largely involves the design, improvement and maintenance of processes involving chemical or biological transformations for large-scale manufacture. Chemical engineers ensure the processes are operated safely, sustainably and economically. Chemical engineers in this branch are usually employed under the title of Process Engineer; a related term with a wider definition is chemical technology.



### What You Learn in Chemical Engineering?

Not every Chemical Engineer is a generalist. Many choose a specific career path, develop an area of expertise, or serve a single purpose on a team. Some areas of specialty include:

**BioChemical Engineering** – This field focuses on the chemical processes occurring naturally in plants and animals. Food companies hire chemical engineers to improve crop yields by developing safer pest control products for farmers and distributors. Utility companies employ chemical engineers who examine ways to dispose of waste more efficiently while delivering supplies of clean drinking water to challenging locations.

**Food Engineering** – As the world's population is increasing, researchers are also looking for new and better ways to improve the quality and extend the life of food products. Food Chemical Engineers also try to make crops more disease-resistant and safer to eat.

**Petroleum and Petro Chemical Engineering** – Petroleum is a finite resource, so Chemical Engineers constantly seek better ways to find and extract oil and natural gas. Oil companies deploy teams of chemical engineers to existing plants and refineries to improve production that yields from dwindling fossil

fuel deposits. Chemical Engineers also travel to new drilling locations to help team of scientists develop better ways to tap previously overlooked sources of oil and gas. At the same time, Chemical Engineers also search for safer and more efficient methods of developing oil-based products. By integrating smart production methods at the site of the drilling or during the refining process, chemical engineers have discovered ways to create useful products by recycling waste elements.

**Process Control** – Computers have become indispensable to every profession. Chemical engineering is no exception. Engineers oversee the quality-control portions of product development, such as temperature and liquid levels in processing tanks. Process control specialists improve production to a diverse array of industries, ranging from ice cream production to plastics manufacturing.

**Pharmaceuticals** – In conjunction with medical researchers, Chemical Engineers help design and operate the equipment that produces life-enhancing drugs. Chemical Engineers specialize in taking the concepts of new drugs from the lab to the factory floor by discovering ways to scale these new inventions. Over time, their efforts produce medicine that costs less for consumers and can be made more efficiently in facilities around the world.

**Production-** – Chemical and Manufacturing plants require professionals to oversee their equipment and processes. Some employers use chemical engineers to maintain production levels or to advise in the purchase and layout of the equipment.

The most common areas of study include:

- Electronic processing
- Semi-conductor processing
- Plastics and high performance materials
- Biochemical and biomedical processes
- Ceramics
- Electrochemical processing

A chemical engineer is usually involved with a variety of processes such as:

- Chemical synthesis
- Chemical separation
- Chemical reaction
- Distillation
- Filtration
- Heat transfer operations
- Energy balances
- Thermodynamics

## Opportunities

A chemical engineer is primarily responsible for:

- Designing systems that are focused on the conservation of energy
- Specializing in oxidation or polymerization
- Developing products such as fertilizer, automotive plastics, clothing, and pulp
- Designing equipment for large-scale chemical manufacturing
- Planning and testing manufacturing products
- Supervising a team of chemical engineers during testing and product development stages

A chemical engineering degree provides the research, technical, and production skills needed to pursue a chemical engineering career. Manufacturing industries in particular, need a skilled chemical engineer team to stay competitive within the growing industry.

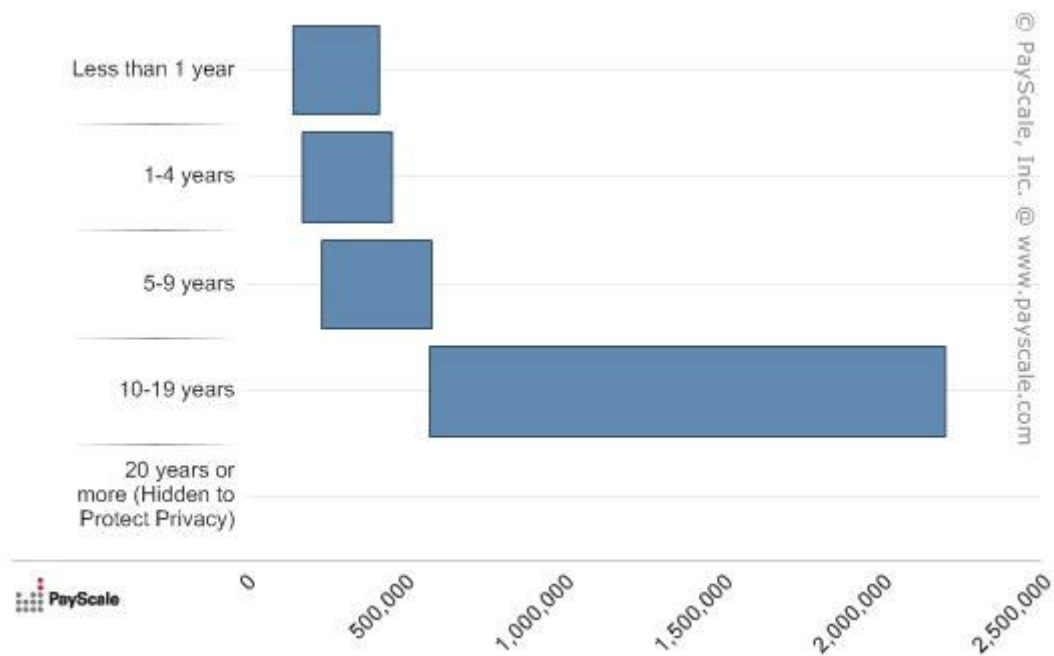
The most common types of chemical engineering careers available include positions in:

- Chemical process modeling
- Chemical technology
- Biotechnology
- Heat and mass transfer
- Nanotechnology
- Biochemical engineering
- Fluid dynamics
- Distillation design
- Environmental engineering
- Materials science
- Thermodynamics

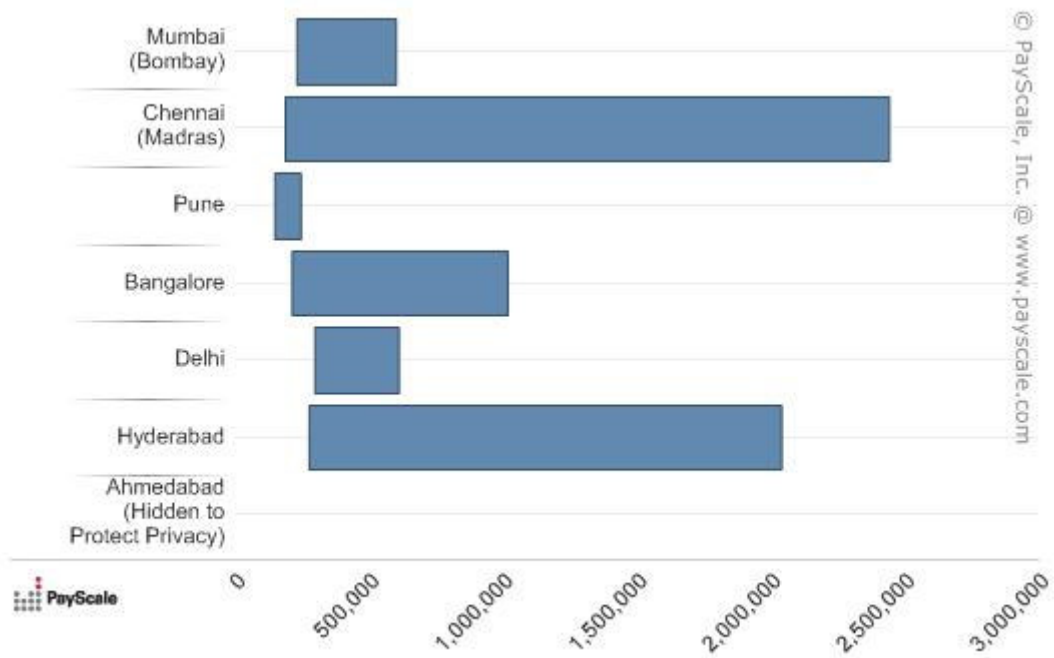
## Salary Profile

This section provides salary profile of chemical engineers in India based on years of experience, city of employment, type of employer.

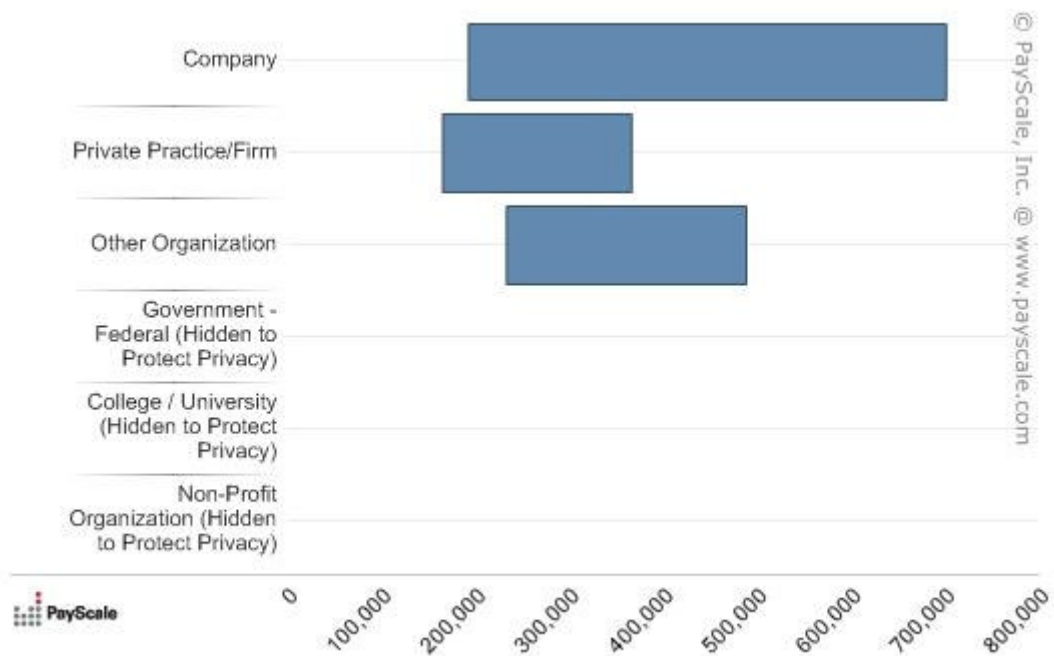
### Salary Range for Chemical Engineers (Years of experience)



### Salary Range for Chemical Engineers (by City)



### Salary Range by Type of Employers for Chemical Engineers



## Gender Profile



## Areas of Research in Chemical Engineering

Prior to the 1970s, a large number of chemical engineers secured work in the booming petroleum industry and became involved in continuous processes. In more recent times, chemical engineers have entered many diverse fields—in particular, the pharmaceutical industry—working on the batch process level. Chemical engineers have also found employment with specialty chemical companies, as well as within the consumer and electronics industries.

Chemical engineers are actively involved in developing improved polymer processing and devices relevant to biomedical engineering. Another important research area is the physical and biological treatment of hazardous wastes. Computational methods are now used extensively in modeling studies, and computer simulation is routinely employed in plant design.

A further key area of interest involves, separation techniques and technologies for solving separation problems in the chemical, environmental, food, pharmaceutical, and biotechnological industries.

Other exciting frontier areas of research in chemical engineering include molecular and nanoscale engineering, molecular simulation, surface modification, protein separation processes, supercritical fluid extraction, fluid particle systems, catalysis and reaction engineering, biochemical engineering, and computer-aided design.

## Reference

This report has been compiled based on the following publications.

- [http://en.wikipedia.org/wiki/Chemical\\_engineering](http://en.wikipedia.org/wiki/Chemical_engineering)
- <http://www.ulinks.com/engineering/chemicalengineeringcareers-onlinechemicalengineeringdegree.htm#Chemical%20Engineering:%20Chemical%20Engineering%20Career,%20Online%20Chemical%20Engineering%20Degree>
- <http://www.worldwidelearn.com/online-education-guide/engineering/chemical-engineering-major.htm>
- <http://www.engineeringservicesoutsourcing.com/ref/eng/fut/ch/ch.html>
- <http://www.google.co.in/images?q=chemical+engineering&btnG=Search&um=1&hl=en&client=firefox-a&rls=org.mozilla%3Aen-US%3Aofficial&tbs=isch%3A1&sa=2>
- <http://www.chemistryexplained.com/Ce-Co/Chemical-Engineering.html>

## About Gajendra Circle

Gajendra Circle (GC) Initiative is a subset of IITM alumni association, and is aimed at building the IIT Madras brand and strengthening the Institute resources. It has been structured as a collection of city specific cells. GC Hyderabad was constituted in April 2010 with the aim to take up activities which strengthen IIT Madras and have a good resonance with the core team.

## About Adayana

Adayana is a leading Human Capital Development organization with its headquarters in Indianapolis, IN, USA and offices across Americas, EMEA, Asia. Adayana provides comprehensive learning services that leverage best-of-class and proprietary technologies and processes.

For four subsequent years, from 2006 to 2009, TrainingOutsourcing.com recognized us as one of the "Top 20 Companies in the Training Outsourcing Industry" for its unique and diverse capabilities. In 2007, 2008 and 2009 Adayana has been named to the Inc. 500 list of America's 500 fastest growing companies. Adayana offers e-Learning, instructor-led training, mobile learning, gameware and performance support tools to its customers for improving human capital performance.

Adayana India (based in Hyderabad) focuses on India and Asia markets - serving large multinationals in the Automotive, IT/ITES, Healthcare, Agriculture & Food and other verticals. Adayana is a leading player in skill development and capacity building and has partnered with leading universities and colleges to provide finishing school content to improve employability of students.

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