



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్  
भारतीय प्रौद्योगिकी संस्थान हैदराबाद  
Indian Institute of Technology Hyderabad

# CHEMICAL ENGINEERING MTech Programs 2024-25

INDIAN INSTITUTE OF TECHNOLOGY,  
HYDERABAD

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Welcome to the Department of Chemical Engineering at IIT Hyderabad (ChE@IITH). On behalf of the department, it is my great privilege to present this wonderful stream of engineering to you. ChE@IITH is one of the fastest growing Chemical Engineering Departments in the country and has an excellent reputation in teaching and research, built over the last 14 years.

Our aim is to provide an excellent and accessible chemical engineering education program that is tailored to address technology challenges of the real world. Our dream is to become a department from which future technology leaders of the modern world will emerge. We hope to achieve our objective and fulfill our dreams with the help of young and vibrant team of faculty members, technical staff and scholars. Our core values of responsible training, integrity and mutual respect are the primary pillars on which the department stands. I believe that with these core values we can build centers of excellence from which future technology leaders will emerge.

Faculty from the department actively address challenges in the fields of health, energy security and national security. We address these challenges by utilizing our research expertise in a range of domains like- Advanced Materials, AI/ML, Biofuels, Catalysis, Drug Delivery, Fuel Cells, Mineral Processing, Nanoengineering, Polymer Engineering, Soft Matter and Systems Biology. The web pages of the department provide more information about the programs, facilities and the faculty members. Please reach out to the office of Chemical Engineering([office@che.iith.ac.in](mailto:office@che.iith.ac.in)) or the faculty members if you have any queries about the programs in the department and the research facilities.

Sincerely,

**Balaji Iyer**  
Head of Department, Chemical Engineering  
[head@che.iith.ac.in](mailto:head@che.iith.ac.in)

Chemical Engineering at IITH (ChE @ IITH) is one of the fastest growing ChE departments in the country. With 22 faculty members engaged in cutting edge research, we provide quality programs in chemical engineering education, research, and expert consulting support to process industries.

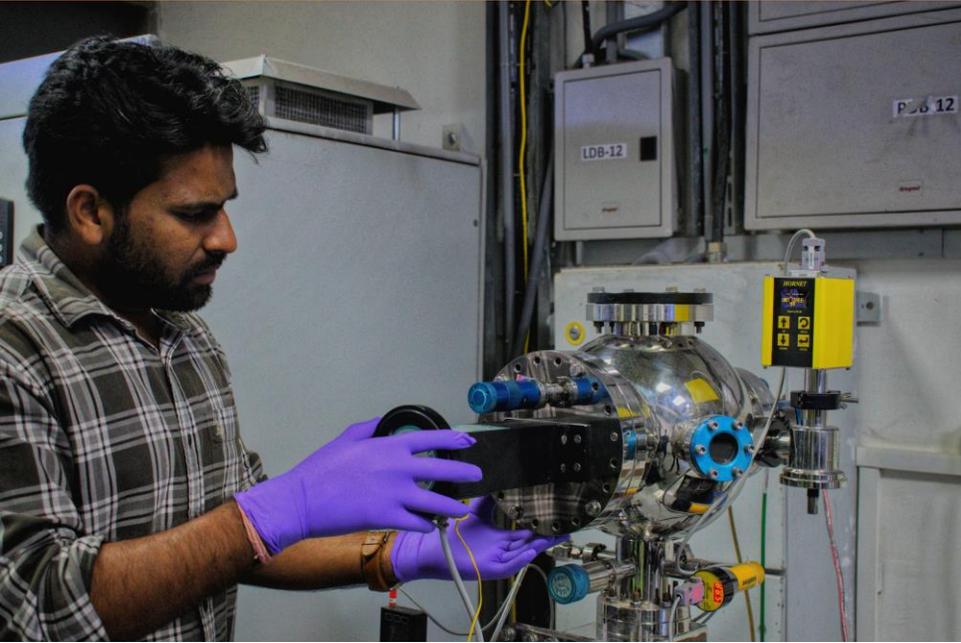
## VISION

"To be recognized as an outstanding contributor to chemical engineering education in the country and be the preferred hub for learning, research, and development of global technology leadership."



## MISSION

"To serve the country and society at large by catalyzing positive transformations that help address challenges in chemical engineering education and practice."

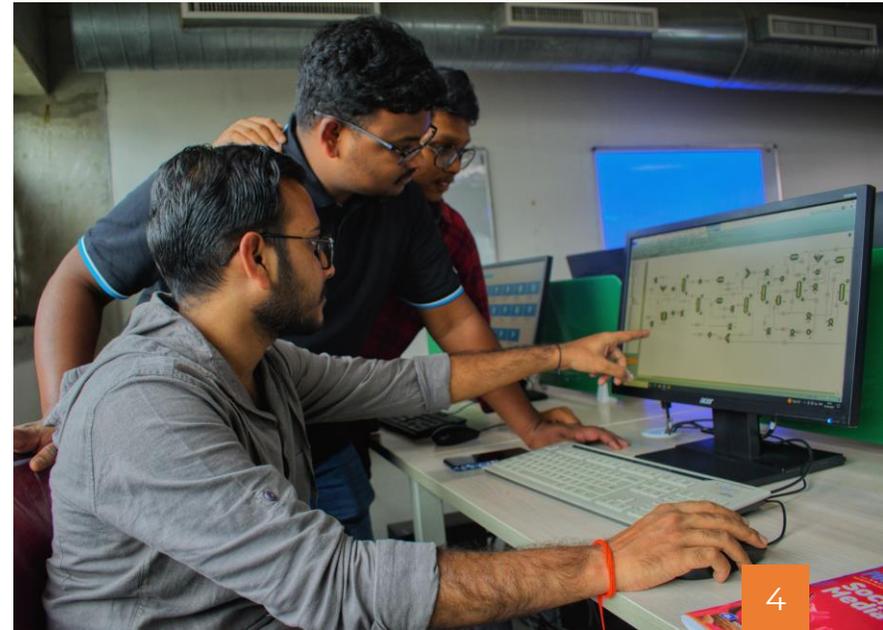


### CORE CHEMICAL ENGINEERING ACADEMIC PROGRAMS

ChE @ IITH offers BTech, MTech and PhD programs. The core curriculum builds strong foundations in chemical thermodynamics, reaction kinetics, fluid mechanics, process control, principles of heat and mass transfer, and transport phenomena. The department electives that encompass the state-of-the-art topics in chemical engineering spanning materials, energy, healthcare and computing along with training on live projects prepare our students to address problems that cut across the boundaries of conventional chemical engineering.

### INTERDISCIPLINARY GRADUATE PROGRAMS

Faculty in ChE @ IITH are also engaged in several interdisciplinary programs. This includes, for example, MTech in Polymer and Biosystems Engineering, Climate Change, Additive Manufacturing, E-Waste Resource and Engineering Management.



## B.TECH

## B.Tech

*Features:*

- Total credit requirement is 129
- B.Tech (Hons) is also offered by the department
- A project work is compulsory for B.Tech (Hons) students
- Students can opt for ChE as minor or major through earning specified additional credits

*Duration:* 4 years (8 Semesters)

*Entrance:* Admission through JEE Advanced

## Dual Degree (B.Tech + M.Tech)

*Features:*

- A student can choose to continue for higher program by converting to dual degree
- Masters thesis is compulsory for all dual degree students
- Dual degree students are eligible to receive fellowship in the last two semesters as per regular M.Tech students

*Duration:* 5 years (10 Semesters)

*Entrance:* Admission through JEE Advanced

## M.TECH

## Regular M.Tech

*Features:*

- Total credit requirement is 52, which includes 17 core courses, 7 electives, and 4 laboratory courses
- M.Tech thesis credit requirement is 24
- Several M.Tech thesis topics are motivated by the industry
- Industry lectures have been introduced in the M.Tech curriculum to get students acquainted with different topics of industry interest

*Duration:* 2 years (4 Semesters)

*Entrance:* Admission through GATE, IIT graduate with minimum CGPA 8.0 without GATE score

## Self-Sponsored M.Tech

*Features:*

- Self sponsored M.Tech is non-subsidized master's degree program.
- Academic requirement is similar to the regular M.Tech program.
- Candidates are required to pay tuition fees on per credit basis.
- Such candidates are not eligible for financial assistantship under MoE.

*Duration:* 2 years (4 Semesters)

*Entrance:* Minimum CGPA 7.0 and based on the performance in written test and interview

## PHD

## Direct PhD

*Features:* Total credit requirement is 24

*Duration:* 5 years with Fellowship

*Eligibility criteria:*

- B.E/B.Tech with valid GATE score
- M.Sc with UGC/CSIR NET and department specified cut off CGPA

## Regular PhD

*Features:* Total credit requirement is 12

*Duration:* 5 years with Fellowship

*Eligibility criteria:*

- M.E/M.Tech with department specified cut off CGPA or equivalent
- IITH project sponsored candidates are also eligible to apply

## External/Sponsored PhD

*Features:*

- Total credit requirement is 24
- Candidates from national laboratories, academia and industry are eligible.

*Duration:* 5 years with no Fellowship

*Eligibility criteria:* M.E/M.Tech with minimum 2 years of experience

## SEMESTER-1

- Advanced Numerical Methods
- Heterogeneous Catalytic Reaction Engineering
- Advanced Process Control
- Process Integration
- Process Engineering Lab
- English Communication
- Electives

## SEMESTER-2

- Advanced Transport Phenomena
- Molecular Thermodynamics
- CFD Lab
- Industry Lectures
- Thesis (Stage 1)
- Electives

**M.TECH**



## SEMESTER-4

- Thesis (Stage 3)

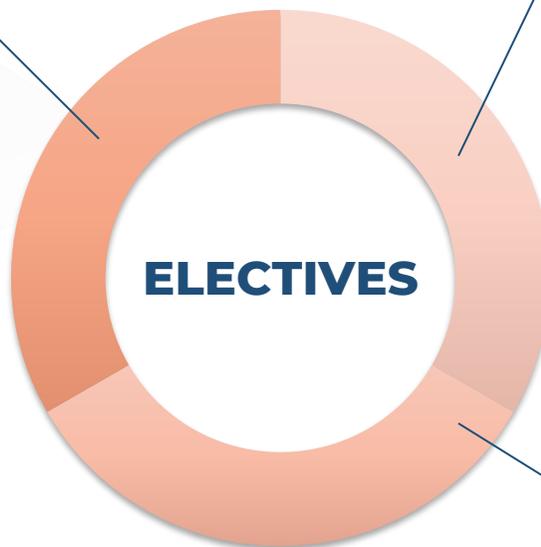
## SEMESTER-3

- Thesis (Stage 2)

A unique feature of the department's academic program is its carefully curated list of electives that expand the curriculum beyond the foundations presented via the core courses. The electives expose students to the present multi-disciplinary state of the field of chemical engineering which underpins materials, health care and energy science and engineering. Our electives cover these state-of-the-art fields and help prepare students to be competent to engage in industrial, research or academic careers of their liking.

### Materials and Health Sciences Research

- Engineering Materials
- Interfacial Chemistry
- Introduction to Nanotechnology
- Intermolecular Forces
- Surface Interactions
- Physico-chemical Fundamentals for Chemical Engineers
- Introduction to Microfluidics and Microreactors
- Food Rheology
- Membrane Separation Process
- Fluidization Technology
- Colloids Emulsions and Foams
- Light Scattering Methods for Complex Fluids
- Fundamentals of Droplet Drying
- Polymer Science and Engineering
- Introduction to Cardiovascular Mechanics



### Computing and Applied Mathematics Research

- Introduction to Statistical Hypothesis Testing
- Machine Learning for Process System Engineering
- Introduction to Stochastic Differential Equations
- Optimization Techniques
- Computational Fluid Dynamics
- Non-Newtonian Fluid Mechanics
- Data Analysis Tools in Experimental Research
- Modern Probability Theory
- Molecular Modelling of Catalytic Reactions
- Linear and Nonlinear Stability of Fluid Flows

### Energy Research

- Chemical Reactor Modelling
- Petroleum Refinery
- Principles of Heterogeneous Catalysis
- Sustainable Energy
- Energy Storage Systems
- Fuel Cell Technology

### REGULAR MTECH

The department offers a two-year regular MTech program in Chemical Engineering with teaching assistantship. Admission is based on a valid GATE score in CH or BT papers. Applicants must hold a B.E./B.Tech. in Chemical Engineering, Chemical Technology (including Petroleum, Petrochemical, Polymer/Rubber, Oil, Pharmaceutical, etc.), Biotechnology, or related disciplines from a government-recognized institution. Students in their final semester of B.E./B.Tech. are eligible, subject to result declaration by July 15, 2024. IIT graduates with a minimum CGPA of 8.0 in Chemical Engineering or related disciplines can apply without a GATE score.

### SELF-SPONSORED MTECH

The department offers a two-year Self-Sponsored MTech program. Applicants must hold a B.E./B.Tech. from a government-recognized institution with a minimum CGPA of 7.0 (equivalent to 70% marks) in Chemical Engineering, Chemical Technology (including Petroleum, Petrochemical, Polymer/Rubber, Oil, Pharmaceutical, etc.), Biotechnology, or related disciplines. A valid GATE score is not required.

### RESERVATION POLICY

The government-specified reservation policy is followed during the selection and admission process for the regular MTech program. Reserved seats include 15% for SC candidates, 7.5% for ST, 10% for EWS, and 27% for OBC. Candidates are advised to apply with the relevant category certificate from the competent authority.

## APPLICATION FEE

Details regarding application fees and accepted payment methods for all categories of candidates can be found on the IIT Hyderabad MTech admissions web portal.

## ONLINE APPLICATION

Candidates are required to submit their applications through the online MTech admissions web portal. Instructions for completing the online application form are provided on the portal.

## SELECTION PROCEDURE

- Regular MTech Program with a valid GATE Score: Admission is solely based on the GATE score.
- Self-Sponsored MTech Program: Selection is determined by performance in a written test and/or personal interview.
- Direct Admission: Graduates of IITs with a minimum CGPA of 8.0, without a GATE score, are eligible to apply. The department may conduct a written test or interview for their selection.

Financial assistance, in the form of Half-Time Teaching Assistantship (HTTA) at the rate specified by the Ministry of Education (MoE) guidelines, will be granted to Indian nationals enrolled in the regular MTech Program with a valid GATE score, subject to Institute rules.

HTTA students are required to contribute 8 hours per week towards teaching assistance (TA) work. TA responsibilities encompass tasks related to the department's academic activities, such as laboratory demonstrations, tutorials, assignment evaluations, quizzes, seminars, and research projects, among others.

Candidates in the self-sponsored category are not eligible for financial assistance.

### PLACEMENTS

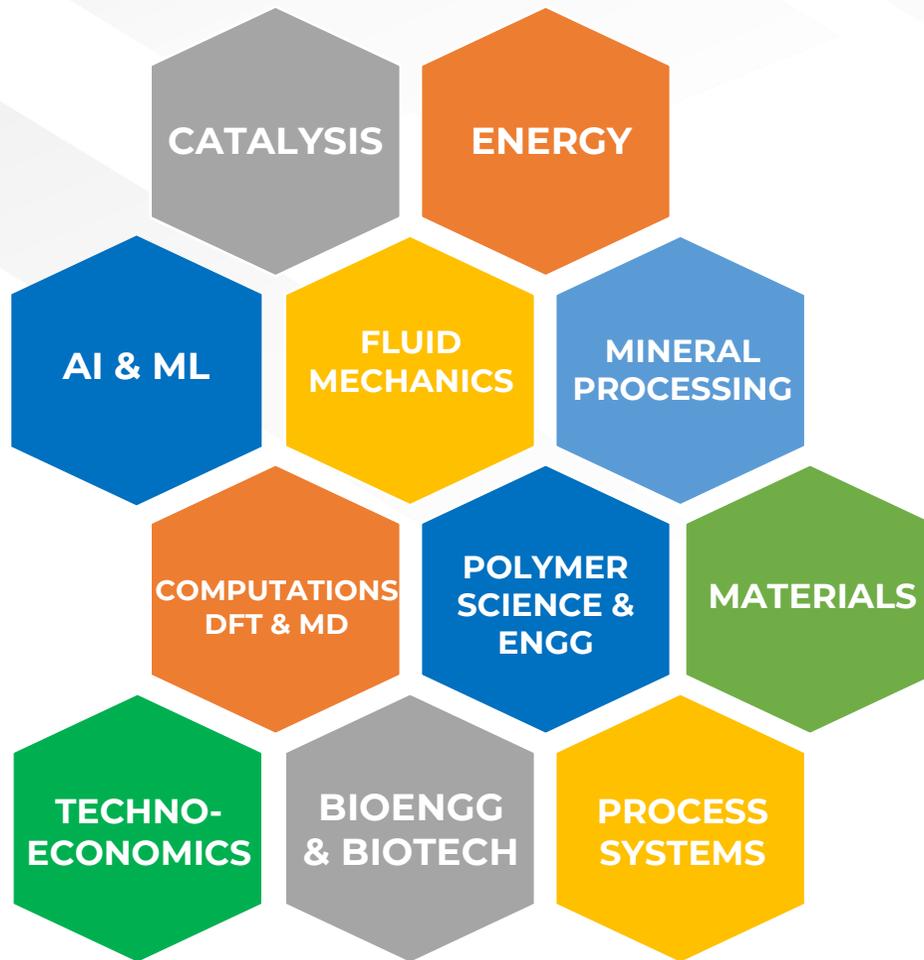
The department provides a cutting-edge curriculum, preparing students to emerge as future industry leaders capable of addressing socio-economic challenges sustainably. Notable past recruiters, both on and off-campus, include BPCL, IOCL, Maruti Suzuki, Phone Pe, Coromandel, Hindustan Zinc, Tata Motors, NEC Technologies, Open World, TCS R&D, Vedanta, Helium Consulting, Nagarjuna Fertilizer, Aurobindo Pharma, Pokarna, Wells Fargo, Perceptive Analytics, Virtusa, Entransys, HPCL, Geny Medium, and Deloitte.

### MTECH TO PHD CONVERSION

Highly motivated candidates with outstanding academic records have the opportunity to convert their MTech program into a PhD program within the department.

### GLOBAL RESEARCH OPPORTUNITIES

Exceptionally driven students have the opportunity to pursue doctoral research in renowned universities worldwide. IIT Hyderabad maintains strong collaborations with various Japanese universities through JICA, facilitating enrollment of interested students in PhD programs with different Japanese universities.



**Research in the department spans a wide variety of areas including fluids, mineral processing, catalysis, materials for energy and biological applications, nanotechnology, bioengineering, process control, optimization, microfluidics, and DFT studies. Faculties are actively involved in hosting conferences and outreach workshops benefitting the students and faculty across several institutes in India. The Department also houses state of the art research and teaching equipment.**

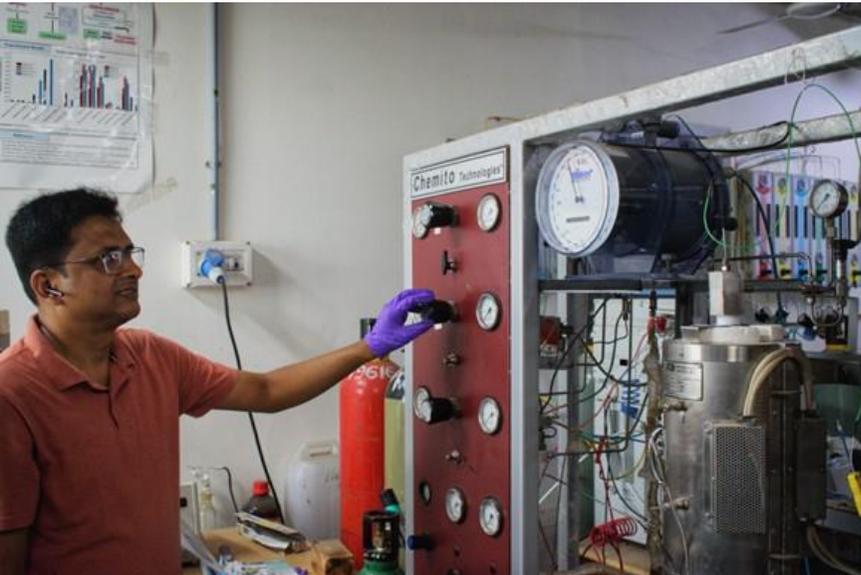
### **CATALYSIS**

Our research is focused on the design and development of catalyst materials – ranging from zeolite, and supported metal/metal oxide – with improved reactivity, stability, and selectivity. The catalysts are tested for various industrial processes (e.g., steam reforming, water-gas shift reaction, CO<sub>2</sub> conversion and fine chemicals) and biomass-based fuels and chemicals. These studies aim to produce hydrogen, bio-fuels, and value-added chemicals and utilize renewable feed stocks, low-value by-products, and waste materials. The design and optimization of chemical processes using Aspen Plus are an also integral part of this research. An integrated approach considering experimental, and density functional theory (DFT) calculations is applied for rational design of catalyst.



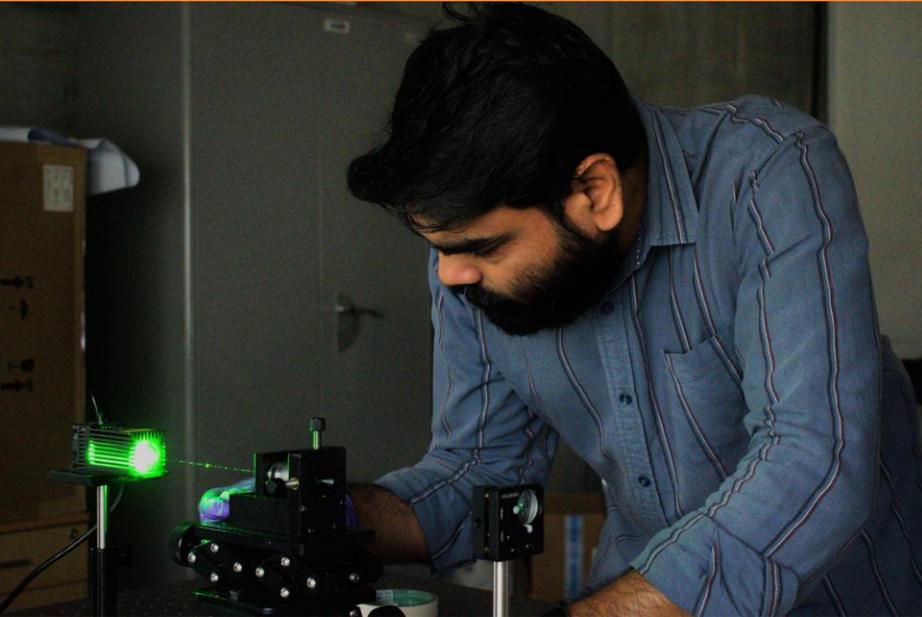
## ENERGY

The department is at the forefront of pioneering energy research, exploring the realms of biofuels, fuel processing, and novel energy conversion and storage solutions. Our faculty members are fervently engaged in the fundamental and applied dimensions of heterogeneous catalysis; transforming vegetable oils through hydro-deoxygenation, and direct conversion of CO<sub>2</sub> into valuable chemicals, steam and oxidative steam reforming of hydrocarbon fuels and biomass conversion to name a few. On the electrochemical side, we are exploring the potential of fuel cells, electrolyzers, and cutting-edge batteries. Our experimental efforts are supported by the power of computational research. This includes the computational identification of novel catalyst materials, intricate reaction pathway analyses, kinetic modeling, and comprehensive reactor modeling for seamless scalability.



## MACHINE LEARNING IN PROCESS SYSTEMS ENGINEERING

Recent improvements in infrastructures and their affordability, automation, ubiquitous connectivity resulted in generation, processing and management of enormous amounts of heterogeneous data in the domain of Process Systems Engineering (PSE). The research in this direction is to investigate how deep supervised / unsupervised learning methods can be used to solve PSE problems (e.g., surrogate optimization, system identification and control, image-based sensing, uncertainty quantifications, optimal control) more efficiently. Targeted applications are wind farm layout optimization, new alloy discovery, monitoring climate change parameters, fast charging protocols in Li<sup>+</sup> battery, bio-fuel supply chain, systems biology to name a few.



### FLUID MECHANICS

We pursue research on a variety of problems of fundamental and applied interest in fluid mechanics, and heat and mass transfer using a combination of tools ranging from basic modeling, computational fluid dynamics (CFD), and linear stability analysis. Fluid mechanics research conducted in the department spans a wide range of topics such as multiphase flows, spatially developing flows in complex geometries, micro-fluidics, and biological flows. A major focus of our research is on understanding the transition to turbulence, with high emphasis on the laminar-turbulent transition.

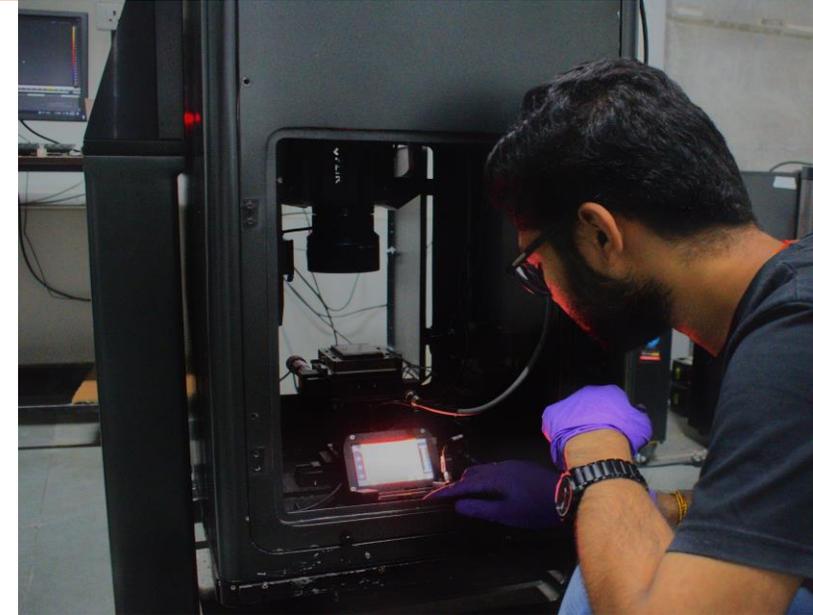
### MINERAL PROCESSING

In mineral processing research, we are involved in flow sheet development and optimization for various mineral beneficiation plants. We study dense medium cyclones (DMC), hydro-cyclones (HC), feed slurry distributors, grinding mills and flotation devices for understanding the process by using computational modeling techniques (multi-phase CFD/discrete element methods/coupling CFD-DEM models). New innovative/novel improved mineral processing equipment designs through integrated CFD/DEM studies and physical modeling is our major focus. Mathematical models based on industrial data and inputs from CFD/DEM are also being developed using non-linear model building techniques for various mineral processing units.



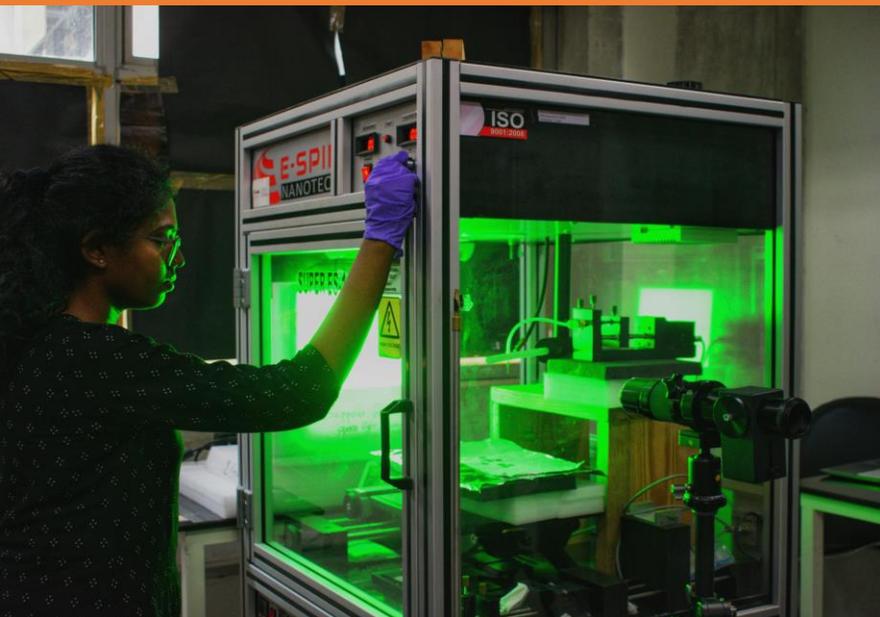
### MOLECULAR & CELLULAR BIOENGINEERING

The key to understanding the role of chemical engineers in biological engineering research is to recognize that biological systems are inherently chemical in nature. Chemical engineering provides a unique integrated perspective across a wide range of length scales (molecular to macroscopic) that makes it well suited to tackling problems of great interest in modern biology. The thrust of this research theme is to understand and control intercellular interactions and cell-matrix interactions involved in conditions such as inflammation, thrombosis, retinopathy and cancer metastasis. Our efforts are also focused on developing models for vascular processes such as bulk phase intercellular interactions in blood flow.



### CARDIOVASCULAR MECHANICS

Pathologies of the cardiovascular system due to coagulation abnormalities are greatly influenced in their progression by the mechanics of vascular tissue, by the flow behavior of blood in blood vessels, and by the biochemistry of the reactions in the coagulation cascade and fibrinolysis. The thrust of our research is to better understand these pathologies by characterizing the rheological and biochemical variables in flow situations that present in the human vasculature, and by identifying conditions that precipitate potentially life-threatening events (like thromboembolisms and strokes). Towards this end, we perform computational simulations of blood flow with suitable complex fluid models of blood in various pathologies. Simulations are validated with experimental data from collaborating groups.



## DRUG DELIVERY

Recent advances in materials design offers several new avenues for the development and application of novel materials in drug delivery. This theme is currently focused on developing new methods, materials and technologies to achieve controlled, targeted and sustained release of drugs and cytokines using polymeric biomaterial carriers. We are also interested in investigating mechanisms of drug release and fundamental forces/interactions between polymer and drug molecules. We are equally interested in applying cutting-edge polymer processing techniques that can be used to develop novel drug formulations for application in specialized biomedical domains.

## NANOSCIENCE & NANOTECHNOLOGY

Nanoscience and nanotechnology is a rapidly emerging interdisciplinary field at the interface between physics, chemistry, materials science, electronics, and biology. Broad activities in this fast-changing arena of research include synthesis of a wide range of nanomaterials, their characterization and applications in energy and environment. Presently, we focus on synthesis, fabrication of carbon-based nanostructures and their applications in energy storage devices such as Li ion rechargeable batteries etc. We also deal with nanopatterning of soft matters for various applications such as superhydrophobic surfaces.



## POLYMERS

Conventional polymers are currently facing a lot of issues related to the environment as well as their petrochemical origin. Our research program aims to address these aspects by coming up with new grades of environment friendly polymers and/or building knowhow of making biodegradable polymers with customized features for specific applications. The main focus is on building polymerization technology through modeling, optimization, and lab scale implementation and then optimally linking with rheology and processing with desired end use properties. Our program also includes research on other polymeric soft materials such as colloids and biopolymers where, we are integrating fundamental, and application driven projects to efficiently create advanced materials of tunable properties.



## PROCESS CONTROL & STOCHASTIC CONTROL

Process Control deals with the use of automatic control strategies to improve efficiency of a chemical process. Apart from the applications of standard control techniques, we develop novel sensor technologies (known as "soft sensors") based solely on data obtained from a running plant. For example, the data could be in the form of images, sound or just input output data of a process stored in a chemical plant. We also study the application of non-linear and stochastic control techniques.

Faculty	Materials	AI & ML	Bio-engg. & Biotech	Computations, DFT, MD	Mineral Processing	Energy	Fluid Mechanics	Catalysis	Process Systems	Polymers	Techno-economic
Alan Ranjith Jacob	★									★	
Anand Mohan			★				★				
Balaji Iyer			★	★						★	
Chandra Shekhar Sharma	★					★					
Debaprasad Shee								★			
Giridhar Madras	★					★		★			
Kirti Chandra Sahu							★				
Kishalay Mitra		★		★		★			★		
Lopamudra Giri		★	★	★							
Mahesh Ganesan	★									★	
Narasimha Mangadoddy					★		★				
Parag Pawar				★							
Phanindra Jampana		★		★			★		★		
Ramkarn Patne	★						★				
Ranajit Mondal	★									★	
Santhosh Kumar Devarai			★								
Saptarshi Majumdar	★			★						★	
Satyavrata Samavedi	★		★							★	
Shelaka Gupta				★				★			
Suhanya Duraiswamy	★		★			★		★			
Sunil Kumar Maity								★			★
Vinod Janardhanan						★		★			

In addition to the Central Institute Facilities, ChE @ IITH in collaboration with the Japan International Cooperation Agency (JICA) and IITH has setup several key high-end research facilities that cater to the different research projects in the department. Some of our capital equipment are indicated below.



## Selected List of Facilities

- *Scanning Electrochemical Microscope*
- *Gel Permeation and Size Exclusion Chromatograph Systems*
- *Biosensor for gas & Humidity testing Unit*
- *Integrated reverse High performance Liquid Chromatography*
- *Chemical Reactor below 1 L 500ML, above 1L 2000ML with accessories, spectrophotometer, analytical balance & 3L laboratory fermenter*
- *Multiple Array Systems for High Throughput Assays*
- *Circular Dichroism Spectrometer/Polarimeter*
- *Differential Scanning Calorimetry*
- *Isamill/Agitator Mill for Fine Grinding*
- *Force-Sensing Optical Tweezer*
- *Module Scale Battery Testing System*
- *Driving Simulator*
- *Multimode Microplate Reader With Live Cell Imaging Facility*
- *UPLC-HRMS Systems*
- *Volumetric PIV Systems & Accessories*
- *Wire Mesh Sensors System*
- *Multifunctional High Resolution X Ray Diffractometer (HR-XRD)*
- *Stereolithography (SLA) Based 3D Production Printer Model Project 6000*
- *MP-AES Microwave Plasma Atomic Emissions Spectrometer*
- *HPC Cluster-250 Crores*
- *Rheometer with different geometry and accessories*
- *Confocal Laser Scanning Microscope with Incubation Chamber*
- *Dynamic light scattering and zeta potentiometer*



Faculty in the department are engaged in several collaborative research projects with industry, other academic institutions both within and outside the country as well as contributing to several national missions via joint projects with governmental research establishments such as DRDO.

## FUNDING AGENCIES SUPPORTING RESEARCH IN CHE @ IITH



... and many more

For more details, please check our departmental website

## Research – Journal Editorship

- Dr. Chandra Shekhar Sharma has been inducted in the Editorial Advisory Board, Nano Express.
- Dr. Satyavrata Samavedi has been selected as the Guest editor for Special issue of JoVE.
- Dr. Alan R Jacob has been invited as review editor in Frontiers of Physics as a specialist in soft matter physics.
- Dr. Kishalay Mitra inducted in the Editorial board of Materials and Manufacturing Processes, Taylor and Francis Journal, USA.
- Dr. Anand Mohan has been selected for the Editorial Board, Computer Research & Modeling.

## Research – Fellows and Committee Membership

- Dr. Kirti Chandra Sahu has been elected as Fellow of the Indian Academy of Sciences (FASc).
- Dr. Chandra Shekhar Sharma has been selected as PAC Member, SERB SRG & NPDF Committee (Engineering Sciences) (2022-24).
- Dr. Kirti Chandra Sahu has been selected as Elected Fellow of Institute of Physics, UK.

## Research – Visiting Positions

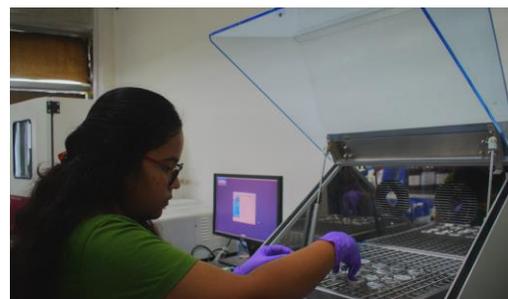
- Dr. Narasimha Mangadoddy has been selected as Visiting faculty at University of Cape Town.
- Dr. Satyavrata Samavedi has been selected as a Guest Researcher at NIMS, Japan.

## Teaching

- Dr. Suhanya Duraiswamy (2023), Dr. Parag Pawar (2022) and Dr. Santhosh Kumar Devarai (2020) have been awarded with IIT Hyderabad Teaching excellence Award.

## Research Recognitions

- Dr. Chandra Shekhar Sharma has been featured as one of the 75 under 50 scientists Shaping Today's India in a DST compendium as a part of Azadi ka Amrit Mahotsav Celebration of India's 75th year of Independence.
- Dr. Giridhar Madras has been awarded with the Research.com Chemistry in India Leader Award for being ranked in the top 10 scientists in India in chemistry.
- Dr. Kirti Chandra Sahu has been selected for the VASVIK Industrial Research for the Year 2021.
- Dr. Suhanya Duraiswamy has been awarded for the Best Poster presentation in International Research Conference on Microfluidics and Organ-On-A-Chip Technologies, Singapore.
- Dr. Chandra Shekhar Sharma, Dr. Giridhar Madras, Dr. Kirti Chandra Sahu, Dr. Kishalay Mitra, Dr. Narasimha Mangadoddy and Dr. Sunil Kumar Maity have been featured in Stanford University's ranking of the world's top 2% of scientists.
- Dr. Kishalay Mitra (2022), Dr Kirti Chandra Sahu (2021), Dr. Chandrasekhar Sharma (2020), have been awarded with IIT Hyderabad Research Excellence Award.
- Dr. Shelaka Gupta has been selected as one of the 75 Women in STEM to be featured in the second edition of She Is.
- Dr. Chandra Shekhar Sharma has been awarded with DST-Swarna Jayanti Fellowship in Engineering Sciences.



## GRADUATE STUDIES & POSTDOCTORAL POSITIONS



## FACULTY POSITIONS



HINDUSTAN ZINC



TATA CONSULTING ENGINEERS LIMITED



## INDUSTRY CAREERS



# GALLERY



FACULTY & STAFF



FACULTY



MASTERS STUDENTS



FACULTY & PGs

# GALLERY



POSTGRADUATES



FACULTY & UGs



PHD STUDENTS



## Department of Chemical Engineering

### Location:

Chemical Engineering Building  
IIT Hyderabad, IITH Main Road, Near NH-65  
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+91 40 2301 6200



Scan this QR Code to visit the  
departmental website or go to  
<https://che.iith.ac.in/>



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Indian Institute of Technology Hyderabad