2025

Absorb. 4.0

Evolution of Chemical Engineering

A Chemical Engineering Department Initiative

Chemical Engineering Association
National Institute of Technology Andhra Pradesh

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Director's Message

Prof N V Ramana Rao
Director (in-charge)

It is with great pleasure that I extend my congratulations on the launch of the Fourth edition of "ABSORB." by the Department of Chemical Engineering.

The department's focus extends beyond mere enrollment numbers, fostering a culture that cultivates well-rounded engineers. The dedication of both faculty and students is commendable, evident not only in academic pursuits but also in co-curricular activities. Faculty support plays a crucial role in encouraging students to undertake challenging projects and showcase their talents on a broader platform.

This magazine, a testament to the outstanding efforts of the student team, delves into captivating themes within the field of chemical engineering, demonstrating its direct relevance to our community. As we navigate a global energy crisis, it's imperative to recognize the pivotal role chemical engineering plays in shaping a sustainable future. Advancements in fuels, fertilizers, and other allied fields hinge on the innovative spirit fostered within this department.

The department's commitment to student success is evident in organizing the insightful talks by renowned academics and industry experts.

These initiatives undoubtedly serve to motivate students and refine their professional aspirations.

My sincere congratulations extend to the Head of Department, faculty advisor, student coordinator, and all members of the Chemical Engineering Association. Your unwavering dedication not only paves the way for future generations of engineers but also upholds the esteemed reputation of NIT Andhra Pradesh.

I wish you all continued success in your endeavors. Happy Reading!!

Registrar's Message

Dr. P. DINESH SANKAR REDDY
Registrar & Associate Professor

Hello Readers,

Greetings!
It gives me immense pleasure to announce the fourth edition of the Chemical Engineering Student's Magazine, "ABSORB.". The students who have been involved in the development of the magazine have worked passionately over the course of the past few months to gather resources, creating and exploring new ideas, capture the reader's attention, and bring a new perspective into the field of chemical engineering. I wish the magazine stands up to its name and gives its readers an ocean of knowledge to absorb.
As a chemical engineer, I understand the significance of integrating principles from physics, chemistry, and mathematics to design and optimize processes that drive industrial-scale chemical transformations. The field of Chemical Engineering, which evolved through the development of unit operations, plays a vital role in producing the essential products we rely on in our everyday lives.
The study of chemical engineering first emerged as a direct consequence of the industrial revolution. Chemical engineering since then has been one of the prominent streams of engineering.

The Department of Chemical Engineering, National Institute of Technology, Andhra Pradesh was established on 20th August 2015 at our temporary campus in Tadepalligudem. With an intake of 30 students every year, the department has been one of the pivotal parts of the institute through the years.
I wish all the students and readers, a great future ahead and that they use their skills to work for the development of our nation.

Department Head's Message.

From the desk of our beloved HOD

Dr. VINOTH KUMAR RAJA
Assistant Professor & HOD

Dear Readers,

Greetings!
First and foremost, I would like to congratulate my dear students for their great contribution to publish the fourth edition of the Department's Magazine named, ABSORB. I believe that this magazine ABSORB. 4.0 will motivate the students and teachers to share their creative and new ideas with the world and facilitate their overall development, as well as enlighten and account for the various activities and achievements of the students and staff members, and events organized by the department.
The Department of Chemical Engineering was set up in the National Institute of Technology Andhra Pradesh at the time of the inception of the institute in 2015. With time the department has grown in every sphere. The students of the department are highly encouraged to get hands-on experience with the industry and acquainted with state-of-the-art technology.
Chemical engineering is a very diverse branch of engineering that embodies in itself a wide array of subjects. Right from the morning when you take a wave-like glob of your toothpaste to when you switch off the lights in the evening, chemical engineering is omnipresent. With this wide range of subjects to choose from, our student editors have diligently narrowed it down to a few.
Having said this, I leave the floor to my dear students. I am very proud to say that the students of the department have worked hard to assemble this Departmental Magazine. I am sure that all the readers of this magazine are impressed by their efforts. I wish the students luck for their future and pray for them to bring glory to themselves, to the institute, and to the country. Also, I invite the readers of ABSORB 4.0 for their contribution and suggestions to the forthcoming issues.

From The Editorial Board.

Through the years of human history, we have evolved from small scale social groups hunting for survival in the Stone age, to highly innovative civilizations such as the Indus Valley, to the modern-day civilizations after the industrial revolution in the 18th century. This industrial revolution paved the ways for the need of studying and controlling industrial processes and unit operations in detail, leading to the inception of this new discipline of Engineering in the late 19th century, evolving into the modern-day Chemical Engineering in the 20th century. In the present era, chemical engineers influence large scale economies and production chains in various industries spanning from Pharmaceuticals and Petroleum to Agriculture and daily household products.

The Chemical Engineering Association of National Institute of Technology, Andhra Pradesh congratulates every Engineer, in being an integral part of our national growth and development and brings in front of you, the latest incorporation of the Departmental Magazine, ABSORB. 4.0, with the enthusiastic participation of the Association members and the mentorship of the Faculty Advisor, Department Head, and the Hon'ble Director of our Institute.

ABSORB. 4.0 aspires to provoke a temperament in the readers to imagine, envision and innovate, for a sustainable, modern, and beautiful planet, and constantly learn and orient themselves with the latest technological challenges and developments that the world is coming across. Besides the constant learning process, the current edition of magazine is also aimed at reminding the readers of the multitude of social challenges, certain aspirants may face and to promote in achieving an egalitarian workplace in STEM (Science, Technology, Engineering, and Mathematics).
We hope of making this reading a delightful and informative experience for the readers, while this being a memorable process for the whole ABSORB. team members in composing this edition of the Magazine.

Kudos! and Happy Reading!

BREWING

A Journey Through Fermentation History

For thousands of years, fermentation has been quietly working its magic, transforming simple ingredients into flavorful and nourishing beverages. Among them, beer stands out—not just as a drink, but as a cornerstone of civilization itself. More than just refreshment, beer has been a source of sustenance, a social glue, and even a scientific curiosity. To trace the history of brewing is to follow the story of our deep and evolving relationship with fermentation—a process once wrapped in mystery but now understood through science.

The Whispers of Ancient Brews

The origins of brewing stretch back into the shadows of prehistory, likely emerging alongside the dawn of civilization in the Neolithic era. The first beers were far from the hoppy beverages we know today. In fact, defining "beer" in those early days is tricky—was it any fermented grain-based drink, or only those resembling our modern brews? Regardless, its roots run deep in the broader tradition of fermented grain beverages.

As early as 5000 BC, humans had the necessary tools for brewing: grains, heat, and fermentation vessels. Before that, people probably stumbled upon fermentation by accident, perhaps by leaving grains in water and discovering a pleasantly intoxicating result. Unlike seasonal fruits, grains provided a reliable year-round source of alcohol, though brewing them required an extra step—breaking down their starches into fermentable sugars. Early brewers likely relied on wild yeasts found on fruits and plants to get the process started. One of the earliest records of brewing comes from Mesopotamia, where beer was not only enjoyed but documented. The famous "Hymn to Ninkasi" from around 1800 BC describes a brewing process using ingredients like bappir (beer-bread), munu (malted cereals), and titab (dried mash), often enhanced with honey and wine. By the Babylonian era, brewing had become incredibly diverse, with up to 70 different types of beer made from barley, emmer wheat, and other grains. Some methods even involved straining beer through reeds or metal tubes to avoid swallowing husks.

In ancient Egypt, beer was just as important—depicted in tomb paintings, used in religious offerings, and even prescribed as medicine. Egyptian brewers employed a mix of cooked and uncooked malt, sometimes incorporating sourdough bread as a yeast source. Large vats from around 3500 BC provide archaeological evidence of early breweries. The Greeks, however, were less impressed. They associated beer with "barbarians" and preferred wine, viewing fermentation with suspicion. The Romans largely inherited this bias, though they made exceptions when practical—supplying beer to their legions in northern Europe, where grapes were scarce.

Fermentation in the Dark Ages and Beyond:

As grain cultivation spread to Northern Europe, brewing traditions evolved. Unlike the Mediterranean, where fermentation focused on wine, northern regions embraced beer. These early brews were likely made from germinated cereals, fermented with wild airborne yeasts, and sometimes flavored with honey and herbs.

During the Middle Ages, monasteries became the keepers of brewing knowledge. While early Christianity had been skeptical of beer, monks in Ireland and elsewhere embraced it. By the 9th century, beer was officially recognized by the Church, and monasteries became brewing powerhouses. The Plan of St. Gallen, dating to around 830 AD, even shows a monastery with three different breweries—one for monks, one for guests, and one for the poor.

One major shift came with the introduction of hops, first mentioned by Abbot Adalhard of Corbie in 822 AD. Initially a monastic innovation, hops gradually replaced the traditional "gruit," a blend of herbs like sweet gale and yarrow. Hops not only added bitterness but acted as a preservative, leading to longer-lasting and more stable beers.

By the late Middle Ages, brewing had become a professional trade. Cities formed brewing guilds, establishing regulations on grain supplies, additives, and consumer protections. During this period, oats were a common brewing grain, though barley, wheat, and rye were also used depending on availability.

The Rise of Hopped Beer and Brewing Innovations:

By the 14th century, hopped beer from the Low Countries began spreading to England, challenging the traditional, less stable ale. Initially met with resistance, hopped beer eventually won favor due to its longer shelf life and better taste. The legalization of hop growing in England in 1554 marked a turning point.

The expansion of naval exploration further fueled the demand for beer, as it proved more stable than water and helped prevent scurvy on long voyages. Meanwhile, brewing technology advanced—water mills assisted with production, copper kettles replaced wooden vats, and efficiency increased significantly.

The Bavarian Revolution and the Lager Legacy:

Bavaria became a brewing powerhouse in the 16th century, largely due to the Reinheitsgebot (Bavarian Purity Law) of 1516. This decree limited beer ingredients to hops, barley malt, and water, ensuring quality and consistency. It also played a role in popularizing bottom fermentation, which led to the creation of lager. Bavarian brewers developed underground storage cellars and used natural ice to control fermentation, allowing them to brew beer year-round. By the 19th century, Bavarian lagers had become famous worldwide.

The Dawn of Scientific Brewing:

For centuries, fermentation remained a mystery—an almost magical process. That changed in the 17th century when Antonie van Leeuwenhoek first observed yeast cells under a microscope. However, it wasn't until the 19th century that scientists finally understood yeast's role in fermentation.

Chemists like Lavoisier and Gay-Lussac unraveled the chemical reactions behind fermentation, but it was Louis Pasteur's work in the 1850s–1870s that truly revolutionized brewing. He demonstrated that yeast, a living organism, was responsible for fermentation and identified harmful bacteria that could spoil beer. Shortly after, Emil Christian Hansen at the Carlsberg Laboratory developed the pure yeast culture method in 1883, allowing for consistent and predictable fermentation.

By the late 19th century, brewing had evolved from an art into a science. Thermometers, hydrometers, and saccharometers became standard tools, and brewing schools emerged to train new generations of scientifically minded brewers.

A Global Thirst: The Internationalization of Beer:

With the advancements of the 19th century, beer production spread worldwide. German immigrants brought lager brewing techniques to the U.S., adapting recipes with local ingredients like corn and rice to create American-style lagers. Refrigeration, bottling, and pasteurization further enabled large-scale brewing and global distribution.

Meanwhile, in Britain, the Industrial Revolution fueled the rise of massive commercial breweries producing porters, ales, and stouts. By the 20th century, beer had become a global phenomenon, with each region developing its own unique styles and traditions.

Conclusion:

From the accidental discovery of fermentation to the refined science of brewing, it reflects our deep connection to this ancient process. What started as a mysterious, trial-and-error craft has evolved into a precise and dynamic industry, continuously adapting to new technologies and tastes. Yet, at its core, brewing remains a celebration of transformation—where humble grains, water, and yeast come together to create something greater than the sum of their parts. And as long as people gather to share a drink, the journey of beer will continue, shaping cultures and communities for generations to come.

Swaroop Chandra
2022–2026

THE BIRTH OF MODERN CHEMICAL ENGINEERING

The birth of modern chemical engineering marked a transformative moment in the history of science, technology, and industrial development. Emerging in the early 20th century, chemical engineering evolved from industrial chemistry into a distinct and essential engineering discipline. This transformation was driven by the growing complexity of industrial processes and the need for a systematic, scientific approach to the large-scale production of chemicals, fuels, and materials. Chemical engineering has since played a pivotal role in shaping the modern world, supporting advancements in energy, healthcare, food production, materials science, and environmental sustainability.

Historical Background

Before chemical engineering was recognized as a distinct discipline, the production of chemicals and related products was largely in the hands of chemists and industrial manufacturers. These individuals often relied on empirical methods rather than theoretical principles. In the 19th century, the industrial revolution triggered massive growth in chemical manufacturing, such as in the production of sulfuric acid, soda ash, and other bulk chemicals. These processes required significant scale-up from laboratory methods to industrial-sized operations, and the traditional knowledge of chemists was not always sufficient to address the engineering challenges that arose.

The term “chemical engineering” began to appear in the mid-to-late 19th century. However, it was not until the early 20th century that chemical engineering was formalized as a profession with a unique identity. The increasing demand for engineers who understood both chemical processes and engineering principles created a need for specialized training and education.

The Concept of Unit Operations

One of the defining moments in the birth of modern chemical engineering was the introduction of the concept of unit operations. This concept was championed by Arthur D. Little and William H. Walker, who recognized that most chemical processes could be broken down into a series of basic steps—such as distillation, filtration, drying, and crystallization—that were common across different industries and chemical products.

In 1923, the publication of Principles of Chemical Engineering by Walker, Lewis, and McAdams helped solidify this idea. By organizing chemical engineering education and practice around unit operations, the field gained a coherent framework that allowed for better analysis, optimization, and scale-up of processes. Unit operations became the backbone of chemical engineering curricula and remain central to the discipline to this day.

Formation of the American Institute of Chemical Engineers (AIChE)

Another major milestone in the development of chemical engineering was the founding of the American Institute of Chemical Engineers (AIChE) in 1908. The formation of AIChE represented the formal recognition of chemical engineering as a professional discipline distinct from chemistry and mechanical engineering.

The founding members of AIChE sought to establish professional standards, promote research and education, and advocate for the unique contributions of chemical engineers. The institute provided a platform for the exchange of knowledge, helping to drive innovation and unify the growing community of chemical engineers.

Early Educational Programs

Chemical engineering education also began to take shape in the early 20th century. The Massachusetts Institute of Technology (MIT) was a pioneer, establishing one of the first chemical engineering programs in 1888. The program emphasized both chemistry and engineering fundamentals, laying the groundwork for future curricula.

As the discipline grew, other universities in the United States and abroad followed suit, creating dedicated chemical engineering departments. These programs trained generations of engineers equipped with the knowledge and skills to design, operate, and improve industrial chemical processes.

Key Figures in the Development of Chemical Engineering

Several individuals played critical roles in shaping modern chemical engineering:

- George E. Davis, a British chemical engineer, is often credited with laying the groundwork for the discipline. In the 1880s, he proposed a systematic approach to chemical process design and published the Handbook of Chemical Engineering in 1901.
- Arthur D. Little not only helped define the concept of unit operations but also emphasized the importance of applying scientific principles to industrial problems.
- William H. Walker, a professor at MIT, contributed significantly to the development of chemical engineering education and research, co-authoring the influential textbook Principles of Chemical Engineering.
- Donald F. Othmer and Raymond E. Kirk helped compile the Kirk-Othmer Encyclopedia of Chemical Technology, a comprehensive reference work that became a cornerstone for engineers in the field.

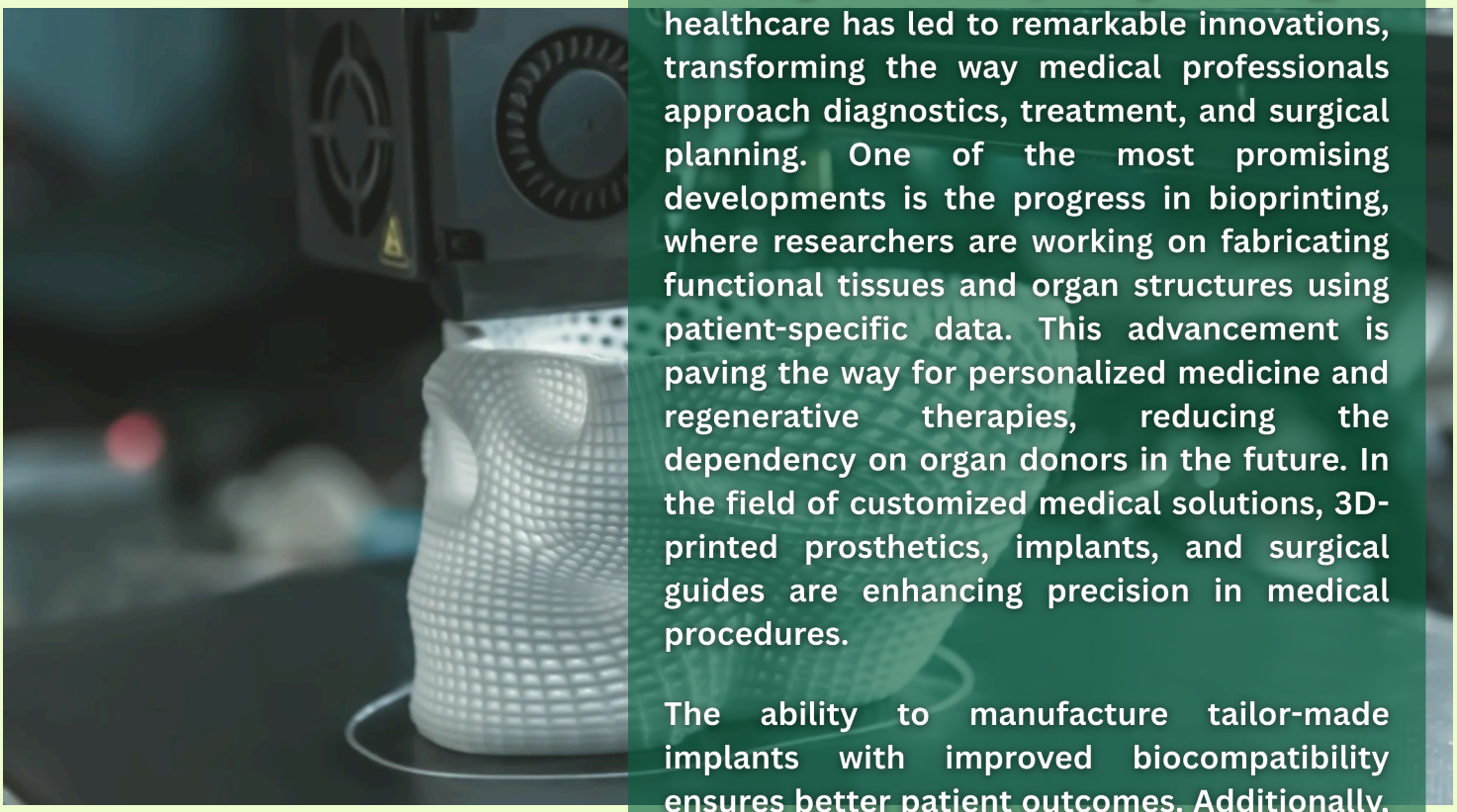
Evolution and Impact

With the foundation laid in the early 20th century, chemical engineering rapidly evolved. During World War I and World War II, chemical engineers played vital roles in the production of explosives, synthetic fuels, and other critical materials. After the wars, the growth of the petrochemical industry further propelled the importance of chemical engineering, as engineers developed new processes for refining oil and creating plastics, synthetic rubber, and fertilizers.

In the latter half of the 20th century, the field expanded beyond traditional chemical production. Chemical engineers began to work in diverse industries, including pharmaceuticals, food and beverage, semiconductors, environmental technology, and biotechnology. They applied their skills to areas such as drug formulation, clean energy development, pollution control, and nanotechnology.

M Harshith Kumar
2022-2026

ADVANCEMENTS IN 3D PRINTING



In recent years, 3D printing has evolved into a transformative technology, revolutionizing industries by enabling rapid prototyping, customized manufacturing, and complex design fabrication. From healthcare to automotive, its applications are reshaping the traditional production methods, enhancing efficiency, and reducing material waste. 3D printing is making a significant impact in various industries such as Biomedical, Aerospace, Construction and Automotive industries. This article mainly discusses the major advancements in 3D printing technology in Aerospace industry and Biomedical Applications.

BIOMEDICAL APPLICATIONS:

The integration of 3D printing technology in healthcare has led to remarkable innovations, transforming the way medical professionals approach diagnostics, treatment, and surgical planning. One of the most promising developments is the progress in bioprinting, where researchers are working on fabricating functional tissues and organ structures using patient-specific data. This advancement is paving the way for personalized medicine and regenerative therapies, reducing the dependency on organ donors in the future. In the field of customized medical solutions, 3D-printed prosthetics, implants, and surgical guides are enhancing precision in medical procedures.

The ability to manufacture tailor-made implants with improved biocompatibility ensures better patient outcomes. Additionally, metallic biomaterials in 3D printing are being explored to create durable and lightweight medical devices, such as custom stents for cardiovascular treatments. Another significant advancement is 3D printing in dentistry, where cutting-edge techniques enable the fabrication of high-precision dental crowns and aligners that mimic natural tooth enamel. These innovations streamline dental procedures, offering faster and more reliable solutions for patients.

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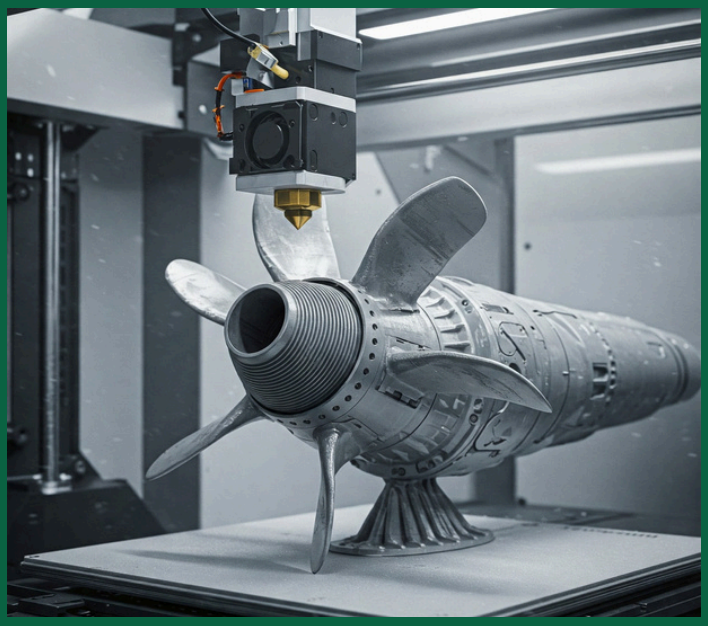
AEROSPACE APPLICATIONS:

The aerospace industry has witnessed groundbreaking advancements in 3D printing technology, revolutionizing the manufacturing of lightweight, high-performance components. Traditionally, metal-based additive manufacturing dominated this sector due to its superior mechanical strength and flame resistance. However, recent innovations have shifted the focus toward polymer composite-based 3D printing, driven by the need for fuel efficiency, thermal management, and design flexibility.

One of the most notable developments is the incorporation of carbon fibre (CF) and glass fibre (GF) reinforced composites, which offer high strength-to- weight ratios while enabling the production of intricate geometries. Researchers have successfully integrated silver and graphite particles into these materials to enhance thermal control, which is particularly critical for spacecraft and cube satellites, where heat dissipation is limited to radiative transfer. Additionally, UV-assisted 3D printing has emerged as a promising technique for fabricating aerospace structures such as propellers and air foils.

By optimizing printing parameters such as layer orientation, speed, and UV curing times engineers have achieved precise, reproducible models with complex geometries. This innovation not only streamlines the manufacturing process but also ensures higher reliability and durability of components used in extreme aerospace environments. Overall, these advancements in 3D printing are reshaping the future of aerospace engineering, offering cost-effective, lightweight, and thermally efficient solutions that push the boundaries of modern aviation and space exploration.



Akash
2023-2027

NANO-TECHNOLOGY IN FORENSIC SCIENCE

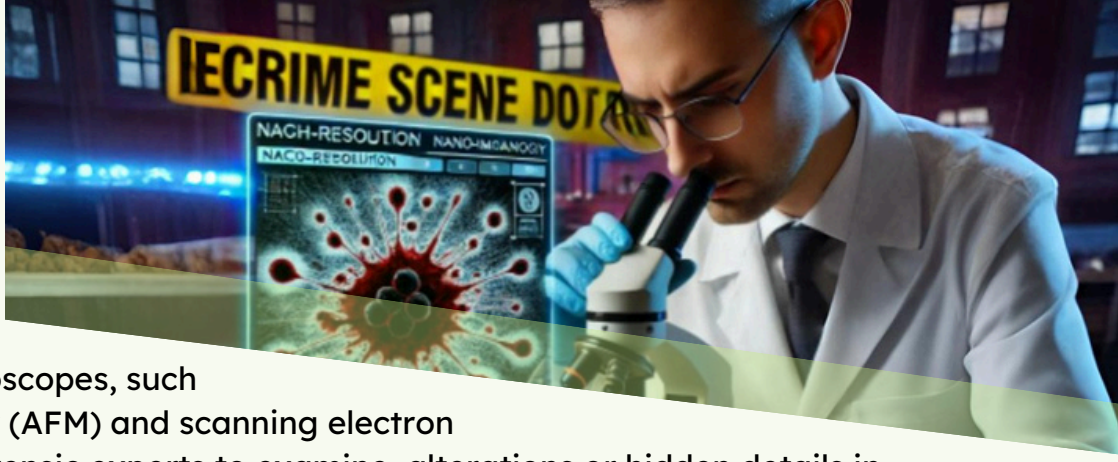
Nanotechnology is changing forensic science by making investigations more accurate and efficient. It helps forensic experts analyze evidence in ways that were not possible before, such as detecting faint fingerprints on difficult surfaces or identifying trace amounts of DNA from degraded samples. Tiny materials called nanomaterials improve fingerprint detection, DNA analysis, drug identification, explosives detection, forensic imaging, and crime scene reconstruction. These advancements allow investigators to find and understand evidence more clearly, leading to better crime-solving techniques.

One of the biggest improvements is in fingerprint detection. Traditional methods like dusting powder or using chemicals can sometimes fail, especially on rough or uneven surfaces. With nanotechnology, tiny particles of gold, silver, or other materials stick to the fingerprint's oils and proteins, making them glow under special light. This method makes even the faintest fingerprints more visible, helping law enforcement link suspects to crime scenes more effectively.

Nanotechnology has also revolutionized DNA analysis. Extracting DNA from tiny or degraded samples is now easier with magnetic nanoparticles, which help separate DNA from contaminants. Nanotechnology has made the polymerase chain reaction (PCR) process more sensitive, making it possible to detect even the smallest traces of genetic material. Portable DNA testing devices using nano sensors are now available, allowing forensic experts to perform quick and accurate DNA tests at crime scenes.

Detecting drugs, toxins, and other chemicals in forensic investigations has also improved with nanotechnology. Sensors made of materials like carbon nanotubes and gold nanoparticles can detect even the tiniest amounts of illicit substances. These nanosensors use advanced techniques to identify specific molecules, helping law enforcement quickly determine the presence of drugs or poisons. Lab-on-a-chip devices, which are small portable labs with nanotechnology, allow for on-the-spot drug testing, speeding up forensic analysis.

Nanotechnology plays a crucial role in detecting explosives, especially in counter-terrorism efforts. Older methods, such as chemical reagent tests and mass spectrometry, required large machines and time-consuming procedures. Now, nano sensors made from special materials can detect even the smallest traces of explosive substances. These sensors can be built into handheld devices, allowing security personnel to scan for explosives in public places or at crime scenes quickly.



Forensic imaging and document analysis have also improved. Special nano-coatings and security markers help prevent counterfeiting of documents and banknotes. Advanced microscopes, such as atomic force microscopy (AFM) and scanning electron microscopy (SEM), allow forensic experts to examine alterations or hidden details in documents. These high-resolution tools are useful in fraud detection, ensuring document authenticity.

Gunshot residue (GSR) analysis is another area where nanotechnology has made a difference. Traditional GSR detection methods can sometimes miss tiny gunpowder particles. With nanoparticles, forensic experts can now detect the smallest traces of lead, barium, and antimony found in gunshot residue. Nanotechnology also makes it easier to distinguish between gunpowder residue and other substances, reducing false positives in investigations.

Crime scene reconstruction has become more accurate with nanotechnology. It helps in analyzing trace evidence like paint, glass, fibers, and soil. Advanced spectroscopy techniques, enhanced by nanomaterials, allow forensic scientists to determine the exact composition of materials found at crime scenes. This helps investigators link suspects, victims, and locations with greater accuracy, improving case outcomes.

Looking ahead, the future of forensic science will likely involve artificial intelligence (AI) combined with nanotechnology. AI-powered nano sensors could quickly analyze and interpret forensic evidence, improving accuracy by identifying patterns, increasing speed in analyzing samples, and reducing human error. Innovations like nano-based biomarkers may help determine the time of death, while nano-engineered forensic dyes could make crime scene visualization even clearer.

In conclusion, nanotechnology has transformed forensic science by improving how evidence is detected, analyzed, and interpreted. From fingerprint detection to DNA analysis, drug identification, and crime scene reconstruction, nanotechnology has enhanced the accuracy and reliability of forensic investigations. As research continues, the combination of nanotechnology with AI and other technologies will make forensic science even more effective in solving crimes and ensuring justice.

Chandrasekhar
2022–2026

Chemical engineering in the food and beverage industry is a blend of science, creativity, and practicality. It's about turning raw ingredients into experiences, like the fizz of a soda, the crunch of a chip, or the creaminess of a dessert. Chemical engineering applies scientific principles to design and optimise production processes, and its impact on the food and beverage industry is significant. Chemical engineers ensure products are safe, high-quality, and produced efficiently, meeting the needs of a growing global population while addressing environmental concerns.

SAVOURING CHEMISTRY

Consider the production of plant-based meats, a booming sector. Chemical engineers use extrusion to transform soy or pea proteins into fibrous, meat-like textures. They optimize moisture, temperature, and screw speed in extruders to mimic the chew of beef or chicken, all while keeping energy consumption low. Similarly, in beverage production, they're developing membrane filtration systems to recycle water, cutting down on waste in breweries and soft drink plants.

Chemical engineers are also crucial for maintaining food safety and quality. They develop processing techniques like pasteurisation, sterilisation, and irradiation to eliminate microorganisms and extend shelf life, preventing foodborne illnesses. They also ensure compliance with safety standards, such as Hazard Analysis and Critical Control Points (HACCP) protocols, and design advanced packaging like vacuum sealing to protect against contamination. Additionally, they optimise food formulation to improve taste, texture, and nutrition, such as fortifying corn meal and bread with vitamins, addressing nutritional deficiencies. By extending shelf life through preservatives and controlled storage, they reduce food waste, enhancing food security.

Key processes in the food and beverage production are fermentation, extraction, emulsification, packaging, preservation, etc. The above processes involve fundamental processes like heat transfer, mass transfer, fluid flow, and reaction engineering that chemical engineers have mastered.

Fermentation:
Beer, yogurt, and soy sauce owe their existence to fermentation, a process where microorganisms convert sugars into alcohol, acids, or gases. Chemical engineers design bioreactors that maintain optimal conditions like temperature, pH, and oxygen levels, for the microbes to thrive. For instance, in brewing, they ensure that yeast ferments wort into beer efficiently, balancing flavor development with production speed.

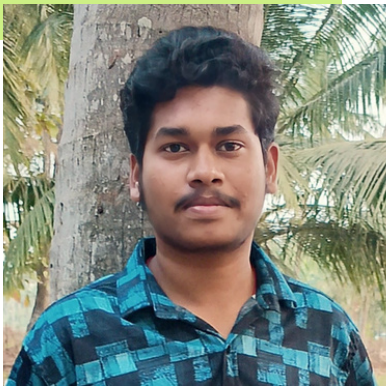
Packaging:
The rise of sustainable packaging owes much to chemical engineering. Engineers create biodegradable films and oxygen-barrier coatings that extend shelf life while reducing environmental impact. For carbonated beverages, they design bottles that withstand pressure using polymer science and material engineering.

Chemical engineering will continue to shape the food and beverage landscape in thrilling ways. Precision fermentation, where microbes are engineered to produce specific proteins or flavors, could revolutionize dairy and meat alternatives. For chemical engineering students and professionals, this field offers endless opportunities to innovate, solve real-world problems, and feed a growing world sustainably.

Extraction:
Chemical engineers use solvent extraction and distillation to isolate compounds like vanillin or caffeine. In coffee decaffeination, they might employ supercritical carbon dioxide, a method they've perfected to remove caffeine while preserving taste.

Emulsification:
Mayonnaise, ice cream, and salad dressings rely on stable emulsions which are mixtures of oil and water. Chemical engineers use their understanding of colloid chemistry to select emulsifiers and optimise high-shear mixing processes, ensuring products don't separate over time.

Preservation:
Food spoilage is the enemy of any producer. Chemical engineers develop preservation techniques like pasteurisation, sterilisation, and freeze-drying. In pasteurisation, they calculate precise heating and cooling cycles to kill pathogens without compromising flavor or nutrients, using heat transfer principles to design energy-efficient systems.



Pawan Karthikeya
2023-2027

Chemical Engineering In Art and Culture

A Fusion of Molecules and Masterpieces

Chemical engineering, often seen as the science behind refineries and pharmaceuticals, also plays an unexpected yet profound role in the world of art and culture. From the vivid colors on ancient pottery to cutting-edge bioart using living cells, the fusion of molecules and creativity has a rich and evolving history.

The Artist's Palette

The discovery of mauveine by William Perkin in 1856 [4] marked the birth of synthetic dyes, transforming both the textile industry and the aesthetics of art and fashion. Before this, colors were painstakingly extracted from natural sources. With synthetic dyes, artists gained access to vibrant, lasting hues never seen before.

Later, the rise of polymer science gave us materials like acrylics and Bakelite [5], allowing artists to sculpt with plastic, paint with synthetic brilliance, and push the boundaries of traditional media.

Spectroscopy: Saving Cultural Heritage

Chemical engineering has been pivotal in art conservation. Non-invasive techniques like Raman spectroscopy [6] are used to identify pigments and materials in historical works, helping conservators understand deterioration and plan restorations without damaging the original art.

These tools have been used to uncover hidden layers in Renaissance paintings, identify forgeries, and restore manuscripts that would otherwise decay with time.

~3000 BCE — ***Egyptian Blue pigment***
One of the earliest synthetic pigments; used in tomb art and pottery [1]

~100 CE — ***Roman glassblowing with additives***
Colored glass mosaics and ornaments; early use of manganese dioxide for clarity [2]

8th–13th Century — ***Islamic ink and dye chemistry***
Advanced natural dye extraction methods shaped manuscript illumination and textile arts [3]

1856 — ***Perkin's Mauve: First synthetic dye***
Revolutionized textile and fashion industries

1930s–60s — ***Polymers in art: Acrylics, Bakelite***
Enabled plastic-based sculptures and modern installations [5]

1980s — ***Analytical tools in conservation***
Raman and IR spectroscopy aided artwork preservation without damage [6]

2000s — ***Bioart emerges***
Living cells and engineered organisms became part of artworks [7]

Living Sculptures: The Rise of Bioart

One of the most radical integrations of art and chemical engineering comes through bioart. Artists like Stelarc and Eduardo Kac use genetically modified organisms, live tissues, and bacterial cultures to create thought-provoking pieces that blur the boundaries between science and creativity. An iconic example is the Earmouse—a living mouse implanted with cartilage shaped like a human ear.
These artworks challenge viewers to consider ethical implications of biotechnology and reflect on humanity's growing control over life at the cellular and molecular levels.

Museums and Media: Engaging the Public

Institutions like the Science History Institute curate exhibitions that highlight the historical relationship between chemistry and culture. These collections often include historical alchemical instruments, pigment displays, and even scent-based installations derived from chemical formulations [1].

In cinema and literature too, the influence is clear—from the mysticism of alchemists in Harry Potter to the vivid color palettes in historical films made possible through chemically engineered dyes and makeup.

Chemical engineering and art may seem like strange bedfellows, but history and innovation prove otherwise. The precision of molecules and the messiness of creativity intertwine beautifully—from ancient dyes to nanostructures that shimmer.

As chemical engineers shape the future of biomaterials, polymers, and nanotechnology, they're not just solving industrial problems—they're helping humanity express itself in new, meaningful ways.

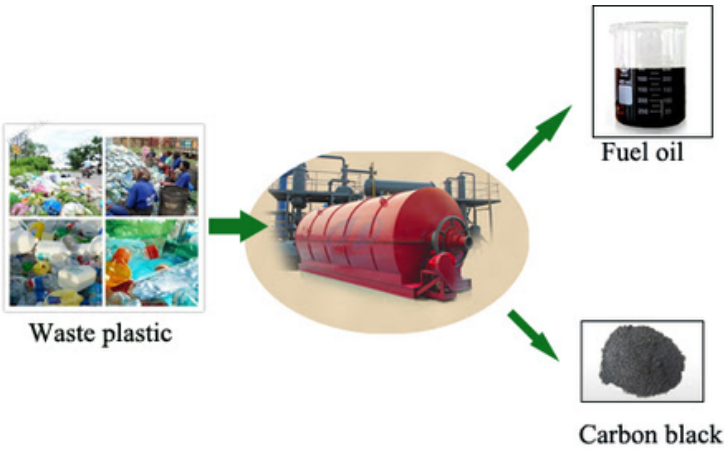
Priya Sivalanka
2022–2026

Role of chemical engineering in India's economic growth and sustainable development

Chemical engineering plays a crucial role in shaping India's economic growth and sustainable future. It's not just about working with chemicals- it's about transforming industries, improving lives, and finding smarter, cleaner ways to move forward. From pharmace- uticals to agriculture, energy to environmental conservation, chemical engineers are at the heart of innovation, ensuring that progress and sustainability go
hand in hand.

One of the most significant impacts of chemical engineering is in the petrochemical and energy industries. As the demand for fuel, plastics, and chemicals continues to rise, engineers are pushing the boundaries of technology to develop cleaner and more efficient solutions. They are pioneering breakthroughs in renewable energy- whether it's biofuels, hydrogen, or carbon capture- helping India reduce its reliance on fossil fuels and work toward the ambitious goal of net-zero emissions by 2070.

In the pharmaceutical sector, chemical engineering is a driving force behind India's reputation as the "pharmacy of the world." From developing cutting-edge drug formulations to enhancing production efficiency, chemical engineers ensure that high-quality medicines reach global markets. Their expertise in sustainable manufacturing processes also helps maintain environmental standards while keeping India at the forefront of medical advancements.



Agriculture, too, has seen a transformation thanks to chemical engineering. Modern fertilizers, advanced pesticides, and innovative soil treatments are making farming more productive and environmentally friendly. Biofertilizers and controlled-release fertilizers are changing the way crops are grown, ensuring higher yields while minimizing ecological impact.

“Chemical engineering stands at the intersection of innovation and sustainability, driving India’s economic progress while safeguarding the future.”

Beyond industries, chemical engineers are tackling some of the most pressing environmental challenges. Waste and water treatment have become critical areas of focus, with engineers developing efficient recycling methods, wastewater purification systems, and biodegradable materials. By adopting circular economy principles, they
are helping industries use resources wisely, reduce pollution, and create a cleaner, more sustainable future.

At its core, chemical engineering is about problem-solving and progress. It’s about finding ways to fuel industries, protect the planet, and improve everyday life- all at the
same time. As India moves towards a greener and more self-reliant future, chemical
engineers will continue to lead the way, ensuring that economic growth doesn’t come at
the cost of sustainability. Their contributions will remain essential in building a
prosperous, forward-thinking nation for generations to come.

Aravinda
2023–2027

GATE ACHIEVERS 2025

Mohit Sondhiya
2021 - 2025

Aditya Ashok
2021 - 2025

D.V.J Karthik
2021 - 2025

S. Abhinav
2021-2025

N. Harika
2022-2026

Meghali B
2021-2025

Ankit Kumar Rajak
2021-2025

Mahalakshmi Sree
2022-2026

Siddhant P
2021-2025

Shravan Patel
2021-2025

Aparna Pankaj
2022-2026

Abhilash R
2021-2025

Priya Sivalanka
2022-2026

Swaroop Chandra
2022-2026

Congratulations!

Career Spotlight

1. What technical skills or tools did you focus on that helped you secure multiple placements?

During my B. Tech, I focused on building strong fundamentals in chemical engineering subjects like Heat Transfer,Mass Transfer, Thermodynamics, Fluid Mechanics, and Reaction Engineering. I also focused on learning industry-relevant software like Aspen Plus and MATLAB, those are already in our curriculum, and which I had used during my internship. Additionally,. practicing mock tests and solving the aptitude questions helped me a lot to clear the first rounds of the placement drives. These technical skills, consistent revision, and internship projects helped me to perform well in both the written tests and technical interviews during placement season.

2. Can you share how any project or internship contributed to building your technical expertise?

Internships matter a lot in your interviews.My internships at ONGC and IITH have actually helped me a lot to build my resume, presenting both the industrial experience and research-oriented skills. Coming to my B.Tech 3 rd year project was on process simulation, where I used Aspen Plus to model and optimize chemical processes. I worked on simulating a distillation train and learned how minor changes in parameters could impact efficiency. It gave me a deeper understanding of plant operations and how simulations are used for cost and energy optimization. For my final year project, I worked on wastewater treatment through carbon dot assisted Photocatalysis involving the synthesis of carbon dots from bioresources and their characterization. This involved both wet lab work and using instruments like UV-Vis and fluorescence spectroscopy. These experiences strengthened both my theoretical and practical understanding, making me more confident during interviews.

3. What steps did you take to improve your communication and interpersonal skills during your time at NIT Andhra Pradesh?

Participating in group discussions which really helped improve my public speaking and communication skills and organizing the college events gave me the confidence to speak clearly and convincingly. Reading newspapers and listening to TED Talks actually helped me to expand my vocabulary and communication style. Whenever I worked on group projects, I actively contribute to practice teamwork and coordination. Over time, I became more comfortable during interviews and networking sessions. These efforts helped me articulate my thoughts better, especially during HR rounds and group discussions in placement drives.

4. Were there any extracurricular activities or roles that helped shape your personality and leadership qualities?

Yes, serving as the Student Placement Coordinator was a defining experience. It taught me leadership, coordination, and the importance of maintaining professionalism under pressure. I had to manage company visits, prepare student data, and ensure smooth execution of placement drives—all while balancing my academics. This role honed my problem-solving skills and taught me to

stay calm in high-stakes situations. Additionally, being part of the organizing team for departmental events gave me experience in planning, logistics, and team management. These responsibilities not only improved my leadership abilities but also shaped me into a more confident and balanced individual.

5. What was the biggest challenge you faced during your placement journey, and how did you overcome it?

The biggest challenge for me was managing multiple responsibilities during the placement season—my academics, final year project, and placement coordinator duties all coincided. There were times I felt pressured, especially when handling back-to-back interviews while ensuring the rest of my academics and final project went smoothly. To overcome this, I maintained a strict schedule and prioritized tasks based on urgency. I made time for mock interviews and regular preparation.. I leaned on my parents and friends for support. This phase taught me the importance of time management, discipline, and self-care—all of which helped me stay composed and crack the interviews.

6. What is the most important piece of advice you would give to juniors aiming to get placed successfully?

Start preparing early, especially in your third year. Focus equally on core subjects, aptitude, and communication. Be strong in the basic fundamentals in the core. Take internships seriously—they give you real-world exposure and a strong edge. Choose a project that genuinely interests you and take ownership of it.

I also recommend being active in departmental activities or clubs—it improves your soft skills and teaches you teamwork. Most importantly, don't hesitate to seek help—from seniors, professors, or peers. Use every rejection as feedback to grow. Believe in your preparation, be adaptable in learning, keep yourself updated with the latest software skills in our core and stay consistent. Success in placements is not just about talent—it's about preparation, mindset, confidence and resilience.

Meghana
2021-2025

(Got offer letters from Reliance Industry Ltd and Jyesta Corporate Entity)

GALLERY

Teacher's Day Celebration

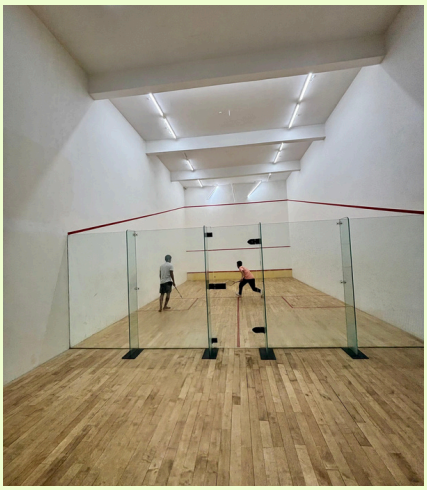
(held on 05 Sep 2024)

GALLERY

Intra-Chemical Sports Meet

(held on 8,9,10 Nov 2025)

Intra-Chemical Sports Meet

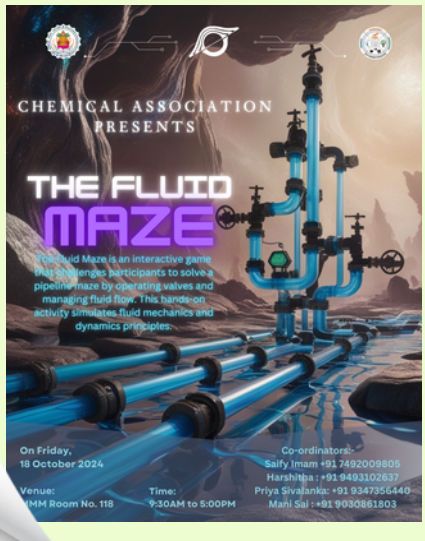


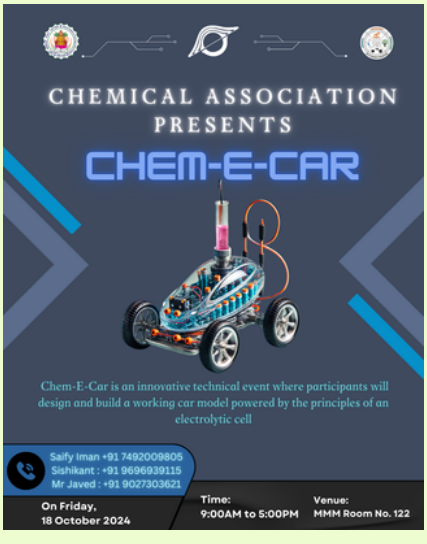
National Webinar on Circular Economy Approach For Mitigation of Plastic Waste

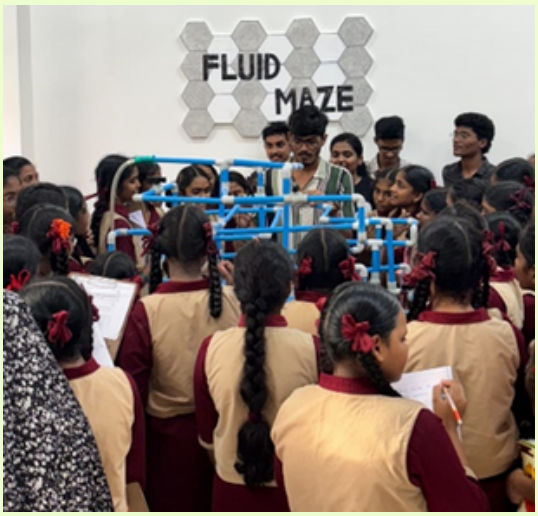
(held on 07 Oct 2024)

Techkriya'24

(held on 18,19 Oct 2024)





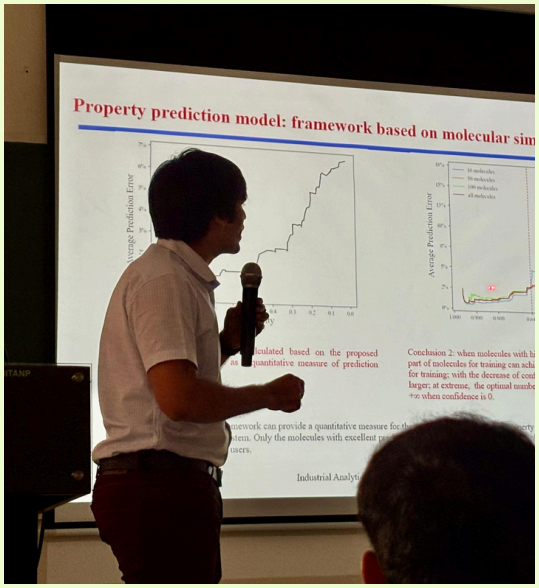

FLUID
MAZE


CHEMICAL
ENGINEERING
ASSOCIATION

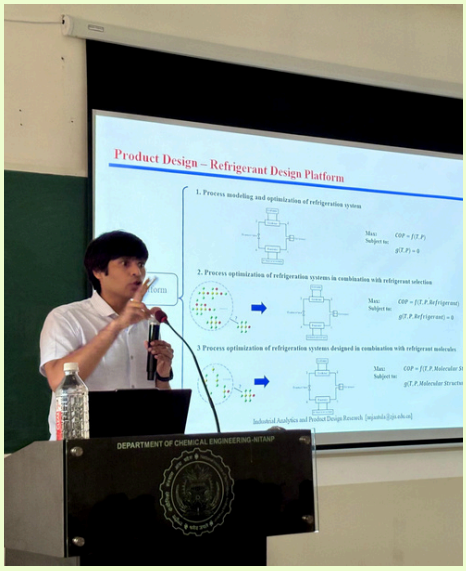

SOLVE

Expert talk on Bridging Academia and Industry

(held on 23 Jan 2025)




Zhejiang University – Hangzhou, China


Product Design – Refrigerant Design Platform
1. Process modeling and optimization of refrigeration system
2. Process optimization of refrigeration systems in combination with refrigerant selection
3 Process optimization of refrigeration systems designed in combination with refrigerant molecules
DEPARTMENT OF CHEMICAL ENGINEERING-NITANP

Intra-Chemical Sports Winners' Award Distribution

(held on 23 Jan 2025)









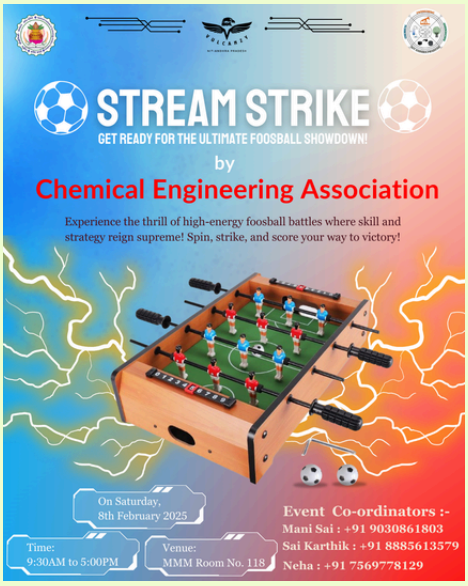







Vulcanzy'25

(held on 07,08 Feb 2025)


STREAM STRIKE
GET READY FOR THE ULTIMATE FOOSBALL SHOWDOWN!
by
Chemical Engineering Association
Experience the thrill of high-energy foosball battles where skill and strategy reign supreme! Spin, strike, and score your way to victory!
On Saturday,
8th February 2025
Time:
9:30AM to 5:00PM
Venue:
MMM Room No. 118
Event Co-ordinators :-
Mani Sai : +91 9030861803
Sai Karthik : +91 8885613579
Neha : +91 7569778129


Galaxy S22 Ultra


Galaxy S22 Ultra


Stream
Strike


STRIKE


Galaxy S22 Ultra

Short Term Course on Innovations in 3D Bioprinting and Functional Biomaterials

(held on 3rd- 7th Mar 2025)


A
Short Term Course
on
Next-Gen Biofabrication:
Innovations in 3D Bioprinting
and Functional Biomaterials
3rd- 7th March, 2025
NIT Andhra Pradesh
Organized by
National Institute of Technology,
Andhra Pradesh
In association with
Institution Innovation Council
and
Next Big Innovation Labs® Pvt. Ltd


Short Term Course on
Innovations in 3D Bioprinting and Functional Biomaterials
About NIT AP
National Institute of Technology (NIT) Andhra Pradesh is the 31st institution in the prestigious chain of NITs established by the Government of India. Since its establishment in the academic year 2015–16, the institute has been dedicated to fostering excellence in education and research. With a strong emphasis on emerging areas of Science and Technology, NIT Andhra Pradesh is rapidly advancing in academics and research, providing state-of-the-art facilities to support innovation and interdisciplinary learning.
About The Short Term Course
The field of biofabrication has revolutionized biomedical research and healthcare applications. This short term course aims to explore the latest innovations, challenges, and future prospects in this cutting-edge domain. This short term course will provide a platform for knowledge exchange, networking, and fostering collaborations among academia, industry, and innovators in the field of biofabrication.
Who Should Attend?
Researchers, academicians, and students in biotechnology, biomedical engineering, materials science, and life sciences.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MINISTRY OF EDUCATION


EDUCATION
rm Course
nnovations in 3D Bioprinting

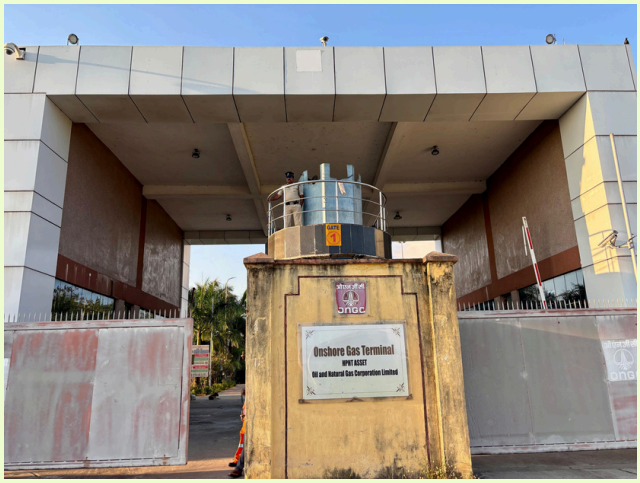
INDUSTRIAL VISIT

(held on 19 Mar 2025)

Industrial visits provide invaluable opportunities for students to gain practical insights into the workings of various industries. The Chemical Engineering branch of NIT Andhra Pradesh recently embarked on a visit to ONGC (Oil and Natural Gas Corporation), Yanam, Puducherry, a major player in the oil and gas sector, on March 19, 2025.

During the visit, students gained a comprehensive understanding of upstream operations involved in natural gas extraction and processing. They observed, firsthand, the sophisticated processes that transform raw hydrocarbons into usable energy resources. The visit enabled them to connect theoretical classroom concepts with real-time industrial applications, enhancing their grasp of chemical engineering fundamentals.

ONGC's cutting-edge infrastructure and operational excellence made a lasting impression on the students. The exposure to safety protocols, environmental management practices, and process optimization techniques offered deep insights into the challenges and innovations of the oil and gas industry.



Overall, the industrial visit to ONGC Yanam proved to be an enriching and eye-opening experience for the students of NIT Andhra Pradesh. It equipped them with practical knowledge and industry perspectives that will undoubtedly support their academic and professional journeys in the field of chemical engineering.

BEHIND THE PAGES

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Dr. P. Dinesh Sankar Reddy

Dr. Gourhari Chakraborty

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2022 - 2026

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K Chandra Sekhar
2022-2026

Harshith Kumar
2022-2026

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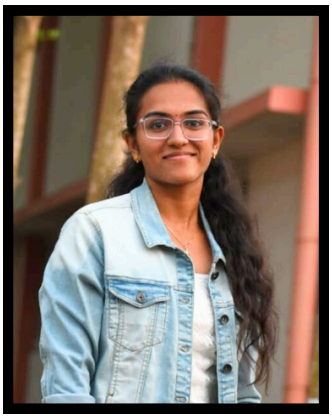

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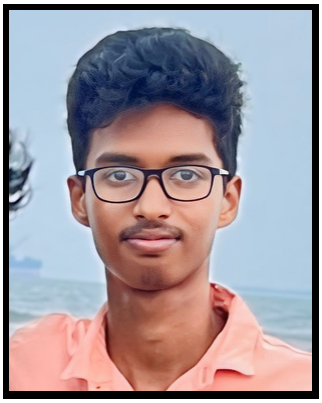

Karthikeya
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Neha C
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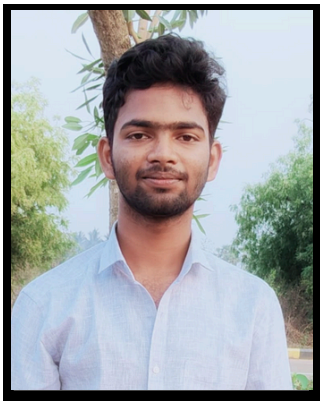

Sai Karthik
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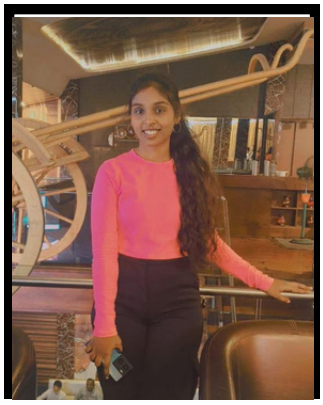

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Aravinda
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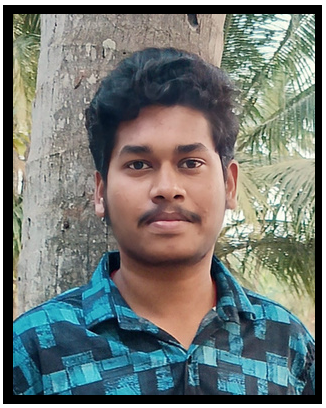

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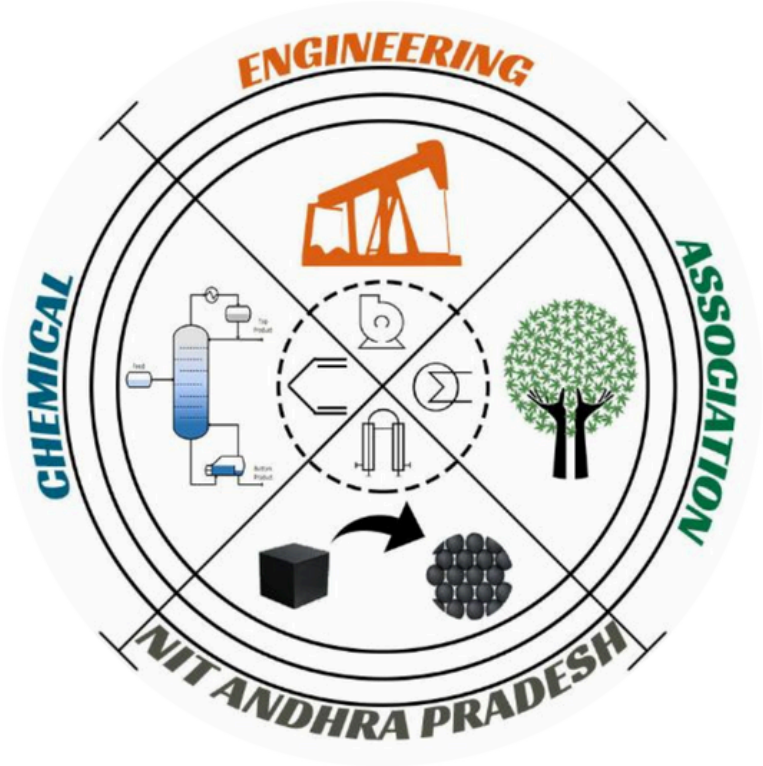

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