



## DEPARTMENT OF CHEMICAL ENGINEERING



## DEPARTMENT AT A GLANCE



## About BITS Pilani

Birla Institute of Technology & Science, Pilani was declared as an Institution, Deemed to be a University under section 3 of the UGC Act in the year 1964, one of the earliest to be so recognized. Ever since, in keeping with its traditions, the mandate given by its founding Chairman, and with its Deemed to be a University status, BITS Pilani has pioneered a number of visionary initiatives in higher education and has established an impeccable and formidable reputation nationally for excellence. As an integral part of its mission of providing education of the highest quality to greater numbers of aspiring students, BITS Pilani established full-fledged campuses in Dubai (2000), Goa (2004) and Hyderabad (2008). BITS Pilani offers UG, PG and PhD programs to over 17,500 students across its 4 campuses in Pilani, Goa, Hyderabad and Dubai. Common academic and governance structure with shared processes have ensured that the same high standards of excellence are adhered to uniformly across the University. Birla Institute of Technology & Science, Pilani (BITS Pilani) has been consistently ranked high, by both governmental and private ranking agencies for its innovative processes and capabilities that have enabled it to impart quality education and emerge as one of the best private Science and Engineering Institutes in India. In recognition of the high standard that BITS Pilani strives to uphold, the University Grant Commission, in 2018, has declared it as an "Institute of Eminence" (IOE). More recently, BITS Pilani has expanded its academic offerings with campuses in Mumbai, namely the BITS School of Management and the BITS Law school.



## About the Department

The Department of Chemical Engineering at BITS Pilani K K Birla Goa Campus was established in 2004. In its early days, it was referred to as the Chemical Engineering Group before it attained Department status in 2009. It offers a strong integrated First Degree academic programme (B. E.) and also a dynamic Higher Degree Programme (M. E.) in Chemical Engineering that reflects the evolution of the Department. Over the years, the academic programme has evolved with a strong core curriculum

complemented by electives in the important emerging areas of Chemical Engineering.

The continually evolving programmes emphasize on fundamental theory as well as practical applications in Chemical Engineering, keeping in view the continuous changing scenarios in this discipline. Aligning with the three tier structure of the University, the Department also offers a Doctoral programme leading to a PhD degree.

The faculty in the Department are a mix of highly qualified and experienced people from both academic and industrial background and this helps the students to understand and appreciate knowledge in this discipline and its relevance to Industry. The Department currently has 20 faculty members comprising of :

- Senior Professor: 01
- Professor: 03
- Associate Professors: 04
- Assistant Professors: 11
- Visiting Faculty: 01



The Department has initiated a vigorous research program in several thrust areas through significant funding from Industry and Government funding agencies. Faculty in the Department are engaged in basic research and applied research of interest to industry. The Department till date through constant efforts of its faculty has secured research funding for projects to the tune of over Rs. 10 crores in the last 07 years. Research infrastructure has been created in a few areas with these funded projects and this is a constant ongoing activity. These experimental facilities are well complemented by theoretical modeling and simulation facilities driven by multi-physics / process modelling and simulation software packages.

In a span of 18 years of its existence, the Department of Chemical Engineering has seen remarkable developments in evolving curricula, teaching, laboratory infrastructure and research programmes as well as funded and consultancy projects. It is poised for all round growth in the next few years spurred on through activities driven by its faculty and students.

# Academic Programmes

The academic programmes of the Department include an Integrated First Degree (B.E.), a Higher Degree (M.E.) and Doctoral Degree (PhD). The academic curriculum has been designed to include various components of science and engineering to impart students the ability to function effectively and efficiently. Core courses, electives, laboratories and project-oriented courses aim to integrate fundamental study of chemical processes and technologies with emphasis on bringing practice to classrooms.



- Process Plant Safety
- Process Equipment Design
- Chemical Process Optimization
- Advanced Process Control
- Environment Pollution Control
- Corrosion Engineering
- Environment Management Systems
- Polymer Technology
- Introduction to Nano Science and Technology
- Petroleum Refining Technology
- Biochemical Engineering
- Microfluidics and its applications
- Molecular and Statistical Thermodynamics
- Process Equipment Design

## List of Core courses offered

### First Degree Programme

- Chemical Process Calculations
- Engineering Chemistry
- Chemical Engineering Thermodynamics
- Fluid Mechanics
- Heat Transfer
- Numerical Methods for Chemical Engineers
- Material Science and Engineering
- Separation Process I
- Separation Process II
- Kinetics and Reactor Design
- Process Design Principles I
- Process Design Principles II
- Process Dynamics and Control
- Chemical Engineering Laboratory I
- Chemical Engineering Laboratory II

### Higher Degree Programme

- Advanced Chemical Engineering Thermodynamics
- Advanced Transport Phenomena
- Reaction Engineering
- Mathematical Methods in Chemical Engineering

### Departmental Electives (Selected List only)

- Transport Phenomena
- Process Plant Simulation



### Minimum Eligibility criteria for admission\*

Details for admission to the First-Degree programme can be found on

<https://www.bitsadmission.com/fdmain.aspx>

### Higher Degree programme (M. E. Chemical)

- Integrated First Degree of BITS (B.E.) in Chemical Engineering or its equivalent

Admission to the M.E. programme is based on the marks

obtained in a BITS HD admission test or based on a valid GATE score.

### Financial Assistance to students admitted into the Higher Degree (HD) Programme

Candidates admitted through GATE will be eligible for a tuition fee waiver of Rs. 13,400/- per month over and above the GATE scholarship they will receive. All other students admitted to the HD program will be eligible for a stipend of Rs. 13,400/- per month. The fee waiver / stipend will be in lieu of 8 - 10 hours of work per week. Consideration for fellowship will be strictly as per Institute norms.

## Doctoral Programme

The Department offers a strong Doctoral programme leading to a PhD Degree. Both full time and part time students are eligible to do a PhD post enrolling as full-time research scholars on a sponsored project (funded by external agencies) or as "Institute" fellows who are funded by the University. Full-time PhD students admitted into the PhD programme are eligible to be considered for a fellowship of ₹28,000 or ₹31,000 per month as per intake qualification. Consideration for fellowship is strictly based on Institute norms, details of which are available in the University brochure on the PhD admission website. It will be obligatory on the part of every admitted full time student to undertake 8 to 10 hours (per week) of work as assigned to her/him by the Department/Institute.



### Minimum Eligibility criteria for admission\*

- **M.E./M.Tech. in Chemical Engineering or its equivalent** with a minimum of 60% aggregate in the the qualifying examination.
- **M.Sc./B.E./ or an equivalent degree** with a minimum of 60% aggregate in the qualifying examination.

Meeting the minimum eligibility criteria does not guarantee admission into the Doctoral programme. The Department can set specific admission criteria for shortlisting. Shortlisted candidates will have to appear for an admission

test, which may comprise of a written exam and/or interview. Candidates admitted are also encouraged to do coursework as per academic regulations

\*Candidates are requested to visit the BITS Pilani admission website for all official information regarding to admissions to various programmes offered by the Department and admission modalities.

### Number of PhD Students in the Department (as on April 2023)

No. of Ph.D. Scholars	: 38
Full Time	: 30
Part Time	: 08

18 students have graduated from the Department.

## Work Integrated Learning Programmes (WILP)

The Work Integrated Learning Programme (WILP) is designed to offer a unique opportunity to employed professionals in various industries, to enhance their academic qualification while gaining significant professional experience at their respective employing organizations. In this regard, the Department is associated with the following programmes:

- B.Tech. in Process Engineering
- M.Tech. in Environmental Engineering

## Research in the Department

Faculty in the Department of Chemical Engineering are engaged in fundamental engineering research as well as applied industrial research. The Department, through constant efforts of its faculty, has secured research funding for projects from several government agencies and industries. Research infrastructure has been created in niche areas with these funded projects and this is a constant ongoing activity. Experimental research via facilities created through extramural and Department funds is well complemented by theoretical research in the area of modeling, simulation and optimization based on computational facilities created and software packages used.



## Research Areas

Faculty members in the Department are actively involved in research activities and contribute to the development of new theories, methods, and applications that can have a profound impact on society. By engaging in diverse research areas, faculty members create opportunities for inter and multi-disciplinary collaborations, knowledge sharing and ultimately, the development of impactful solutions to some of the world's most pressing problems. The active involvement of the faculty members in research activities demonstrates the Department's commitment in pushing the boundaries of the Chemical engineering field and inspiring the next generation of researchers and engineers. The research areas of faculty in the Department while not exhaustive, include

- Material Science and Engineering
- Process Engineering and Intensification
- Process Systems Engineering
- Interfacial Science and Engineering
- Rheology
- Biochemical / Biomedical Engineering
- Membrane Science and Engineering
- Environmental engineering
- Energy science and Engineering
- Electrochemical Engineering
- CFD / Molecular Modelling & Simulation / Data Science



## Research Funding

Department research is supported by extensive funding primarily from external Government and industrial funding agencies. The funding helps acquire and/or create state-of-the-art research facilities and help faculty conduct cutting edge scientific and technological research that has potential to impact society. The Department also through its annual budget extends support to specific research requirements of faculty and students. Faculty have been successful in extramural funding to the tune of more than 15 crores (INR) from the following agencies:

- Department of Science & Technology (DST)
- Aditya Birla Group
- ONGC Energy Centre

- GAIL (India) Ltd.
- Apollo Tyres
- Centre for High Technology (CHT)
- Ministry for New & Renewable Energy (MNRE)
- Department of Biotechnology (DBT)
- Department of Science, Technology and Environment – Goa
- Deccan Fine Chemicals
- Thermax Ltd.
- DST – Inspire
- DST – FIST

In addition, faculty often engage in consultancy projects outside of their regular academic duties. These projects involve providing technical expertise, guidance and solutions to problems faced by industries with a specified time frame. Over 1 crore (INR) has been secured through such engagements.



## Research Publications

Department faculty have a strong track record of publishing research papers in reputable academic journals and securing patents for novel technologies developed during the course of their research work. These are both crucial as they signify the impact of the research efforts of faculty. They serve as a medium for sharing research findings with the academic community and contributing to the advancement of knowledge in Chemical Engineering. By publishing their work, faculty gain recognition from their peers and attract funding. Patents protect the Department's innovations and allow faculty to commercialize their discoveries.

**Total Publications: 295**

**Scopus Index / Web of Science**

h-index : 30 / 24  
Citations : 3207 / 2267  
Highest SNIP : 4.684 / 16.800  
Avg. SNIP : 1.082 / 5.301





**No. of Patents**

Filed: 16  
Granted: 04

# Faculty Profiles

Name	Designation	Research Interests	Photo
<b>Sutapa Roy Ramanan</b> (Ph.D., Jadavpur University)	<b>Senior Professor</b>	Nano-biomaterials for labeling and drug delivery Electroceramic nano powders, Thermal interface materials for electronic packaging, thin films for optical and electronic applications, Corrosion Engineering Advanced Heat Transfer	
<b>Srinivas Krishnaswamy</b> (Ph.D., University of London)	<b>Professor</b>	Process Engineering / Process Intensification with emphasis on addressing techno-commercial challenges posed in developing practical cost-effective energy efficient and environment friendly systems	
<b>Saroj S. Baral</b> (Ph.D., NIT Rourkela)	<b>Professor</b>	Adsorptive removal of heavy metal from waste water Extraction and purification of metals from ores and industrial waste, Biogas Production from different waste by Anaerobic digestion and Control Engineering	
<b>Sampatrao D. Manjare</b> (Ph.D., BITS Pilani)	<b>Professor</b>	Life Cycle Assessment studies of the process plant, environmental management systems, separation processes, recovery of resources from waste materials and development of fillers for rubber compounds	
<b>Manjuri Kumar</b> (Ph.D., BITS Pilani)	<b>Associate Professor</b>	Design, synthesis and characterization of novel copper and zinc complexes using different chelating ligands. Biological studies: DNA binding, DNA cleavage studies using metal complexes, protein interaction and molecular docking using Human serum albumin, cytotoxicity studies and anticancer activity of metal complexes on cancerous and noncancerous cell lines	
<b>Sharad Sontakke</b> (Ph.D., IISc, Bangalore)	<b>Associate Professor</b>	Water and wastewater treatment, Metal organic frameworks, Catalysis, Materials engineering, Photocatalysis, Hydrogen production, CO <sub>2</sub> capture and conversion, Waste to value added materials	
<b>Anirban Roy</b> (Ph.D., IIT Kharagpur)	<b>Associate Professor</b>	Membrane separation, Water and wastewater treatment, Thermodynamics, Water-energy nexus, Biomedical Devices	

<b>Vivek R</b> (Ph.D., IIT, Kharagpur)	<b>Associate Professor</b>	Biosurfactants, Hydrolytic enzymes for the production of reducing sugars, Fermentation of cashew apple, Biopolymers	
<b>Jegatha N. Krishnan</b> (Ph.D., KIST – UST S Korea)	<b>Assistant Professor</b>	Bio-MEMS – Microfluidic separation and detection technologies, Nanomaterials for sensor applications, Fuel Cells and Hydrogen Technology	
<b>Richa Singhal</b> (Ph.D., Drexel University, USA)	<b>Assistant Professor</b>	Nanomaterials synthesis, Electrospinning, Electrochemical energy storage, Supercapacitors, Rechargeable batteries, Electrocatalysis, Renewable energy systems	
<b>Pradeep Kumar Sow</b> (Ph.D., IIT, Delhi)	<b>Assistant Professor</b>	Hydrogen Energy, New diagnostic tools for understanding surface wettability, Smart materials with an active control over the wettability	
<b>Amol Deshpande</b> (Ph.D., BITS Pilani)	<b>Assistant Professor</b>	Unmixed combustion for heat transfer applications, Transport Phenomena, Computational Fluid Dynamics (CFD), Reaction engineering (Modeling)	
<b>Asima Shaukat</b> (Ph.D., IIT Kanpur)	<b>Assistant Professor</b>	Rheological behavior of polymer-layered silicate clay and graphene nano-composites, Rheological and tribological behavior of bio-greases, Advanced Transport Phenomena	
<b>Paramita Haldar</b> (Ph.D., IIT Bombay)	<b>Assistant Professor</b>	Molecular simulation techniques including Density Functional Theory (DFT), Molecular Dynamics (MD), Monte Carlo (MC), Kinetic Monte Carlo (KMC), Molecular Docking, and Nudged Elastic Band Method (NEB)	
<b>Riju De</b> (Ph.D., IIT Bombay)	<b>Assistant Professor</b>	Process systems engineering (PSE), Dynamic Optimization, Multi-objective Optimization, Stochastic Optimization, Batch-to-batch iterative learning control, Model based design of experiments, Machine learning methods	
<b>Sundari Ramji</b> (Ph.D., IIT, Madras)	<b>Assistant Professor</b>	Transport Phenomena, Multiphase flows, Microfluidics, Computational Fluid Dynamics, Systems Biology	

<b>Mrunalini Gaydhane</b> (Ph.D., IIT, Hyderabad)	<b>Assistant Professor</b>	Functionalized nanomaterials for agricultural, healthcare and environmental applications	
<b>Upasana Mahanta</b> (Ph.D., IIT, Guwahati)	<b>Assistant Professor</b>	Non-aqueous solvents, Phase equilibria and thermodynamics, Electrochemical energy storage, Molecular dynamic simulation	
<b>Saurabh Patankar</b> (Ph.D., ICT, Mumbai)	<b>Assistant Professor</b>	Waste management and valorization, Green chemistry and technology, Catalysis, Sustainable Engineering	
<b>Jayita Chopra</b> (Ph.D., IIT, Kharagpur)	<b>Visiting Faculty</b>	Bioprocess optimization, Biofuel production, Hydrothermal liquefaction, Life cycle assessment	

## Research Facilities in the Department

Several research facilities both experimental and computational have been created over the years from extramural and Department funds. Such facilities play a vital role in advancing the understanding and knowledge in various areas of Chemical Engineering. These facilities are designed to provide state-of-the-art equipment and resources to faculty and students working on various projects related to chemical engineering.

### Analytical Facilities

- Gas Chromatography-Tandem Mass Spectrometry (GC-MS/MS)
- Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES)
- Thermogravimetric Analysis - Differential Scanning Calorimetry (TGA-DSC)
- Total Organic Carbon (TOC) Analyser
- Fourier Transform Infrared (FTIR) spectrometer
- UV- VIS Spectrophotometer
- Brunauer-Emmett-Teller (BET) Surface Area Analyser
- Rheometer
- Atomic Absorption Spectrophotometer (AAS)
- Optical Microscope
- Gas Chromatograph





## Experimental Test Rigs

- Unmixed Combustion Test Rigs
- Photocatalytic reactors
- Solar Bioreactor
- Electrochemical Workstation
- Goniometer
- Electrospinning Unit
- Vapour Liquid Equilibrium test rig (0 – 3 bar)
- High pressure vapour liquid equilibrium test rig (upto 250 bar)
- High Temperature Variable Shear (HTVS) test rig
- Low temperature differential scanning calorimeter
- Gas hydrate autoclave
- Pulsed micro-reactor set-up
- HPLC
- Micro carbon residue tester
- Hydrothermal Reactors / Microwave reactors
- Liquid feed-flame pyrolysis setup
- Four ball tribotester
- Pin-on-disk tribotester
- Retsch Planetary Ball Mill and its accessories
- Membrane performance test rigs / Spinning unit



## Placements

The Department of Chemical Engineering prides itself on producing graduates who are in high demand in the job market. Students in this Department have access to a wide range of placement opportunities coordinated by the Placement Division of the Institute. Several companies, in addition also offer summer internships and pre-placement opportunities to Chemical Engineering students, providing them with invaluable hands-on experience before being placed. Student placement is more than 90% at First and 100% at Higher Degree level. With practice being integrated into the curriculum, the Department makes its students highly sought-after by industry leaders, positioning them for success in the competitive job market. Students are provided placement opportunities in several organizations including Schlumberger, Honeywell, Exxon Mobil, Aditya Birla Group, Deccan Fine Chemicals and Asian paints.



## Computational Facilities

- Workstations / Servers
- ASPEN PLUS Process Simulation Software
- COMSOL Multiphysics Software (CFD)
- MATLAB
- Molecular Modelling / Simulation Software (Quantum Espresso, Gaussian 16, VASP)



## IChE student Chapter



The Goa regional Center of the Indian Institute of Chemical Engineers (IChE) was established in 2015 at the Department of Chemical Engineering. The primary objective of the Chapter is to promote among students in Chemical Engineering, a feeling of fraternity and brotherhood and to complement the objectives and activities of the Department. The activities of this chapter include conducting workshops/ seminars, arrange lectures and plant visits of students, assist students in their career planning and placement and assist in any other activity social, technical and educational interest to students in the Department.

## M.E. (Environmental Engineering)

The Department more recently is associated with hosting a multi-disciplinary Higher Degree programme, i.e. M.E. (Environmental Engineering) commencing from Semester 1 2023 – 2024. For admission modalities, refer to <https://www.bitsadmission.com/hdmain.aspx>

## Upcoming Events

- 'ChemFERENCE 2023', 10<sup>th</sup> Chapter, Sept. 30 – October 02, 2023, Goa, India
- 24th International Symposium on Surfactants in Solution (SIS) June 16-21, 2024, Goa, India



## Contact us

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