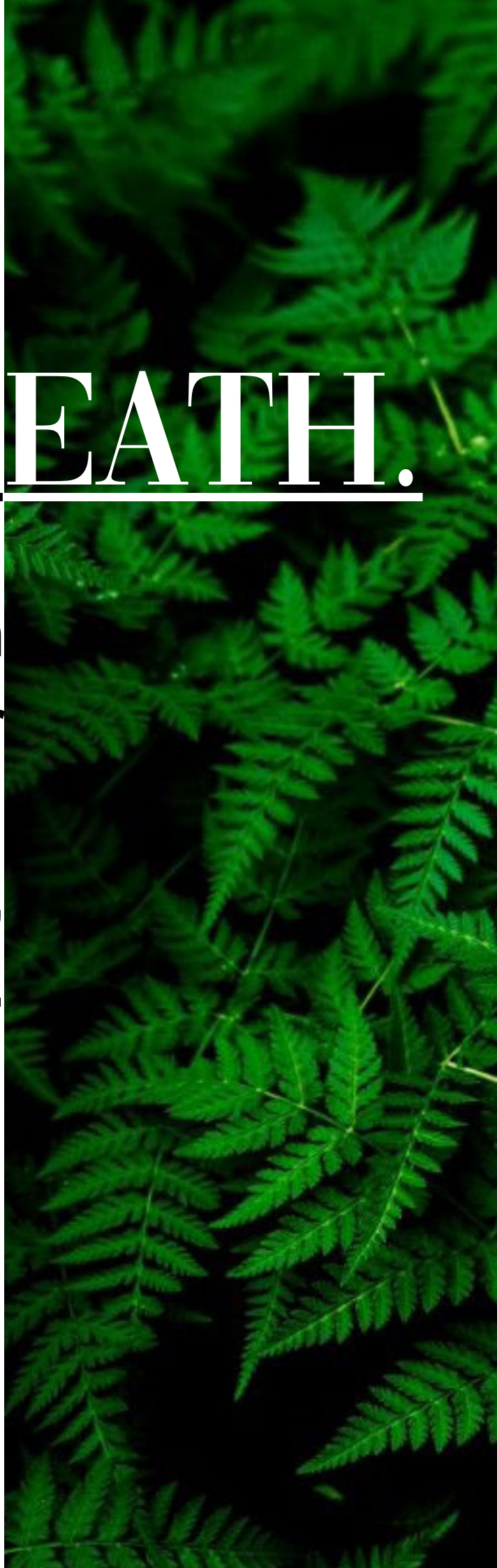
SUSTAINABILITY

# CHEMZONE

ISSUE
JULY 2023

# FEEL THE BREATH.

**In every walk in with nature one receives far more than he seeks.**
**By discovering nature, you discover yourself.**



# *From the* EDITORs

***PRAJWAL YASHWIN PINTO***
4th year, Chemical Engineering

In today's world, the concept of sustainability has become increasingly vital and pervasive. As we grapple with the challenges posed by climate change, resource depletion, and environmental degradation, it is clear that sustainable practices and initiatives are very essential for the well-being of our planet and future generations.

Sustainability, at its core, is the principle of meeting present needs without compromising the ability of future generations to meet their own needs. It encompasses environmental, social, and economic considerations, emphasizing the importance of balance and harmony between these interconnected aspects. In a world where the effects of human activity are increasingly evident, embracing sustainability is not merely an option; it is a responsibility that falls upon individuals, communities, governments, and businesses.

***KIRAN PRASAD J P***
4th year, Chemical Engineering

*"Sustainability- It's the right thing to do, it's the smart thing to do, it's the profitable thing to do."*

IIChE BMSCE Student Chapter is proud to present its second edition of magazine with the name “Chemzone” after its successful release and positive feedbacks on the first edition “Vanadium”. This time the magazine goes with the theme of “Sustainability”.

The theme of sustainability for our magazine encompasses a broad spectrum of ideas and practices that are vital for the long-term well-being of our planet and its inhabitants. By prioritizing sustainability in our personal choices, policies, and business strategies, we can pave the way for a more sustainable and prosperous future.

This magazine will provide the readers with the knowledge of sustainability related topics along with some other trending topics of Chemical Engineering. We would like to thank HOD of Chemical Engineering Department of BMSCE, IIChE BMSCE Student Chapter faculty coordinator and all the faculty, staff and IIChE Student members of Department of Chemical Engineering, BMSCE for their keen interest in the release of the magazine “Chemzone”.

*Together, let us embark on this journey towards a greener, more sustainable world.*

*THANK YOU*

# HOD's Note

The Chemical Engineering curriculum is designed to work in many fields starting from process industries, marketing, sales, software, design, and offshore pipeline design to management. As the curriculum in practice gives an understanding of various levels of technology development, a chemical engineer can become a successful entrepreneur also. The present need for sustainable technology, energy requirement, and resource management has opened many opportunities to future budding engineers.

It might take a few years for fresh graduates to identify a suitable profession to stick to and continue to grow and shine. Nevertheless, any opportunity to learn, and get trained practically should be utilized by each and every individual who wants to grow. Many achievers of today have started their journey with minimum or zero experience but with a thirst for knowledge and work, crossed many hurdles, and reached milestones with difficulty.

They did not stop and withdrew from the path chosen even though they starved in between. It might be required to stop for a while and look back to identify what went wrong, to correct, and continue. An individual is always a part of society, and hence the seriousness and dedication with the commitment to achieve will surely ,

**TAKE HIM/HER TO SUCCESS AND HENCE CONTRIBUTE TO THE DEVELOPMENT OF THE NATION.**

*WISHING ALL, THE BEST OF LUCK.*

**Dr. Y. K. Suneetha**
Associate Professor and Head
Department of Chemical Engineering

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# INDIAN INSTITUTE OF CHEMICAL ENGINEERING

The Indian Institute of Chemical Engineers (IIChE) is the professional body for chemical engineers in India. The headquarter of IIChE is in the campus of Jadavpur University, Kolkata. The organization has 42 regional centers along with 172 student chapters spread throughout India.

The institution's membership comprises academics, professionals from the chemical industry, researchers, and students.

IIChE also publishes scientific journal "Indian Chemical Engineer", which is published in two sections – A and B. Section A provides an international platform for presenting original research work, interpretative reviews and discussions on new developments in the expansive areas of Chemical Engineering and its allied fields. The journal invites papers describing novel theories and practical applications, including reports of experimental work – carefully executed and soundly interpreted. Section B features technical articles or overview of technology with a view to guiding practicing chemical engineers, news snippets on research developments, industry updates, issues of environment and health hazards, etc. This section also offers in-house news for those associated with the institute.

Indian Institute Of Chemical Engineers is a confluence of streams of professionals from academia, research institute and industry. It provides them the appropriate forum for joint endeavors, hand-in-hand, to work for human being through application of chemical engineering and allied sciences. If youare interested about, attached to or involved in chemical engineering related activities – whether as a student as a seasoned professional - you shall find the program of IIChE immensely beneficial, opening up doors of new possibilities and existing possibilities.

# CORE 2022-23

**Prajwal Yashwin Pinto**
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**DESIGN HEAD**

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**Prathyusha ND**
**EVENT MANAGEMANT HEAD**

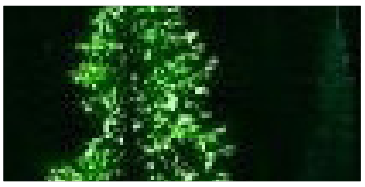
# Note from faculty coordinator of IIChE BMSCE student chapter

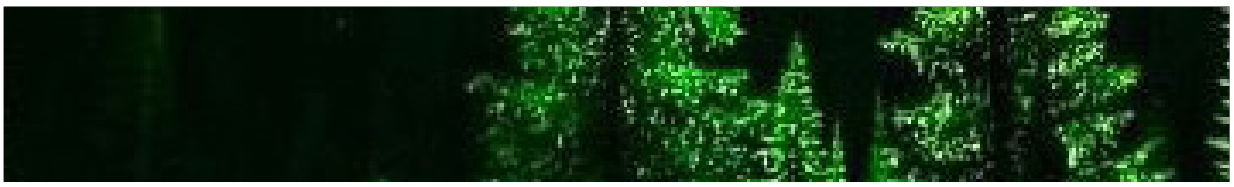
IIChE BMSCE student chapter is the active student chapter in Bangalore regional center of Indian Institute of Chemical Engineers (IIChE). It is a pleasure to be a part of the chapter as faculty coordinator. All members were actively participated in the all the activities and showcased their talent. Core committee members were involved in organizing various technical and social events throughout the year. Few notable activities were Plogging - jogging and trash picking, webinar, hands on training, IIChE confluence –annual technical events include technical disclosure, quiz, puzzle hunt etc. All the events were very successful and it gave organizers, members and participants immense knowledge towards the recent technological advancements, leadership quality and up gradation of skills. Students also involved in the release of magazine-Vandium, where they published their articles on the theme "Technology to mitigate the climate change". This year the student chapter is releasing the magazine CHEMZONE with the theme "Sustainability". I wish all the best to the all core committee members for the grand release of the magazine CHEMZONE.

**Soumen Panda**
Faculty Coordinator
IIChE BMSCE student chapter

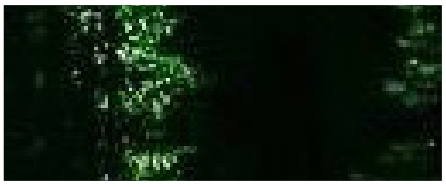
We thank
Mr. Soumen Panda for your serivce as IIChE BMSCE Student Chapter faculty coordinator.

We welcome
Dr. G. N. Rameshaiah for taking charge as IIChE BMSCE Student Chapter faculty coordinator.





# ARTICLES



# BY

# STUDENTS

# SUSTAINABILITY

In our road to achieving sustainability in production of materials and chemicals, we must strive to eliminate pollution at the source, improve material and energy efficiency of our processes and use renewable resources. The best way to prevent pollution is at the source. Thus, if we want to have high tech processes that are "sustainable" and "green", we must use chemical reaction engineering concepts to the fullest extent. The days when the chemist found a magic ingredient (catalyst) for a recipe and the chemical engineer tried in earnest to get its full potential expressed in an available 'kettle', must be replaced by the efforts of the chemical engineer to select the best catalyst, provide the best flow pattern and reactor. This effort requires the multi-scale CRE approach consisting of molecular and reactor scale considerations. Since the last decade, the chemical engineers have been re-focusing on developing new technologies that prevent or minimize pollution rather than dealing with 'end of pipe' treatments. In order to develop such technologies, a quantitative understanding of reaction systems and transport properties on the reaction rates is a must. Furthermore, the physical properties of the catalyst and media are also determining factors in choosing the "right" reactor for an environmentally benign process. Hence, it is a multidisciplinary task combining chemistry, reaction engineering, environmental impacts and economics. The combination of CRE approach with "green processing" principles should lead to the development of a sustainable chemical industry with minimal waste production.

**By**
**VAISHNAVI SUDARSAN PERUMBULLY**

# CLEAN ENERGY TECHNOLOGY

By PRAJWAL YASHWIN PINTO



Clean energy technology refers to any process, product or service that reduces negative environmental impacts through significant energy efficiency improvements, sustainable use of resources or environmental protection activities. Clean energy technologies also endure economic growth by enhancing the supply of energy demand and tackling environmental challenges and their impacts due to the use of other conventional sources of energy.

Some of the most common examples of clean energy sources include solar, wind, water, geothermal, bioenergy, natural gas, and nuclear power.

**Solar:** Solar radiation is light – also known as electromagnetic radiation – that is emitted by the sun. While every location on Earth receives some sunlight over a year, the amount of solar radiation that reaches any one spot on the Earth's surface varies. Solar technologies capture this radiation and turn it into useful forms of energy.

**Wind:** Wind energy, which transforms the power of an inexhaustible resource such as wind into electricity, is a sustainable and valuable investment for the future. Utilising wind requires the construction of wind farms, either on land or at high sea, with dozens of wind turbines. These giants have become part of the landscape in recent years.

**Water:** Energy supply depends on water. Water supply depends on energy. The interdependency of water and energy is set to intensify in the coming years, with significant implications for both energy and water security. Each resource faces rising demands and constraints in many regions because of economic and population growth and climate change.

**Geothermal:** Geothermal energy is a type of renewable energy taken from the Earth's core. It comes from heat generated during the original formation of the planet and the radioactive decay of materials. This thermal energy is stored in rocks and fluids in the centre of the earth. It has been used in some countries for thousands of years for cooking and in heating systems.

**Bioenergy:** Bioenergy is one of many diverse resources available to help meet our demand for energy. It is a form of renewable energy that is derived from recently living organic materials known as biomass, which can be used to produce transportation fuels, heat, electricity, and products.
**Natural Gas:** Natural gas is a fossil fuel – but it's cleaner and more efficient than other traditional fuels.Natural gas produces less pollution and greenhouse gases than its counterparts, according to the Center for Liquefied Natural Gas. For example, when natural gas is burned, it produces 45 percent less carbon dioxide than coal, 30 percent less than oil and 15 percent less than wood. During combustion, it produces heat, water vapor and Carbon dioxide.

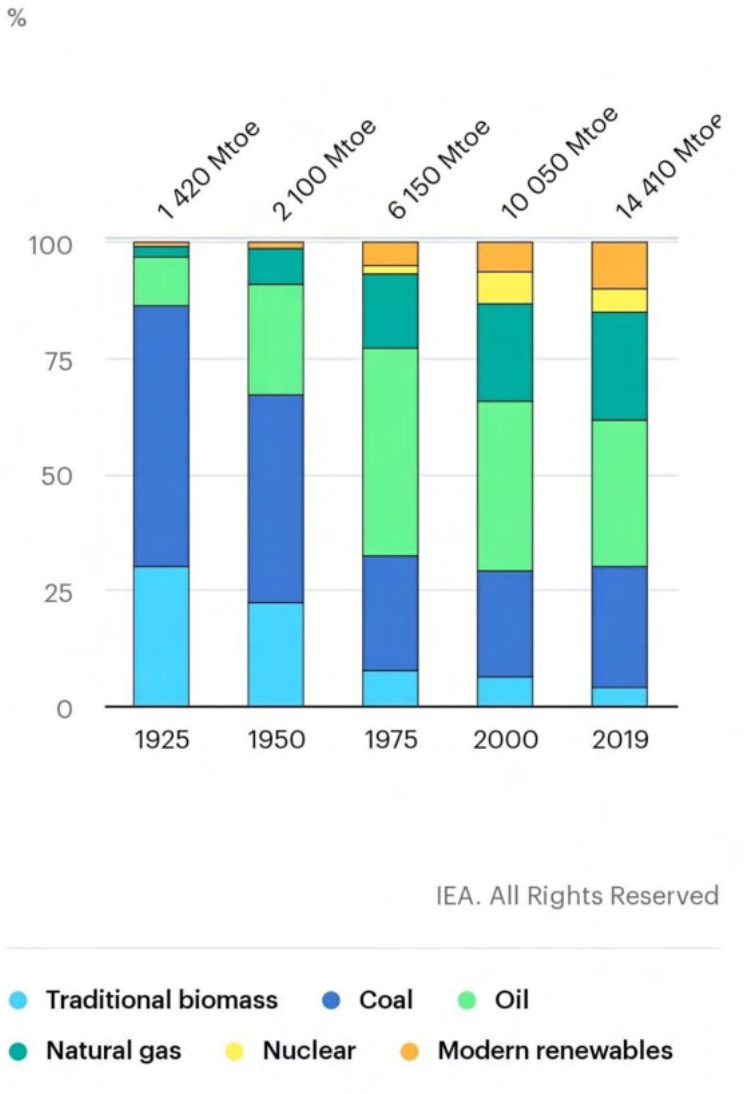
**Nuclear Power:** Nuclear power is a clean and efficient way of boiling water to make steam, which turns turbines to produce electricity. Nuclear power plants use low-enriched uranium fuel to produce electricity through a process called fission—the splitting of uranium atoms in a nuclear reactor. Uranium fuel consists of small, hard ceramic pellets that are packaged into long, vertical tubes.

Clean energy is a critical component to sustainable development throughout the world. Clean energy technology not only improves our quality of life by reducing air and water pollution, it also mitigates energy dependence by creating renewable resources in local communities. The way we currently produce and consume energy is unsustainable, and while technology is not the only ingredient to a cleaner energy future, there is no credible path to net-zero emissions without a significant and speedy ramping up of clean energy technologies across the entire energy sector.

The carbon footprint of the global energy system has been reduced in waves driven by government policies. For instance, construction of nuclear reactors surged in the 1960s and 1970s, but slowed down thereafter. More recently wind and solar PV have seen rapid expansion, led by policy support in Europe, United States, the People's Republic of China ("China" hereafter) and India.

The expansion of wind power is evidenced since the late 1990s and today accounts for over 5% of global power supply. Solar PV expansion was not too far behind and now accounts for about 2.5% of global power supply. Biofuels for transport has expanded steadily to reach 3% of global transport energy requirements today, mainly due to blending mandates and production targets in Brazil, United States and European Union.

Clean energy technology progress, however, has been slow in end-use sectors. Energy efficiency has been the main means of moderating growth in CO2 emissions in end-use sectors. Some progress has been made, notably in the development of electric cars, which accounted for 2.6% of global sales in 2019. The momentum for critical technologies such as hydrogen and CCUS is also increasing. If the world is to reach net-zero emissions this century, faster progress will be needed in end-use sectors, which accounted for 55% of energy and industry-related CO2 emissions in 2019.

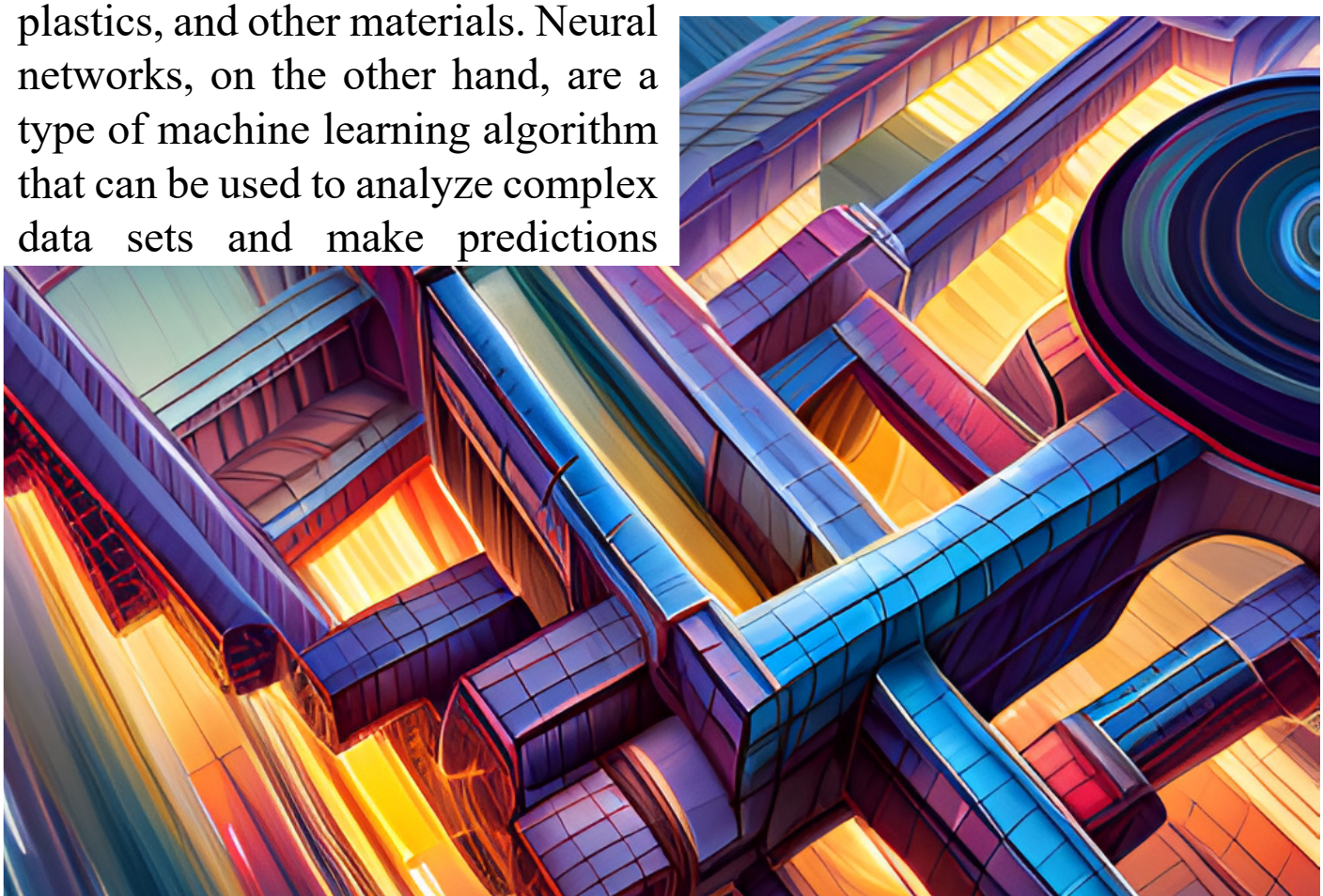



Progress in deployment of clean energy technologies has been outpaced by overall energy demand growth. In 2019, CO2 emissions from fossil fuel combustion reached more than 33 gigatonnes (Gt), a record high. Many existing energy assets are still young, particularly in Asia. Around 45% of installed fossil-fuelled power generation capacity in Southeast Asia was built within the last ten years, and 70% within the last 20 years. Much of the infrastructure for the production of steel, cement and chemicals is also relatively young, particularly in China. The global average age is 10-15 years, compared with a typical lifetime of 30 years for chemical plants and 40 years for steel and cement plants. Existing energy infrastructure could lead to nearly 750 GtCO2 of additional emissions by 2070 if unchanged.

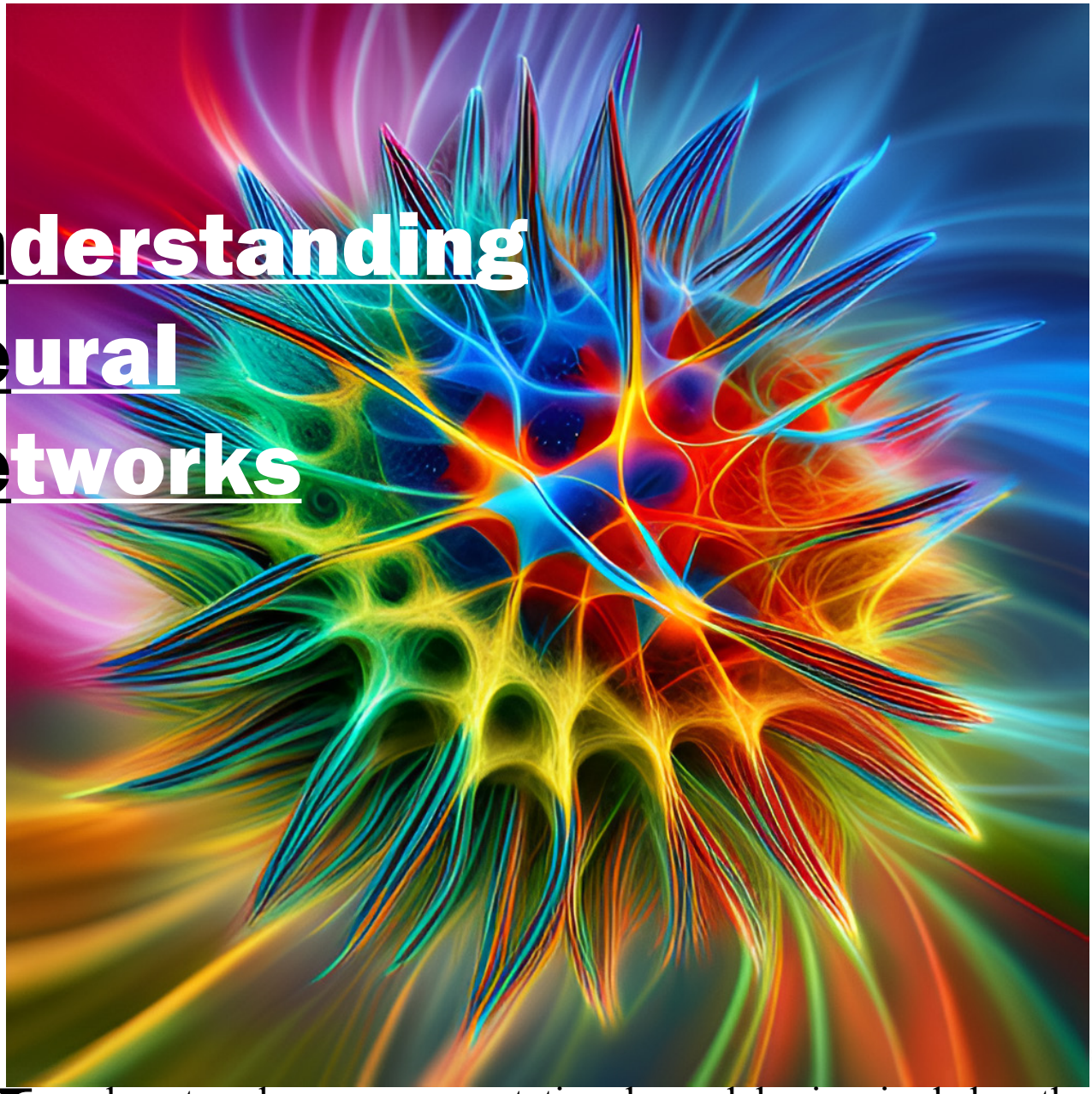
# Neural Networks and Chemical Reactions: *A Match Made in Science*

By Kiran Prasad J P

Chemical engineering and neural networks may seem like two unrelated topics, but they actually have a lot in common. Both fields involve complex systems that require careful analysis and optimization in order to achieve optimal results. Chemical engineers are responsible for designing and optimizing processes that involve chemical reactions, such as those used in the production of pharmaceuticals, plastics, and other materials. Neural networks, on the other hand, are a type of machine learning algorithm that can be used to analyze complex data sets and make predictions based on patterns in the data. By combining these two fields, we can create powerful tools for optimizing chemical processes and improving product quality. This is especially important in industries where small improvements can have a big impact, such as the pharmaceutical industry, where even a slight increase in efficiency can lead to significant cost savings and better patient outcomes.



In the rapidly evolving world of science and technology, the fusion of neural networks and chemical reactions has emerged as a formidable combination. Neural networks, a branch of artificial intelligence, and chemical reactions, a fundamental aspect of chemistry, are converging to drive groundbreaking innovations across various fields. This article explores the intricate relationship between neural networks and chemical reactions and delves into the immense potential they hold for scientific advancement.

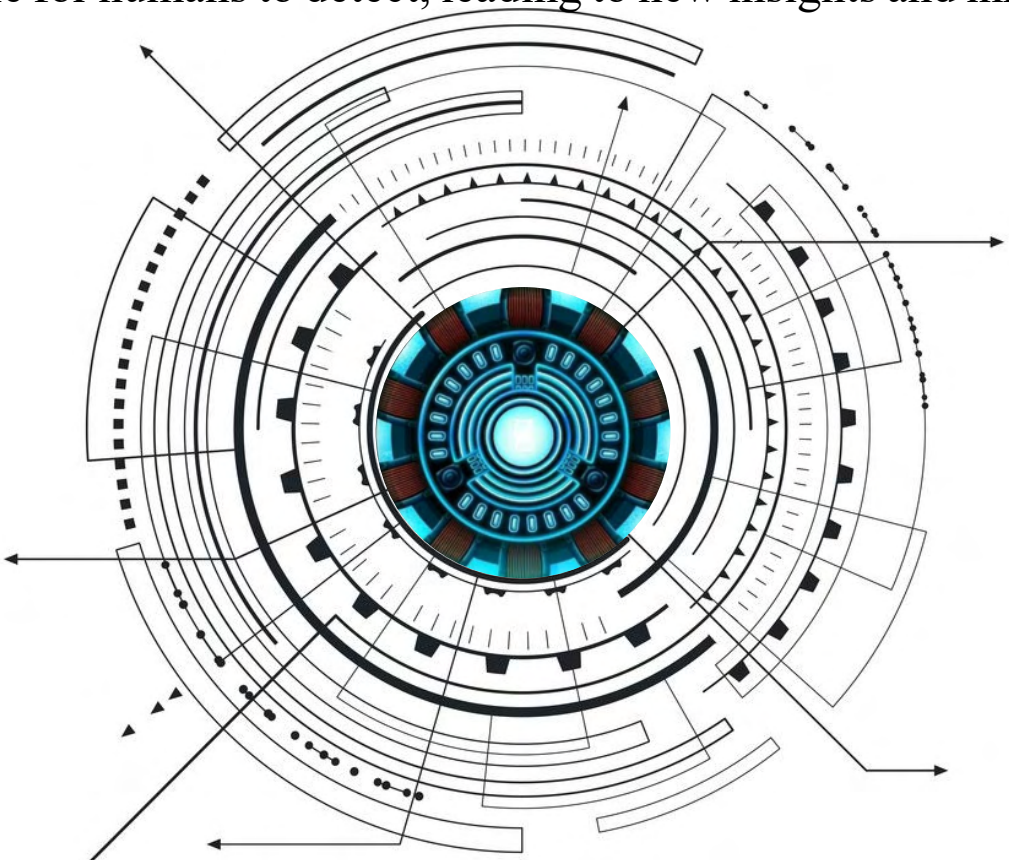


## Understanding Neural Networks

Neural networks are computational models inspired by the complex network of neurons in the human brain. These networks consist of interconnected nodes, known as artificial neurons or "perceptrons," which process and transmit information. By emulating the neural structure of the brain, neural networks can learn from vast datasets, recognize patterns, and make intelligent decisions.

# Unleashing the Potential

Chemical engineering and neural networks may seem like two completely different fields, but they actually intersect in many ways. Neural networks are used to model complex chemical systems and predict their behavior, which is crucial for designing efficient and cost-effective processes. In turn, chemical engineers use their knowledge of chemical reactions and thermodynamics to optimize neural network algorithms and improve their accuracy. One of the main benefits of using neural networks in chemical engineering is the ability to analyze large amounts of data quickly and accurately. This is especially important in industries such as pharmaceuticals and materials science, where even small improvements in efficiency can have a significant impact on the bottom line. Additionally, neural networks can be used to identify patterns and correlations that would be difficult or impossible for humans to detect, leading to new insights and innovations.



## Drug Discovery and Development

The field of drug discovery and development has greatly benefited from the integration of neural networks and chemical reactions. By harnessing the power of artificial intelligence, scientists can analyze massive chemical libraries and predict the efficacy, toxicity, and potential side effects of drug candidates. This accelerates the discovery process, reduces costs, and enhances the chances of identifying effective treatments for various diseases.

## Materials Science and Engineering

The synthesis and characterization of advanced materials are crucial for technological advancements. Neural networks can facilitate the design and optimization of new materials by predicting their properties based on chemical composition and structure. This enables researchers to expedite the development of materials with tailored properties for applications such as energy storage, electronics, and catalysis.

## Environmental Monitoring and Remediation

Addressing environmental challenges requires a multidisciplinary approach. Neural networks can be employed to analyze complex datasets obtained from environmental monitoring stations, satellite imagery, and chemical sensors. By combining these inputs with knowledge of chemical reactions, scientists can develop accurate models for pollution prediction, ecosystem monitoring, and remediation strategies.

## Process Optimization and Control

Chemical reactions often occur within complex industrial processes. Neural networks can be utilized to optimize and control these processes, leading to improved efficiency, reduced energy consumption, and enhanced product quality. Through continuous learning and adaptation, neural networks can make real-time adjustments, ensuring optimal operating conditions and minimizing waste.

# Challenges and Future Directions

While the integration of neural networks and chemical reactions shows immense promise, several challenges persist. The complexity of chemical reactions, the need for comprehensive and high-quality training datasets, and the interpretability of neural network models are among the key areas requiring further research and development.

Looking ahead, advancements in computational power, data availability, and algorithmic innovations hold the potential to address these challenges. As researchers continue to explore the synergistic relationship between neural networks and chemical reactions, we can expect revolutionary breakthroughs that will reshape the landscape of science and technology.

# Conclusion

The convergence of neural networks and chemical reactions represents a transformative force in scientific research and development. From drug discovery to materials science and environmental monitoring, their integration is revolutionizing various domains. By embracing this synergy, we open doors to new possibilities and pave the way for a future where intelligent systems work hand in hand with chemical

# Production of Ethanol from bamboo

By Shubhi Tiwari

Owing to the increasing demand for fossil fuels and chemicals and growing environmental problems, it has become necessary to develop renewable resources to produce biofuels which promote sustainable development. Cellulosic ethanol, a second- generation biofuel, is produced from bamboo which contains lignocellulose. Lignocellulose is a complex carbohydrate polymer composed mainly of cellulose, hemicellulose and lignin. The polysaccharides present in bamboo have to be hydrolysed to monomeric sugars like glucose and xylose before the fermentation process, but the presence of lignin in the biomass largely prevents the action of any acid or enzyme for hydrolysis. To overcome this problem, a pretreatment process is used, which aims to make the cellulose more accessible to the hydrolytic enzymes. This facilitates the carbohydrate polymers to form fermentable sugars which in turn are converted to ethanol.

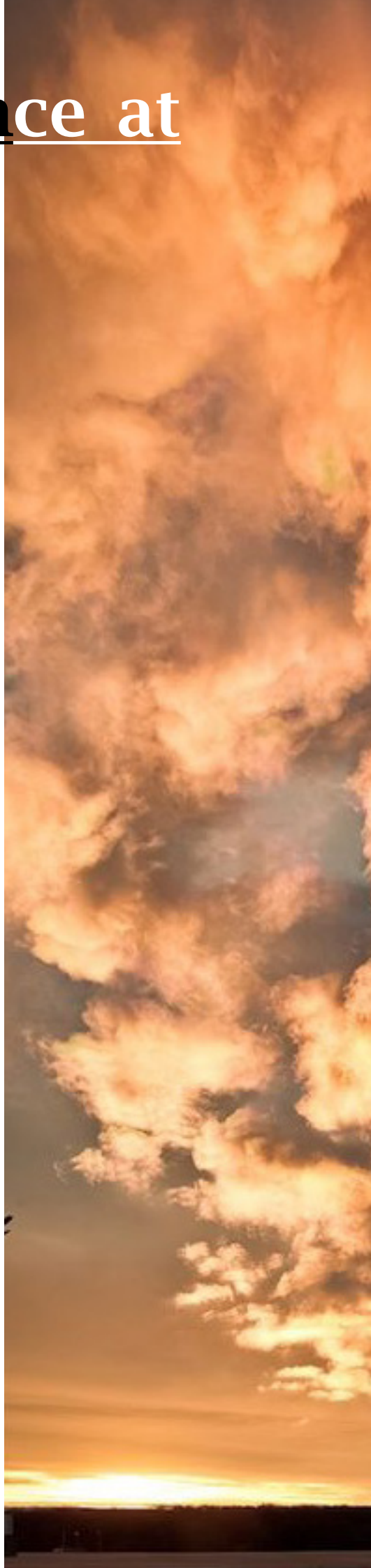
Dedicated to the current challenge of reducing pollution and greenhouse gas emissions, production of biofuels from non-food plant materials are taken into consideration for research making it an economical and environment friendly approach. Lignocellulosic biomass is a low cost biomass which is easily available worldwide and can be used as a raw material for the production of ethanol. Lignocellulosic resources include food waste, municipal and industrial waste, agricultural residues like bamboo, corncobs, wheat straw, fruit bunch and coconut husks, forest residues like hardwoods and softwoods and energy crops. The high and easy availability as well as the non-toxic nature of lignocellulosic biomass has appeared to be potential raw materials if proper pretreatment methods are used.

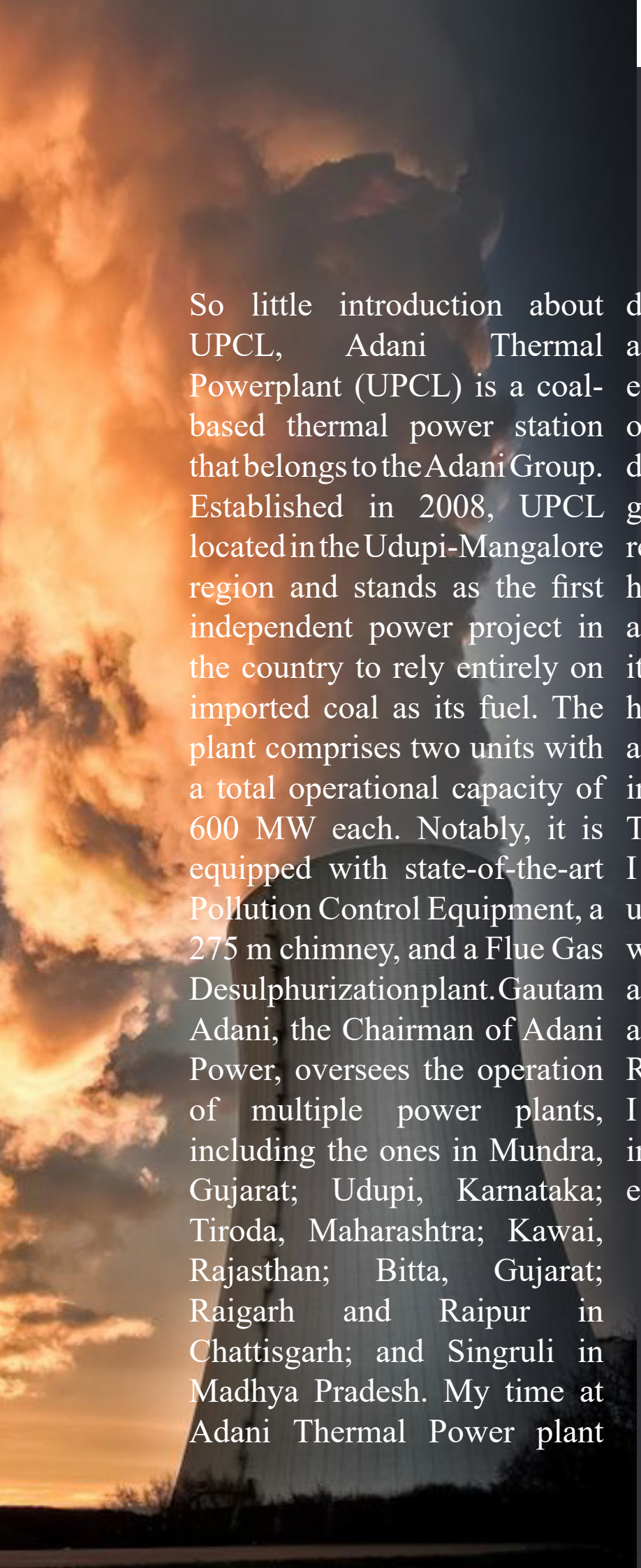
Lignocellulose is a complex carbohydrate polymer consisting of cellulose, hemicellulose and lignin. Cellulose consists of high molecular weight polymers of glucose rigidly held together. Hemicellulose binds the cellulose bundles together while the lignin is embedded in and bound to hemicellulose to provide rigidity to the biomass. The rigid and defensive inner structure of lignocellulosics makes them resistant to degradation and offer hydrolytic stability and structural robustness and inertness to microbial activity. The presence of cross links between cellulose and hemicellulose with lignin via ether and ester linkages leads to biomass recalcitrance. This is why it becomes necessary to understand the chemistry of biomass in order to carry out the breakdown of lignin and expose cellulose to enzymatic hydrolysis to obtain biomass derived fuels, chemicals and intermediates. For conversion of lignocellulose to bioethanol the following steps are to be followed. The biomass is first procured followed by the pretreatment to improve the accessibility of cellulose to the hydrolytic enzymes which are used in the next step to convert carbohydrate polymers to fermentable sugars followed by the last step which is fermentation in order to extract ethanol.

# Internship Experience at Adani Power Plant

By Natesh Y

Internships are of utmost importance in a student's learning journey as they provide an opportunity to discover their interests and preferences in a work. They serve as the initial point of contact between a student and a professional organization. During internships, students have the chance to apply the knowledge and skills they have acquired throughout their academic journey, thus undergoing a practical evaluation of their abilities. Through experiential learning, internships enable students to gain a deeper understanding of intricate real-life concepts. I had a wonderful opportunity to do my Internship at Adani thermal power plant (UPCL).A thermal power plant efficiently converts the heat energy derived from coal into electrical energy through a series of interconnected processes.Initially, coal is combusted in a boiler, resulting in the conversion of water into steam. The expansion of this steam within a turbine generates mechanical power, which subsequently drives the Excitation Generator (Alternator) that is coupled to the turbine. In terms of power generation, thermal power plants make the most significant contribution for any country, accounting for 75.43% of the total installed captive and non-captive power generation in India. These power plants utilize various energy sources such as coal, oil, and natural gas in their operations, specifically in thermal generating stations.





So little introduction about UPCL, Adani Thermal Powerplant (UPCL) is a coal-based thermal power station that belongs to the Adani Group. Established in 2008, UPCL located in the Udupi-Mangalore region and stands as the first independent power project in the country to rely entirely on imported coal as its fuel. The plant comprises two units with a total operational capacity of 600 MW each. Notably, it is equipped with state-of-the-art Pollution Control Equipment, a 275 m chimney, and a Flue Gas Desulphurization plant. Gautam Adani, the Chairman of Adani Power, oversees the operation of multiple power plants, including the ones in Mundra, Gujarat; Udupi, Karnataka; Tiroda, Maharashtra; Kawai, Rajasthan; Bitta, Gujarat; Raigarh and Raipur in Chattisgarh; and Singruli in Madhya Pradesh. My time at Adani Thermal Power plant during my internship has been an exceptionally distinct and enriching experience in terms of personal and professional development. In addition to gaining valuable knowledge related to my project, I have had the opportunity to learn a multitude of things beyond its scope. The supportive and helpful nature of my mentors and colleagues has been instrumental in my growth. Throughout my internship, I acquired a comprehensive understanding of the inner workings of the organization, as well as the technology and machinery employed. Reflecting on my experience, I can confidently say that my internship at Thermal was truly enjoyable and rewarding.

# INTERNSHIP AT JUGGAT PHARMA

By MADHURA P

I did my internship at Juggat Pharma for a period of 3 weeks i.e from 06.03.2022 to 29.04.2022. JUGGAT PHARMA is the flagship division of Jagdale, Bengaluru. Juggat Pharma was acquired by Jagdale group in 1973, and amalgamated with JIPL in 1994. Today, Juggat Pharma: the pharmaceutical division of Jagdale, has pan-India presence. It has 50+ branded formulations on active promotion.

Juggat Pharma is dedicated to ***"Excellence through quality and innovation."***

Its first-mover products include:

- Botropase – injectable haemostatic wound healer,
- BotroClot – topical haemostatic wound healer (which has a product patent), and
- Talsil Forte - hydrotalcite based antacid tablets.

Before entering the plant, there were set of instructions that had to be followed like change of dress from street style to company's dress, no heavy earrings, no cosmetics and strict prohibition of mobiles.

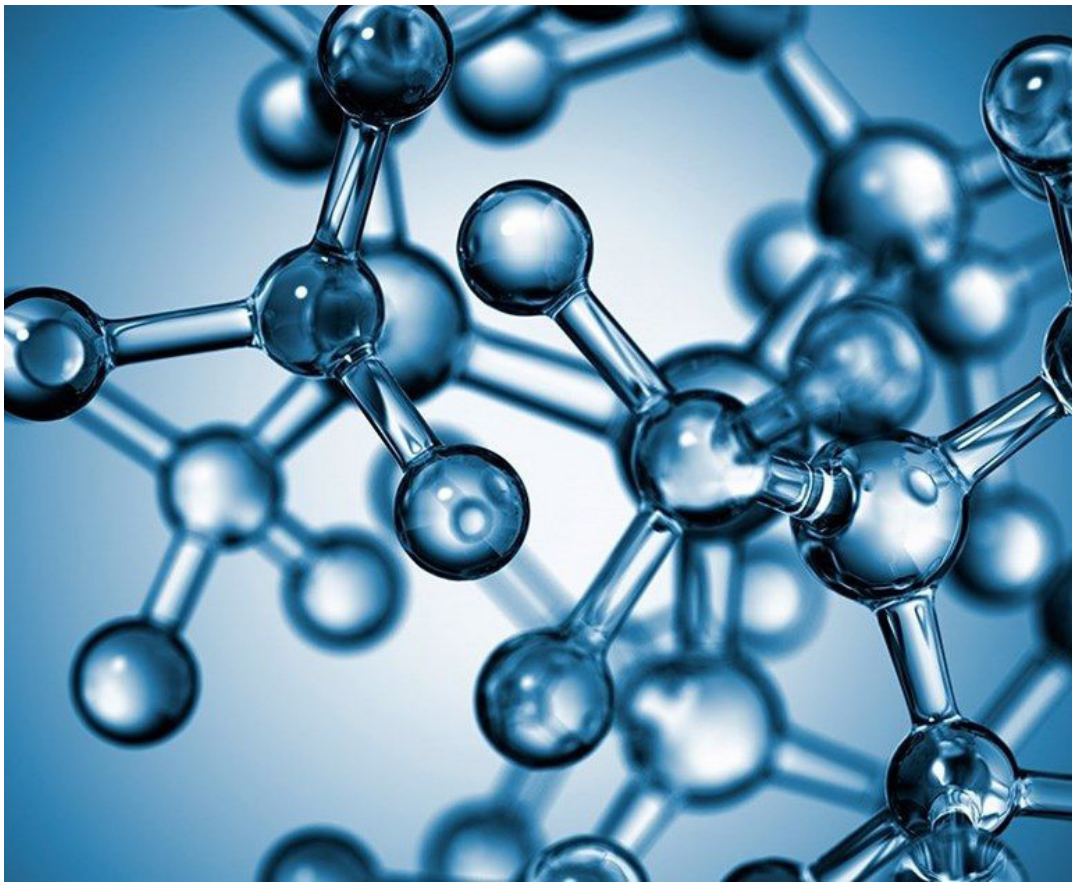
There are five main divisions of juggat pharma and I gained knowledge about each division during my internship journey. These include:

**1. STORES:**

In stores the main focus study was on dispensing activity of required raw materials to the production area inside a booth called dispensing booth, made up of SS361. Before starting the activity 15 min prior AHU (Air handling unit) system is switched on to maintain proper temperature, pressure and humidity. R-LAF (Reverse-Laminar air flow) occurs in dispensing booth through these filters i.e pre-filter, intermediate filter, and HEPA filter before starting the process. The temperature and humidity maintained is < 25°C and < 60%. Finally, the dispensed materials are stored in waiting area which are taken by respective departments the next day.

**2. TABLETS:**

This part of section was very much related to our branch because it involved heat and mass transfer operations, size reduction operations, drying, compression etc. At first the materials were subjected to both dry and wet grinding in high shear mixing granulator, followed by drying in fluid bed dryer and finally blending in octagonal blender. After this processes the granules are subjected to compression to obtain desired shape and size. Finally, the tablets are packed in blisters and sent for shipping.



**3. LIQUIDS:**

Another important department of the industry which involves liquid orals likes syrups. The production of liquid orals starts with preparation of sugar syrup in sugar syrup dissolving vessel at a temperature of 80°C. Then the raw materials along with sugar syrup is fed to pre-mixing vessel for first stage of mixing. Further to obtain uniform mixing the mixture is transferred to manufacturing vessel where color and flavor addition is done. The final product is filtered using bag filter and is sent to storage vessels through pipelines. After the analysis of final product stored in storage vessels is done by QC and approved the product is sent to filling, later to sealing, inspection, labelling and finally to packing.

**4. PARANTERALS:**

The highly sterile department of industry producing intravenous injection, tropical solution, eardrops and eye drops. One of the highly demanded product called “Botropase” injection is manufactured here. The department is divided into two sections, core and non-core. Core region is where manufacturing of product takes place and is further parted has bottle side and ampoule side. Non-core region includes work station, inspection and packing area. Since intravenous product production is involved high care and sterility should be maintained. Hence raw materials obtained from stores are received to core area through pass box only. This pass box is installed with UV light which sterilizes the material. Not only raw materials but the equipment’s used, scoops, pipes, flasks, gowns, filters etc are also sterilized in autoclave for 25-30 min at 121°C. These sterilized equipment’s are unloaded on unloading side which falls inside the core sterile area.

**5. QUALITY CONTROL (QC):**

This department of industry is responsible to ensure that all materials meet the established criteria throughout all phases of the process. This is further divided into four different labs such as wet lab, instrumentation lab, microbiology lab and packing material testing lab. Here different labs have its own contribution of work. For any test to be conducted by QC first RDS (Raw data sheet) must be issued by QA.

Working in Juggat Pharma has intern was a great lifetime experience. Got to live with the professional industrial culture. The training period enhanced my knowledge on several important parts like; how a pharma industry works, SOP followed for each and every worked carried out, the change-over of dress, the importance of proper unloading, sampling and testing methods for each and every material received from supplier, importance of sterilization and cleaning (done periodically) especially in production of intravenous products, how water is an important and a key material in pharma, different types of water and how water should be treated to use it as a pharma product, and much more.

As a chemical engineer there was a lot to relate from a pharma industry. Our department of study mainly deals with working and designing of equipment's like dryer, granulator, sifter, compressor, filling and washing equipment's and much more. Our study also focuses on the heat and mass transfer operations taking place inside each equipment's. Quality control is also another area to learn a lot as a chemical engineer, where different instruments like gas chromatography, HPLC, UV Spectroscopy, colorimeter etc was main area of my interest.

# INTERNSHIP AT BHAGERIA INDUSTRIES LTD

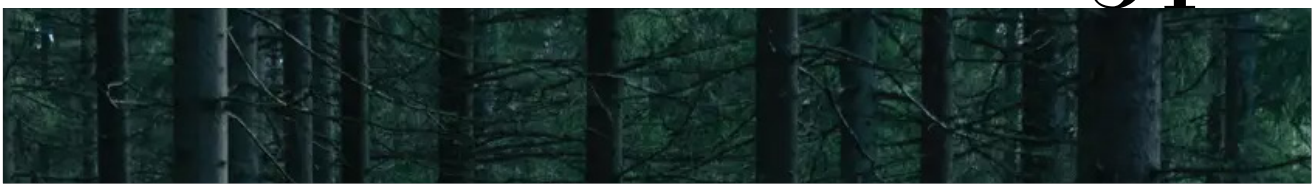
By Ashutosh Mishra

My Internship as a 3rd yr chemical engineer Bhageria Industries LTD has been most rewarding and motivational experience,which helped me to apply my knowledge in practical on large scale . I connected with many department hod in industries such as RND, production units ,administrative department . My mentor DR. Pr malav , helped me a lot throughout my internship.

I was working in industries for two weeks ,first two days was induction programme in which they introduce about industries ,HR of industrie took me to different part of industries . we had 1-2 hr session of safety and management in which they give detailed about how industries handel hazardous gas, and saftey precaution use of medick kit in case of accident there will be siren and all people industies should assemble near assembly point there were three assembly point based on wind direction. and they spoke about A Material Safety Data Sheet (MSDS) is a document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product.it is starting point of saftey and consideration.

In this industie there were three plant H- acid plant ,gamma acid plant and dye plant ,this industrie is leading producer in H-acid . H-acid formula is 1-naptha -8 amino -3,6-Disulphonic acid , basically in this plant they take napthalane as raw material and then melting and subsequently heating and cooling. Then reduction and nitration after neutralizing and at last fussion will get slurry H-acid which is then carried to mechanical operation to convert to powder. Our work as an intern in industries is to understand thee process and make report of it and submit to mentor .

I would thanks my HOD mam to give the permission for doing internship and also my mentor Dr. PR Malav for helping me throughout my internship course.



# ARTICLES

# BY

# PROFESSORS

# Biomass: Towards sustainable development in energy sector

Fossil fuels such as oil, coal, and natural gas are the key energy sources. Several statistical predictions from different energy policymakers expect that these sources will exhaust within the next 30-40 years. An increase in environmental damages such as acid rain, urban smog, and greenhouse gas emissions due to the use of fossil fuels has shifted the world's focus on reducing the same. The energy policies are majorly focusing on the use of renewable energy resources such as solar, wind, biomass, etc. Biomass is one of the renewable energy sources readily available in rural areas. Biomass is the next accessible source for energy generation after coal mainly because it ranks as the fourth source of energy in the world. India has a potential to utilize these agricultural & agro residues as biomass feedstocks for energy generation. Blending biomass with coal can be one of the technology changes adopted for energy generation. Biomass blends with coal result in a low carbon fuel mix. Agricultural residue utilization will lead to a balance between carbon dioxide uptake and release and bring about the neutrality of the carbon cycle.

**Dr. Shivakumar R**
Assistant Professor,
Dept. of Chemical Engineering


“Sustainability is no longer about doing less harm. It’s about doing more good.

# Artificial intelligence (AI) & Machine learning in Chemical Engineering

Artificial intelligence (AI) applications in Chemical Engineering (ChE) have increased rapidly in recent 3 to 5 years. The AI applications in chemical engineering are not new there are more than 3000 related research papers. Artificial Intelligence is the study of how to make computers do things at which, at the moment, humans are better. AI in Chemical Engineering can be classified into four phases: Phase 1 : ChE-AI in 1983 to 1995. Various knowledge pool on the separation of domain knowledge from inference, flexible execution order of program, IF-THEN rules for procedural knowledge, semantic networks for taxonomies were established. Phase 2: ChE-AI in 1995 to 2005. More on neural networks, most applications in ChE were in process control and fault diagnosis with some industrial applications. Phase 3: ChE-AI in 2005 to 2015.

Machine Learning II - Data Science will help in many process control and automation of ChE plants Phase 4: ChE-AI in 2015 to present: Novel technologies of self-organizing intelligent systems, modeling, predicating and controlling the behaviour a large population of self-organizing intelligent agents, self-assembling nanostructures, Design, control, and optimization through self-organization. Machine learning and AI has significant advantages over traditional modeling techniques, including flexibility, accuracy, and execution speed.



These strengths also come with weaknesses, such as the lack of interpretability of these models. The greatest threat in artificial intelligence research today is inappropriate use because most chemical engineers have and had limited training in computer science and data analysis. The machine learning and AI impact the decision making of a process industry. Hence it's high time for chemical engineers to gear up for the future challenges and opportunities.

**Dr. Chetan A Nayak**
Assistant Professor,
Department of Chemical Engineering

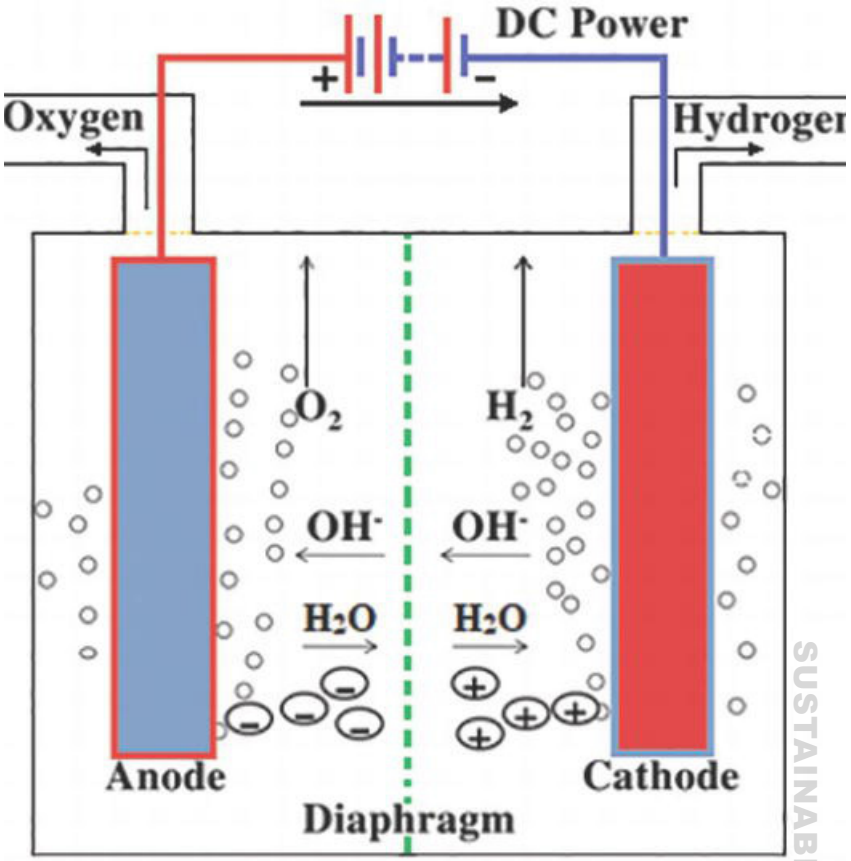
# Electrocatalysis – Sustainable energy technologies

**Dr. Hari Prasad Uppara**
Assistant Professor
Department of chemical engineering

Now-a-days, the demand for fuel cells and metal-air batteries have tremendously increasing for meeting the future energy requirements. It drives the research community to develop the sustainable energy technologies for the storage of energy and the conversion. However, for development of these energy technologies the problems of overpotentials, thermodynamic and kinetic sluggishness of the cell reactions need to be addressed. Herein, the energy conversion and storage devices mainly rely on Oxygen Evolution Reactions (OER) and Oxygen Reduction Reactions (ORR), to assess the performance of these devices. Electrocatalysis is one of the emerging fields for the development of sustainable energy technologies. Thus, fabricating the highly effective electrocatalysts are necessitated to materialize for increasing the reactions rates of OER/ORR reactions.

Developing and designing the highly performing electrocatalysts are the crucial step, and it is importunity to explore the better alternative performing electrocatalysts which can demonstrate higher activity towards OER/ORR reactions. Perovskites are one the promising electrocatalytic materials which can exhibit the excellent catalytic features in terms of ionic conductivity, electrochemical properties, oxygen vacancy concentration, oxygen storage capacity, redox potential sites, and thermochemical stability. According to reported studies, the perovskites proved to show higher OER activity in alkaline medium at room temperature.

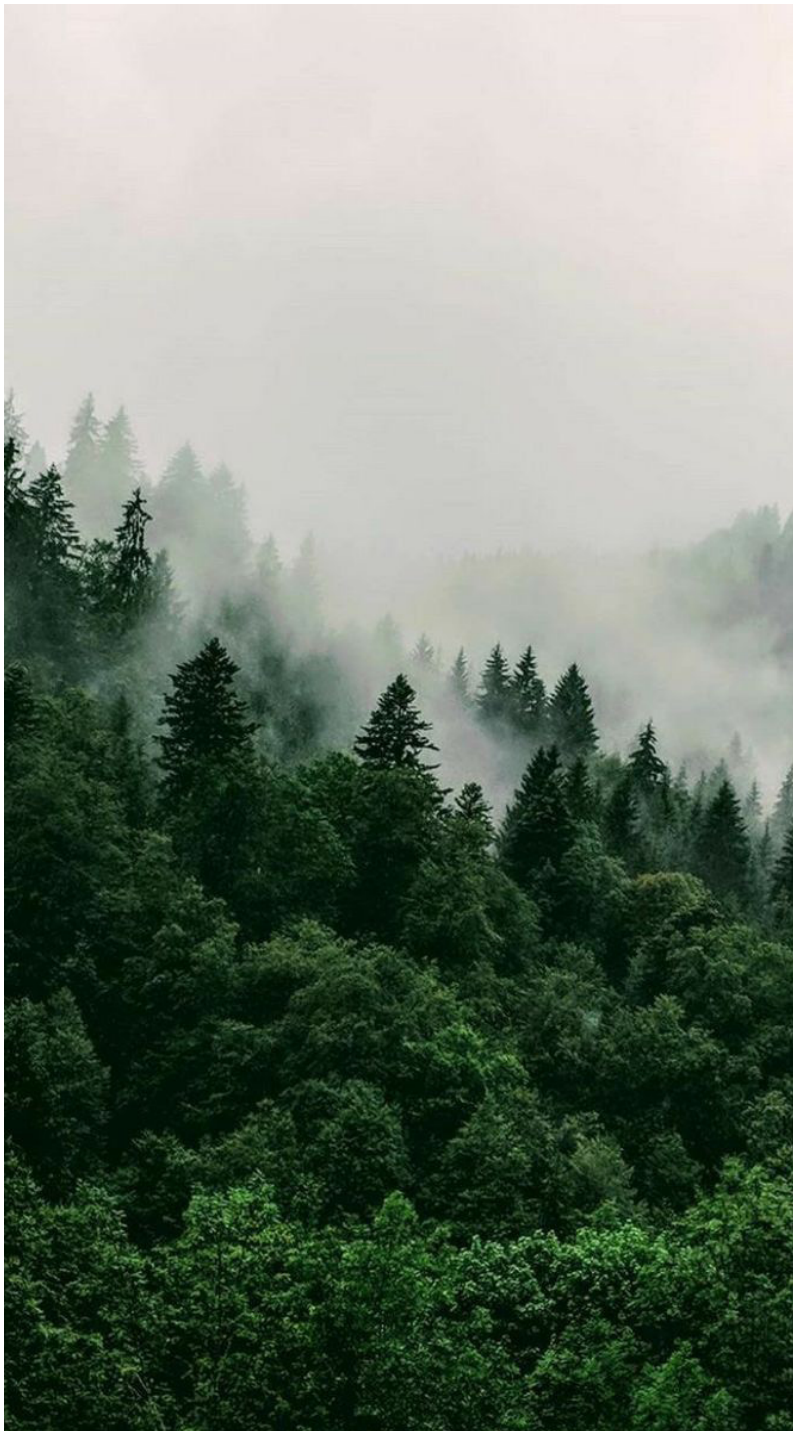
In addition, the perovskite with an eg occupancy close to unity would exhibit the higher OER activity, particularly, Ba0.5Sr0.5Co0.8Fe0.2O3-δ was the excellent electrocatalyst for OER reactions (Suntivich et. al. (2011), Science). Moreover, OER activity was predicted with volcano plot, in which the perovskites LaNiO3, LaCoO3 and La0.5Ca0.5MnO3 shown good OER activity. Thus, it strategically demands to design the perovskite nano materials by co-doping the transition metals such that eg was adjusted close to one, because eg was the key descriptor for OER/ORR reactions. Besides, it needs to address the two more major issues such as (i) ORR electrocatalyst may undergo the oxidation reaction during OER activity and lose its overall efficiency (ii) Similarly, OER catalyst may also experience reduction reaction during ORR and could lose its OER activity. Therefore, the scientific community should be motivated for carefully tuning and investigating the perovskite materials such that it should exhibit higher activity for both OER and ORR reactions.



# Sustainable Development: A role of Chemical Engineers

The chemical engineering profession, perhaps more than any other technical discipline, engage the use of available natural sources and more energy resources for the production of value-added essential lifesaving products and other services of commerce in society at large, it is captious important that pharmacist/chemist, food processing and chemical engineers incorporate the ideas of sustainability in all facet during the such products development and production.

Energy, water, food, and the environment are all interrelated. Chemical Engineers use their knowledge of physics, math, chemistry, materials & energy balances, thermodynamics, kinetics, and transport phenomena to sustainably provide the critical resources we need while protecting the environment from irreparable damage, during this process a chemical engineers facilitates transforming raw materials into useful products, generating energy, measuring contaminant concentrations, capturing emissions, and generally developing benign processes to protect the planet.



Chemists create reactions. Chemical Engineers study whether those reactions can be performed efficiently enough to be worth implementing. Chemical Engineers design processes to make a reaction cost-effective enough to be competitive with existing technology. Chemical Engineers understand what happens to those reactants and products after they are used, and whether they can be easily disposed of later. Chemical Engineers design tools that allow those reactions to be performed at scale. No other specialization combines this molecular micro level -level understanding with the macro systems-level perspective.

Innovations invented by chemical engineers encompasses across energy sectors, the environment, and sustainability in all chosen fields. From be it providing potable and portable water filtration and its treatment innovations, reduce, recycle, reuse and conversion of society wastes into wealth, to increasing conversion efficiency of all processes, chemical engineering produces state of art cutting-edge solutions to today's most pressing societal problems with sustainable development.

As per the World Commission on Environment and Development (WCED), sustainability will be attained when the remaining natural resources of the Earth are being utilized in a manner that augments the development needs of the present generation without compromising the ability of future generations to meet their own needs. Undoubtedly, this socioeconomic concept as stated is not enough to make available ideas for scientific or engineering actions. It is generally apprehended that sustainable development is a very much essential to balance among three after effects of economic development, impacts on environmental and social benefits evolving from the overall development.

Many have described sustainability as the desired state, and sustainable development is the continuous process to achieve the development and environment go hand in hand without compromising the future demand. In the recent past, sustainable development has been widely adopted as a policy choice for the nations, as evidenced by their willingness to gather at conferences in Rio in 1992, and Johannesburg in 2002, and by various programs launched by nations, states, cities, communities, and industry. Industrial programs on sustainable development thus far have emphasized eliminating or substantially reducing adverse environmental impacts. Thus, in addition to the standard industrial practice of optimizing for productivity and cost for a process or product, sustainable development came to also mean minimizing environmental impacts (wastes of resource, generation of toxicity as residues, etc.).

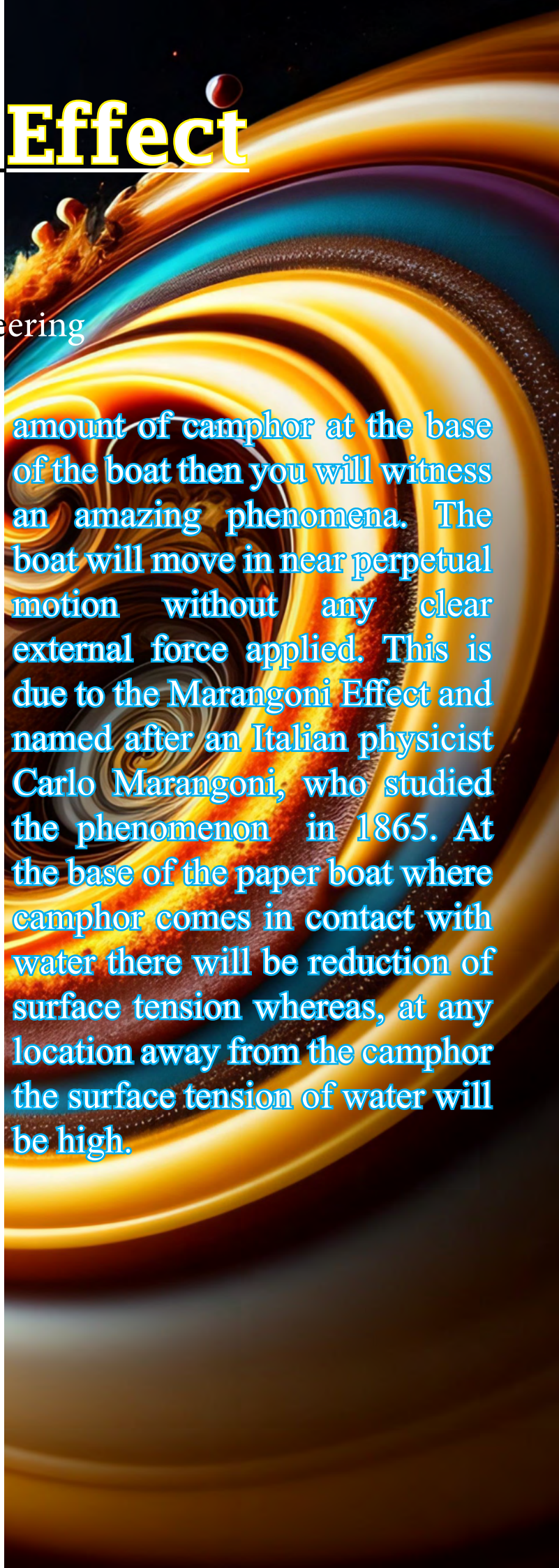
The third aspect of sustainability, social concern, has been difficult to include, and is just now getting some serious attention. Historically, industry, especially the manufacturing industry, has been driven to the goal of sustainability by corrective actions triggered by public outcry about human health impacts that have already occurred. This is in contrast to the present day focus on proactive action to prevent potential impacts not just on human health, but also on ecological health.

**Dr. C.T. Puttaswamy**
Professor
Department of Chemical Engineering.

# Marangoni Effect

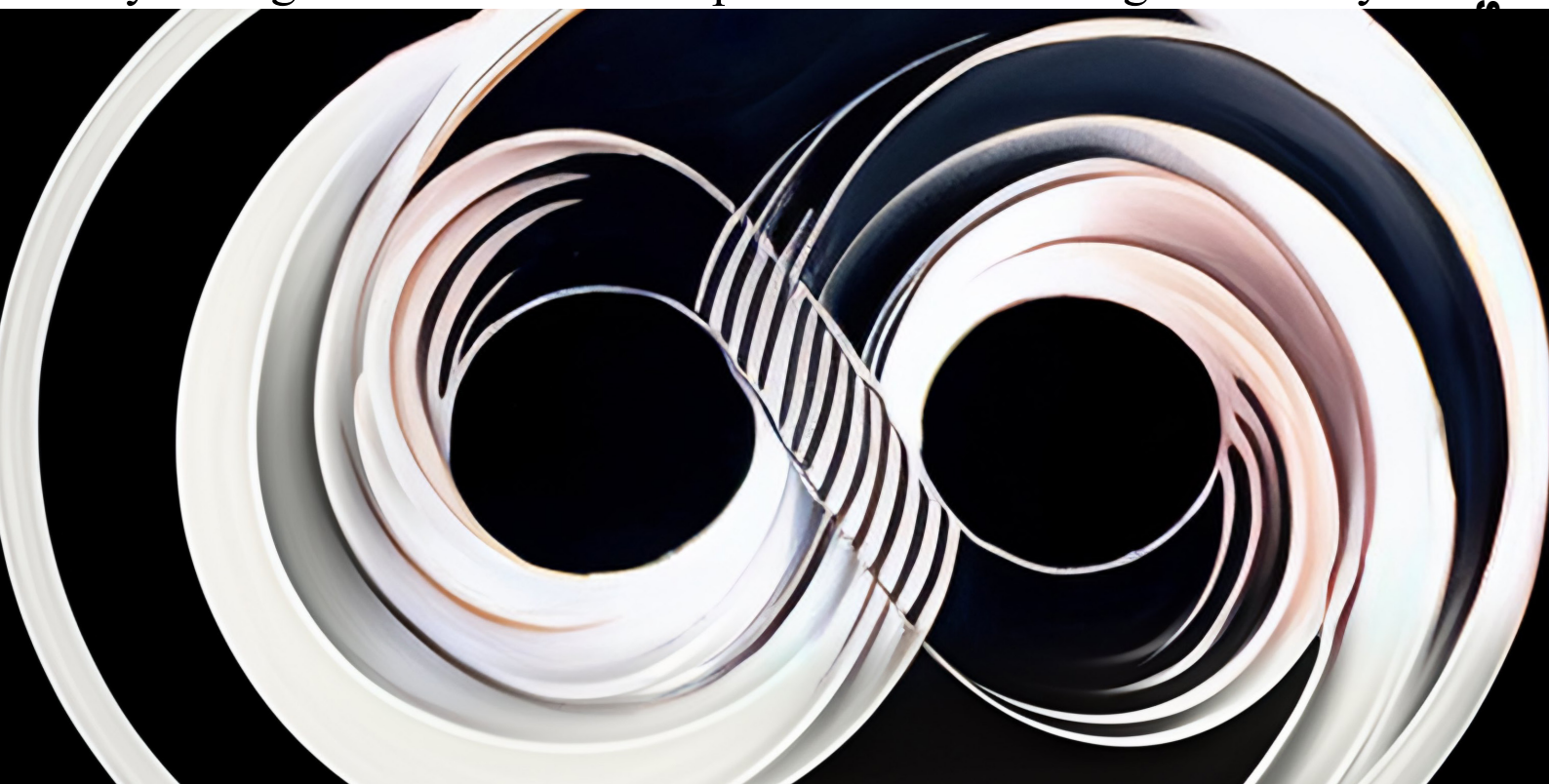
**Dr. Samita Maitra**
Professor,
Department of Chemical Engineering

In Chemical Engineering we often come across transport processes. These are heat, mass and momentum. In the usual sense of transport processes any flux is proportional to the gradient. But, if you have seen a self-propelling light weight boat attached with camphor at the bottom it will be a rather intriguing experience. Camphor is a terpenoid found in the wood of the camphor laurel which is a large evergreen tree, with the chemical formula $C_{10}H_{16}O$ and it known as karpura in vernacular. A lightweight boat can stay motionless in the quiet stagnant water collected in a petri dish. But, if you attach a small amount of camphor at the base of the boat then you will witness an amazing phenomena. The boat will move in near perpetual motion without any clear external force applied. This is due to the Marangoni Effect and named after an Italian physicist Carlo Marangoni, who studied the phenomenon in 1865. At the base of the paper boat where camphor comes in contact with water there will be reduction of surface tension whereas, at any location away from the camphor the surface tension of water will be high.



Hence, there will be movement of water from zones of higher surface tension to lower even though the mass transfer of camphor molecules will be in the opposite direction. This is a very interesting phenomena of reverse gradient of momentum transfer and mass transfer arising due the surface tension variation.

If you happen to travel through the narrow streets of Varanasi you might witness such camphor boats still being sold as toys.



# Reducing the Carbon Footprint: The Role of 3D Printing in Sustainable Manufacturing

**Mrs. Shabnam Siddiqui**
Assistant Professor
Department of Chemical Engineering

**"The manufacturing sector plays a significant role in contributing to carbon emissions. Discover effective measures that can be adopted by industries to minimize their carbon footprints. Embracing sustainability not only benefits the environment but also proves advantageous to your bottom line.**

Climate change is a pressing global issue with far-reaching consequences. What was previously unimaginable is now scientifically undeniable: human activity has the power to profoundly affect the immense expanse of our planet, Earth.

The manufacturing industry significantly contributes to climate change through its environmental footprint. This impact extends beyond production energy to include transportation energy used throughout supply chains. As a result, more organizations and consumers are recognizing the importance of embracing sustainable and eco-friendly business practices.

The documented consequences of climate change, resulting from widespread carbon emissions, are significant. Gradual yet consistent temperature rises, heightened occurrence of extreme weather patterns, such as severe droughts and intense storms, and the accelerated melting of ice caps leading to rising sea levels are among these consequences.

The ecological impacts are equally concerning, as fragile ecosystems and habitats face destruction, posing a long-term threat to countless species and overall biodiversity of our planet.

These consequences extend beyond the environmental realm and have significant anthropological implications. The adverse effects of extreme weather and droughts can adversely impact crop yields, posing a threat to global food supplies. Intense storms have the potential to cause devastating property damage and loss of human life. Moreover, rising sea levels reduce habitable land, with experts predicting a significant rise in coastal flooding by the 2030s. This situation could potentially displace coastal communities and lead to overcrowding in other areas.

# Why does environmental impact matter for manufacturers?

The environmental impact of manufacturing is substantial. Factories consume a significant amount of energy, and activities such as engineering, production of goods, and transportation of parts across supply chains collectively contribute a substantial share of emissions that contribute to climate change.

# But what's in it for the business?

Adopting sustainable manufacturing processes brings several tangible benefits to businesses. By reducing waste and energy consumption, operational efficiency is improved, and compliance with regulations becomes easier.

Sustainable practices are increasingly becoming the industry norm. In 2016, Harvard Business Review highlighted that research demonstrates consumers' willingness to pay higher prices for sustainably produced products and their increased brand loyalty. Deloitte research indicates that investors, supply chain partners, and employees also show a preference for environmentally conscious organizations. In fact, in a survey conducted in 2021, over half of the 750 executives reported that their environmental sustainability initiatives had a measurable positive impact on their corporate financial performance.

# The environmental impact of manufacturing and 3D printing: how does additive make a difference?

In short, yes. Manufacturers can significantly reduce their environmental impact by incorporating additive manufacturing for producing components whenever possible. Traditional supply chains contribute to substantial carbon footprints due to energy-intensive logistics operations reliant on fossil fuels.

**Less Energy and Material Waste:** Additive manufacturing offers notable advantages in terms of energy and material efficiency. The process itself has a significantly lower carbon footprint compared to subtractive manufacturing methods. With additive manufacturing, there is considerably less waste generated as the shapes of manufactured parts are built up rather than cut away. The utilization of hollow infill structures further reduces material consumption while maintaining performance. Additionally, manufacturers have the flexibility to produce only the required amount, minimizing excess production and waste.

**No Carbon-heavy Supply Chains:** When considering fabrication alone, subtractive manufacturing exhibits a considerably higher carbon footprint compared to additive manufacturing. However, the environmental impact of traditional manufacturing extends beyond fabrication due to the carbon-intensive supply chain activities involved in delivering the final product. The transportation and logistics required downstream contribute a significant carbon footprint that surpasses the emissions generated during fabrication. 3D printing, with its versatile point-of-need fabrication, eliminates the need for multiple carbon-intensive steps, thereby reducing environmental impact while simultaneously enhancing operational efficiency.

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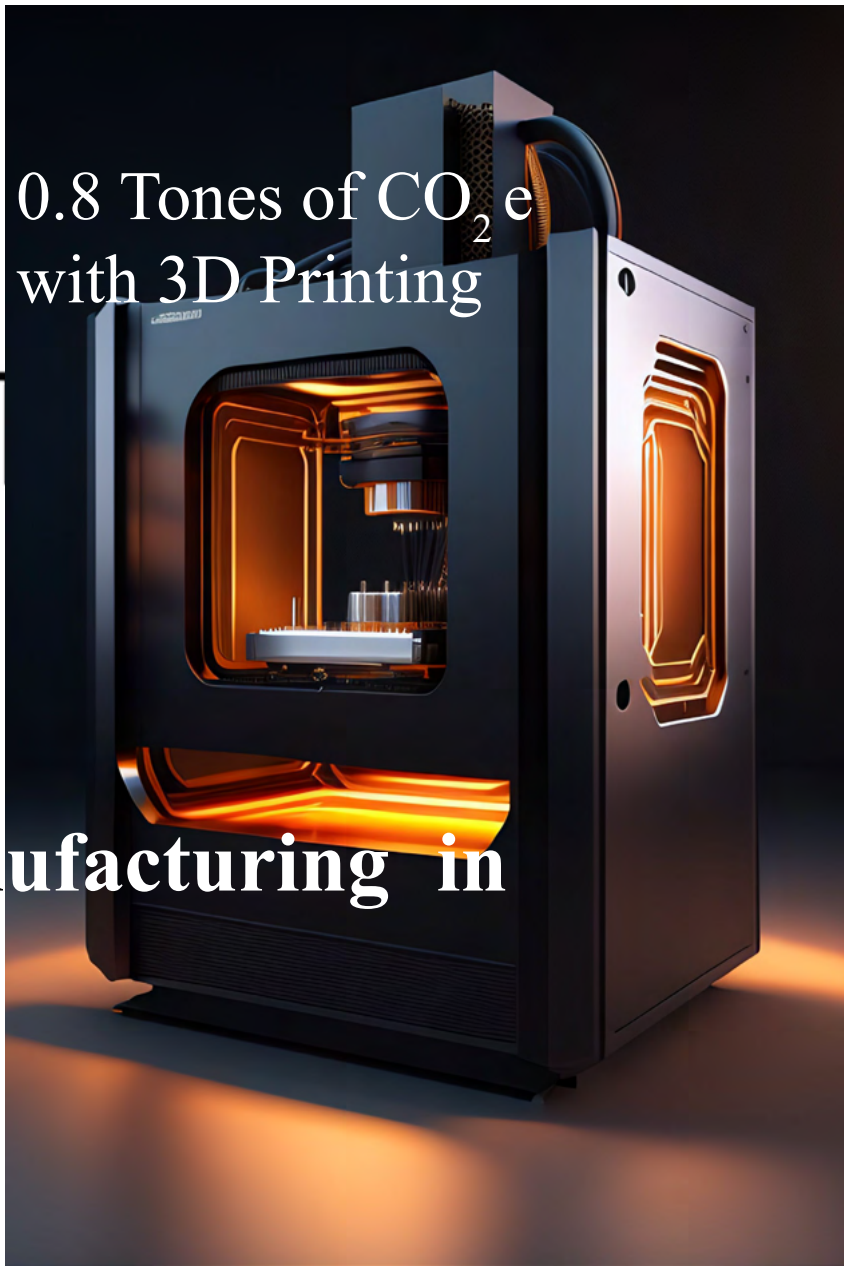
With conventional supply chain




# Sustainable Manufacturing in Practice

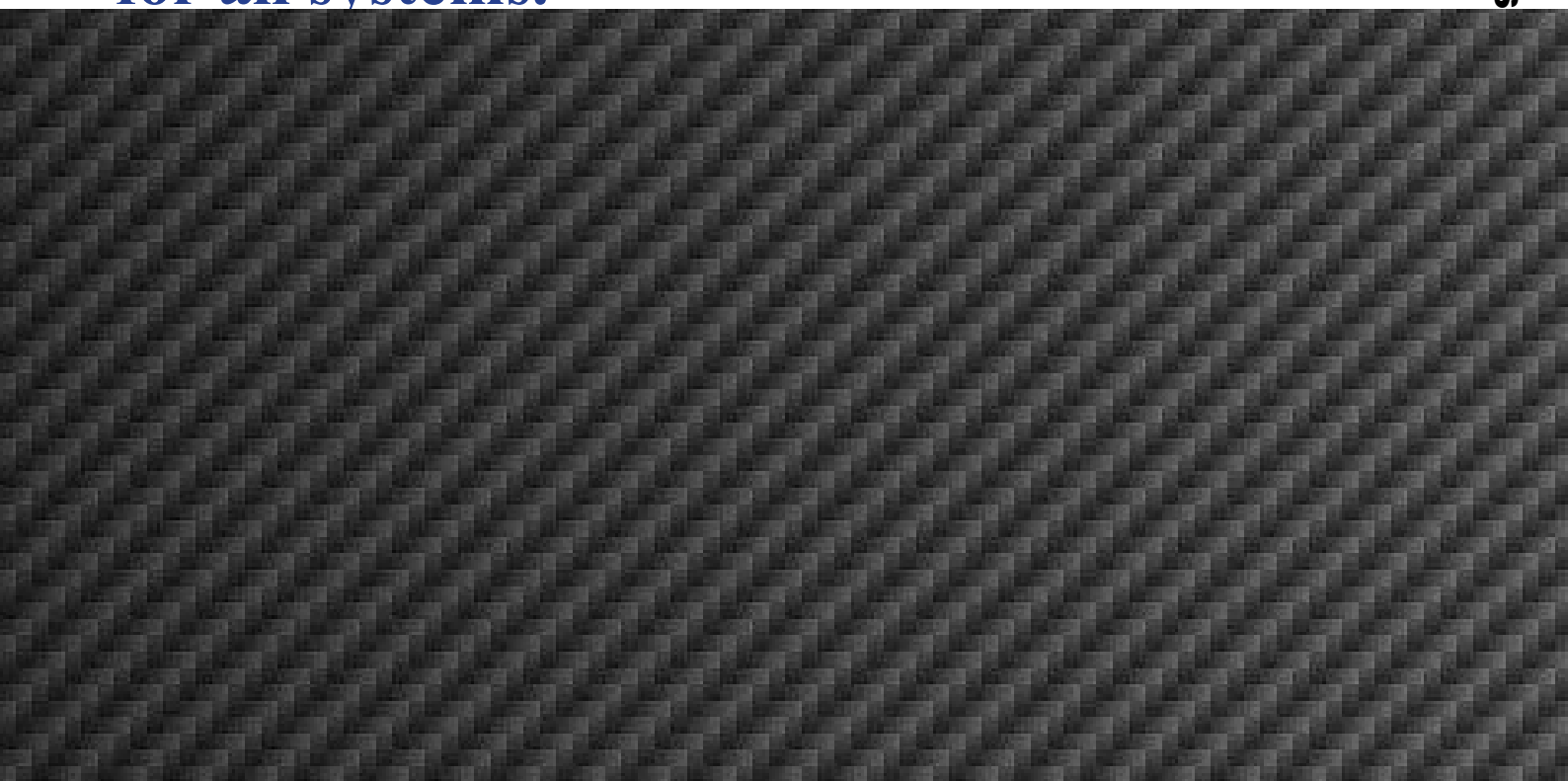
Vestas, a Danish-based global leader in wind energy, excels in the design, manufacturing, installation, and servicing of wind turbines. With a presence in over 86 countries, Vestas holds the distinction of being the largest wind turbine manufacturer worldwide.

In a comprehensive assessment of sustainability criteria such as carbon productivity, clean revenue, and clean investment, Vestas claimed the top spot among the 100 most sustainable corporations.

To achieve its goal of net-zero decarbonization by 2030 and produce zero-waste wind turbines by 2040, Vestas has embraced additive manufacturing for sustainability. Through its direct digital manufacturing (DDM) program, the company has stored more than 2000 digital part files in the cloud.

This enables Vestas specialists to 3D print critical maintenance tools, turbine part prototypes, and turbine components precisely where they are needed, irrespective of their location across the globe.
Vestas leverages the Digital Forge to achieve a significant reduction in its carbon footprint by minimizing shipping and freight requirements throughout its supply chains. This strategic approach addresses the fact that logistics, encompassing all manufacturing activities, account for the majority of carbon emissions. By leveraging digital technologies and reducing transportation needs, Vestas takes a substantial step towards enhancing its environmental sustainability.

**“The continuous growth and development of 3D printing technology indicate that it has the potential to surpass traditional manufacturing methods in terms of environmental sustainability. These advancements in manufacturing processes will contribute to a better ecological balance for all systems.**



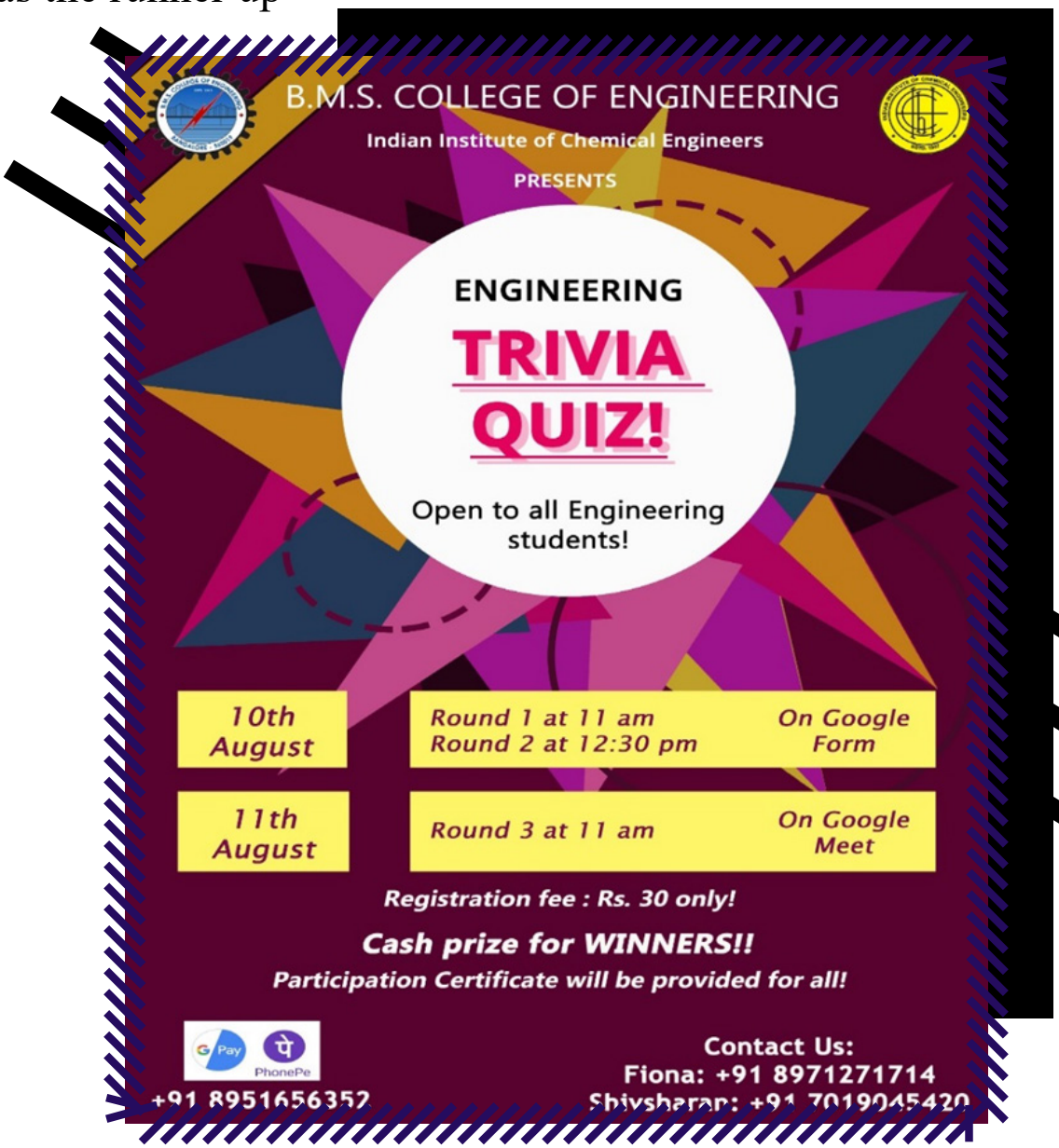

# IIChE *Events* & Achievements

# Engineering Trivia Quiz

Engineering Trivia Quiz was a general quiz event conducted online during the lockdown days on 10th and 11th august 2020. Around 20 people participated in this event.

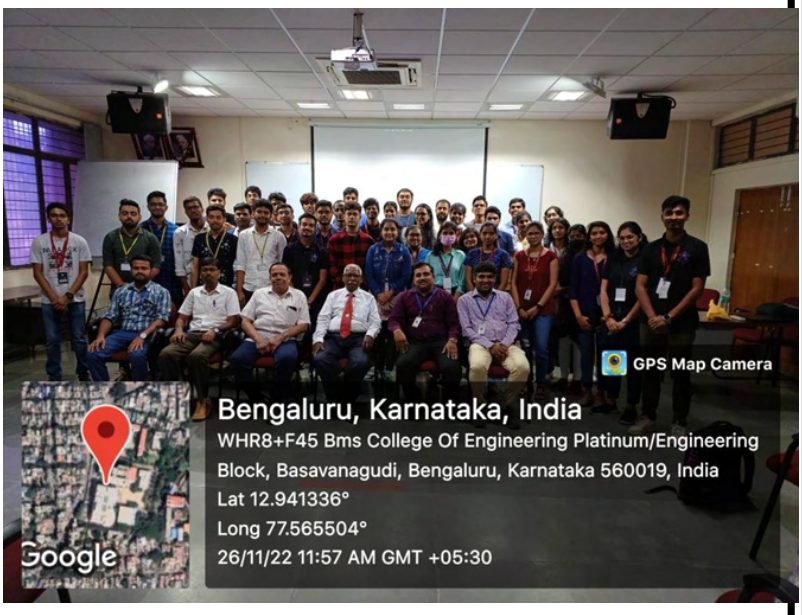
Day 1 was a Google Form Quiz round where the participants had to answer the questions from google forms provided to them. There were 2 rounds on this day. The highest scorers were passed to the next round and then the second round highest scorers were passed on to day 2.
Day 2 was a Google Meet round where the passed participants from the previous day were made to answer live questions on Google Meet.

Aishwarya Kulkarni was the winner of this quiz. Shruthi Munukutla was the runner up



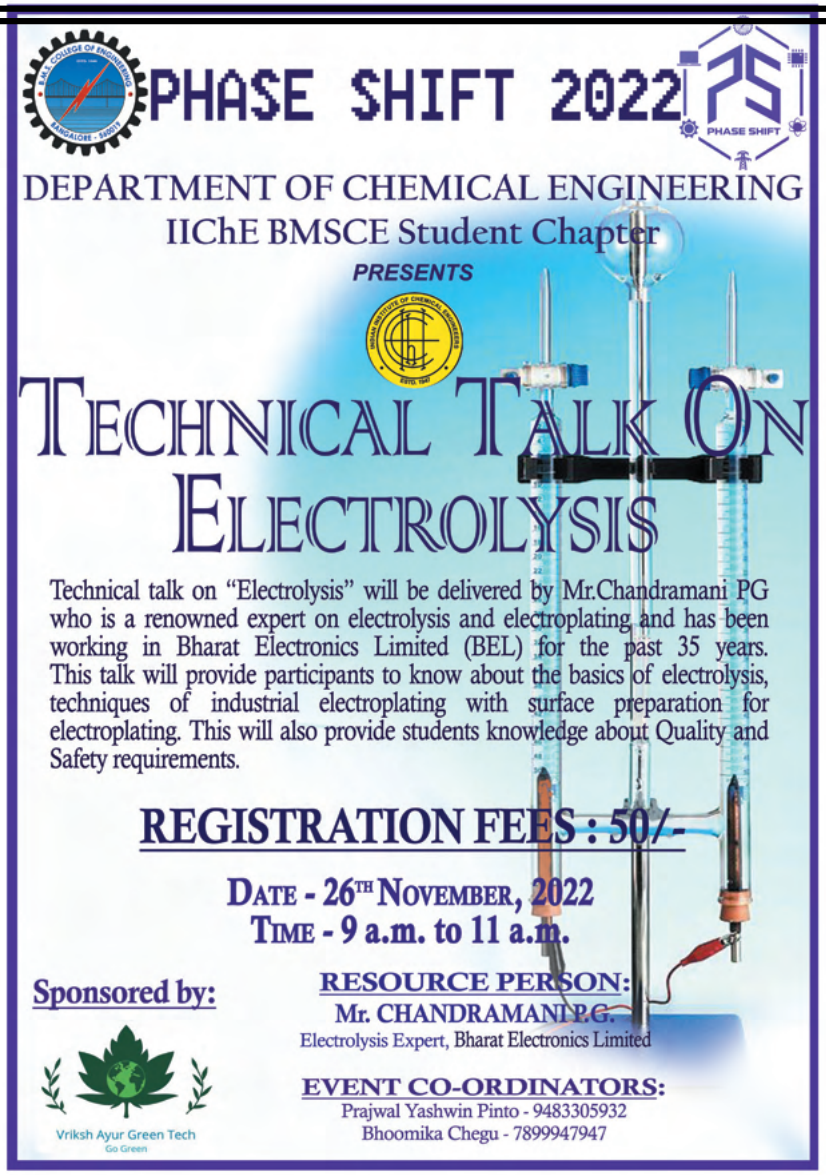
# Technical Talk On Electrolysis

At Phase Shift 2022, Technical Talk on Electrolysis was organised by IIChE BMSCE Student Chapter of Chemical Engineering department of BMSCE. The resource person to deliver the talk was Mr. Chandramani P G, Electrolysis and Electroplating expert, who has more than 35 years' experience at Bharat Electronics Limited, Bengaluru. The talk took place at FDC Hall, PG Block, BMSCE. The event was sponsored by Vriksh Ayur Green Tech. The talk was followed with the live demonstration of electroplating at the project lab of Chemical Engineering department, BMSCE.




The students understood the concepts of electrolysis, techniques of industrial electroplating, surface preparation with quality and safety requirements. The live demonstration was very helpful for the students to gain practical knowledge on Electroplating.

Dr. Chethan Nayak and Dr. Shivakumar were the faculty coordinators of the event. Prajwal Pinto from 4th year, Chemical Engineering hosted the event. Bhoomika Chegu from 3rd year Chemical Engineering gave brief introduction of resource person. Swathi Wadavi from 3rd year proposed vote of thanks.



# Walkathon and Plantation Drive

IIChE BMSCE Student Chapter and AIChE BMSCE Student Chapter in collaboration with NSS Unit of BMSCE and Adamya Chethana had organised a Walkathon on 12th of November 2022. The students of BMSCE had taken part actively in this walkathon. The Walkathon started from Adamya Chethana, South End Circle and went on through DVG Road and then to Surana College. Light dinner was provided to all the participants.



IIChE BMSCE Student Chapter and AIChE BMSCE Student Chapter in collaboration with NSS Unit of BMSCE and Adamya Chethana had organised a Plantation Drive on 13th of November 2022. The students of BMSCE had taken part actively in this '359th Green Sunday'. The event took place at Anantavana, Govt Boy's School, BP Wadia Road, Basavanagudi, Bengaluru. The program started at 8:00 am. Breakfast was first provided to students. Then the students were made to understand the importance of planting trees. Maintenance and cleaning then took place around the Govt Boy's School, Basavanagudi. It was then followed by Plantation.

# Hands on Training on Introduction to MATLAB and Chemical Engineering Applications

MATLAB is a programming language and numeric computing environment. A hands on training on introduction to MATLAB and Chemical Engineering Applications was organised by IIChE BMSCE Student chapter during 17/11/2021 to 21/11/2021. This was a 3 day training where the participants were able to understand MATLAB and how it can be applied to Chemical Engineering.

The training was given by the faculty of Chemical Engineering Department BMSCE. 84 participants were present to receive the training. MATLAB license was provided to the participants. The assignments were given to the participants which helped them to understand the training in a more creative way. Participation certificates were provided to all the participants.

# Workshop on Unisim Software

Unisim is a simulation software that allows any engineers to create steady state and dynamic models for plant design, performance monitoring, troubleshooting etc. A workshop on this was successfully conducted by IIChE BMSCE Student Chapter on 3rd Feb 2020 to 5th Feb 2020. Mr. Aviram Sharma, Trustee, BMSET, Dr. Ravindra D Gudi Professor and Chair IIT Bombay were the chief guest. The entire event was sponsored by BMSCE and IIChE. Around 70 people attended this event.

# SENSOR TECHNOLOGY AND MICROSYSTEMS GUEST LECTURE REPORT

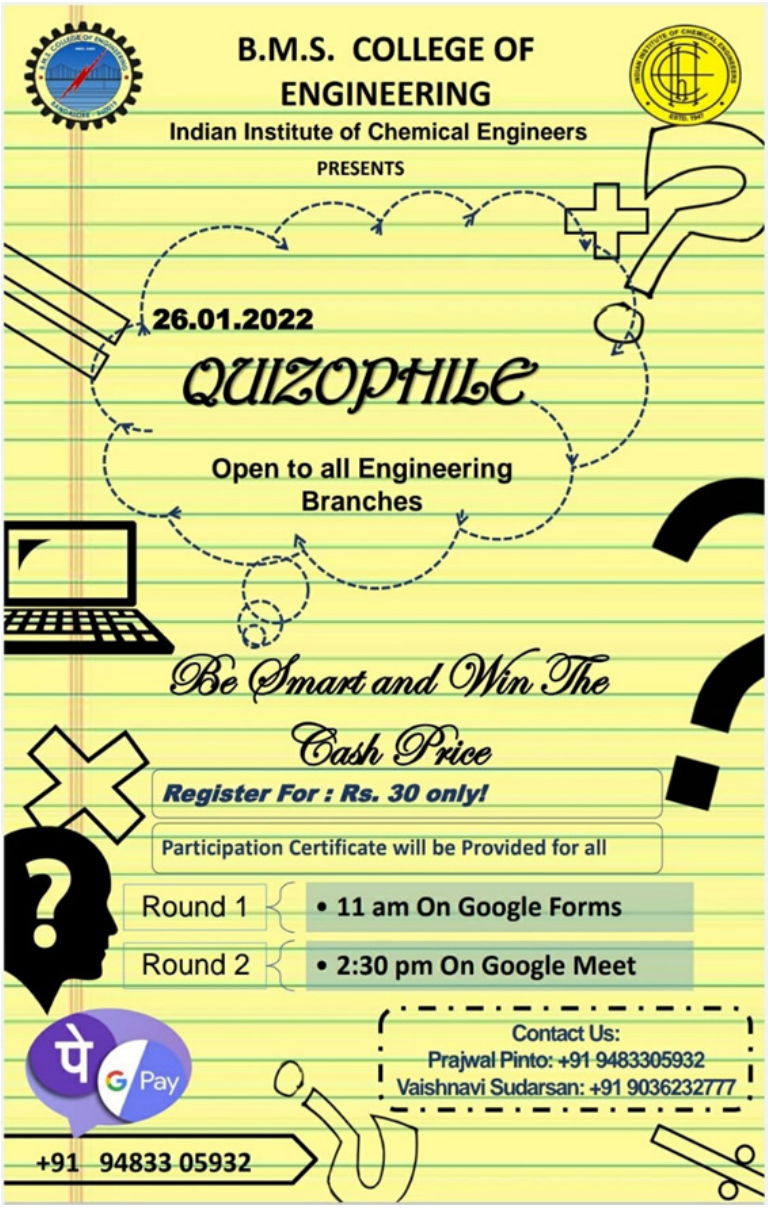
On 12th May 2023, IIChE BMSCE Student Chapter of Department of Chemical Engineering, BMSCE held a guest lecture talk on ''SENSOR TECHNOLOGY AND MICROSYSTEMS'' for the faculty and the students of 3rd and 4th year of Chemical Engineering. The event started at 11:30 am and the person to deliver the talk was Mr. Harsha. S, Scientist- Sensor Technology Development Centre(STDC), Centre for sensors and Vision Technology(CVST), Central Manufacturing Technology Institute. A total of 58 which included the students of 3rd and 4th year and Faculty of the Chemical Engineering Department, BMSCE attended the event. Refreshment was provided to all the attendees.



Mr Harsha pointed out about the types of sensors, elements of sensors, significance and materials used for making sensors development. Development of sensor systems, method of fabrication, stages involved in the fabrication of various techniques, advantages and limitations were also addressed in the talk. Future scope of research in the area of sensor technology, the difference between IC's and MEMS, components and construction of IC's and MEMS were also presented. Mr Harsha also gave introduction about the Central manufacturing technology institute. CMTI has several divisions and material development and machine developments are the major tasks undertaken. The event ended with a photograph with all the attendees.

# QUIZOPHILE

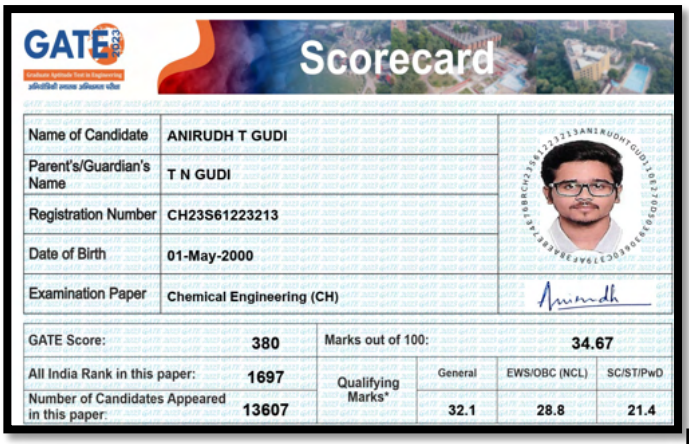
Quizophile 2022 was an online quiz competition conducted by IIChE BMSCE Student Chapter. This quiz was attended by 25 participants. This quiz was conducted on 26th January 2022 in an online mode. This quiz had 2 rounds.




The first round was Google Forms round at 11am. The participants had to answer the questions given to them in Google Forms. The best participants were passed on to the next round. The second round was Google Meet round at 2:30pm. The participants had to raise their hand virtually through a button on Google Meet to answer the question. This was the final round and the winners were announced in this round.

The participants from almost all branches attended Quizophile. 1st place was bagged by Thanush CN and 2nd Place was bagged by Amogh Ananda.

# List of Gate Qualifiers 2023

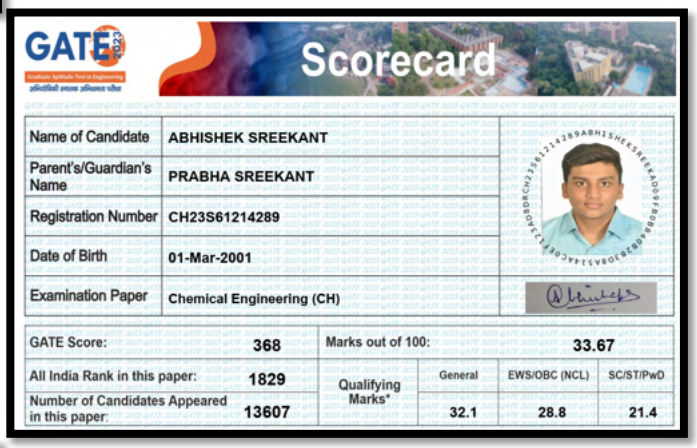


GATE 2023 Scorecard

| | |
|---|---|
| Name of Candidate | ANIRUDH T GUDI |
| Parent's/Guardian's Name | T N GUDI |
| Registration Number | CH23S61223213 |
| Date of Birth | 01-May-2000 |
| Examination Paper | Chemical Engineering (CH) |

| | | | | | |
|---|---|---|---|---|---|
| GATE Score: | 380 | Marks out of 100: | | 34.67 | |
| All India Rank in this paper: | 1697 | Qualifying Marks* | General | EWS/OBC (NCL) | SC/ST/PwD |
| Number of Candidates Appeared in this paper: | 13607 | | 32.1 | 28.8 | 21.4 |

## Anirudh T Gudi

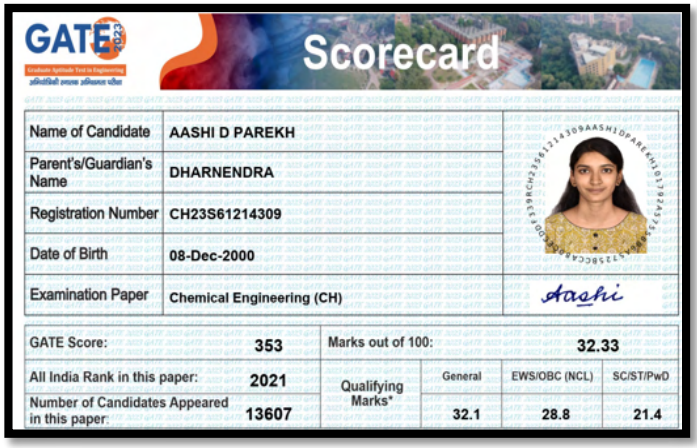


GATE 2023 Scorecard

| | |
|---|---|
| Name of Candidate | ABHISHEK SREEKANT |
| Parent's/Guardian's Name | PRABHA SREEKANT |
| Registration Number | CH23S61214289 |
| Date of Birth | 01-Mar-2001 |
| Examination Paper | Chemical Engineering (CH) |

| | | | | | |
|---|---|---|---|---|---|
| GATE Score: | 368 | Marks out of 100: | | 33.67 | |
| All India Rank in this paper: | 1829 | Qualifying Marks* | General | EWS/OBC (NCL) | SC/ST/PwD |
| Number of Candidates Appeared in this paper: | 13607 | | 32.1 | 28.8 | 21.4 |

## Abhishek Sreekant

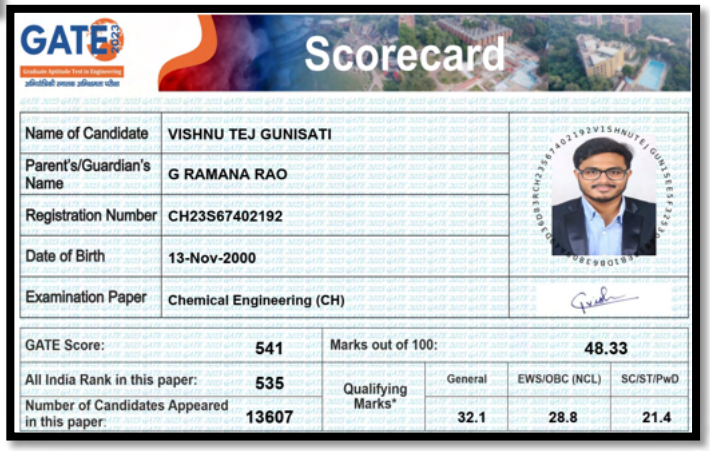


GATE 2023 Scorecard

| | |
|---|---|
| Name of Candidate | AASHI D PAREKH |
| Parent's/Guardian's Name | DHARNENDRA |
| Registration Number | CH23S61214309 |
| Date of Birth | 08-Dec-2000 |
| Examination Paper | Chemical Engineering (CH) |

| | | | | | |
|---|---|---|---|---|---|
| GATE Score: | 353 | Marks out of 100: | | 32.33 | |
| All India Rank in this paper: | 2021 | Qualifying Marks* | General | EWS/OBC (NCL) | SC/ST/PwD |
| Number of Candidates Appeared in this paper: | 13607 | | 32.1 | 28.8 | 21.4 |

## Aashi D Parekh



GATE 2023 Scorecard

| | |
|---|---|
| Name of Candidate | VISHNU TEJ GUNISATI |
| Parent's/Guardian's Name | G RAMANA RAO |
| Registration Number | CH23S67402192 |
| Date of Birth | 13-Nov-2000 |
| Examination Paper | Chemical Engineering (CH) |

| | | | | | |
|---|---|---|---|---|---|
| GATE Score: | 541 | Marks out of 100: | | 48.33 | |
| All India Rank in this paper: | 535 | Qualifying Marks* | General | EWS/OBC (NCL) | SC/ST/PwD |
| Number of Candidates Appeared in this paper: | 13607 | | 32.1 | 28.8 | 21.4 |

## Vishnu Tej Gunisati

# IIChE BEST PROJECT AWARD FUNCTION

Shruthi, Aashi and group from 4th year of our department have won 1st place in IIChE Best Project Award organised by Department of ChemicalEngineering, DSCE and IIChE-BRC held on 28 June, 2023.


Lakshmi S from 1st year of our department has won 1st place in IIChE- BRC- Prof. Kuloor memorial essay competition organised by Department of Chemical Engineering, DSCE and IIChE- BRC held on 28 June, 2023. She is also the event management volunteer of IIChE BMSCE for 2023-24.

# DEPARTMENT OF CHEMICAL ENIGINEERING

*Faculty and Staff*

# DEPARTMENT OF CEMICAL ENGINEERING

Dr. Y. K. Suneetha
Associate Professor & HOD
suneetha.che@bmsce.ac.in

Dr. Samita Maitra
Professor
smaitra.che@bmsce.ac.in

Dr. G. N. Rameshaiah
Professor
gnrameshaiah.che@bmsce.ac.in

Dr. C. T. Puttaswamy
Professor
puttaseamyct.che@bmsce.ac.in

Mrs. Shabnam Siddiqui
Assistant Professor
shabnamsiddiqui.che@bmsce.ac.in

Dr. Chetan A. Nayak
Assistant Professor
canayak.che@bmsce.ac.in

Dr. Sreelakshmi Diddi
Assistant Professor
sreelakshmi.che@bmsce.ac.in

Mr. Soumen Panda
Assistant Professor
soumenp.che@bmsce.ac.in

Dr. Shivakumar R.
Assistant Professor
shivakumarr.che@bmsce.ac.in

Dr. Sanjay Kumar
Assistant Professor
sanjaykumar.che@bmsce.ac.in

Dr. Sainath K
Assistant Professor
sainath.che@bmsce.ac.in

Dr. Hari Prasad Uppara
Assistant Professor
hariprasad.che@bmsce.ac.in

Mr. Basavaraj K.
Foreman
basavaraju.che@bmsce.ac.in

Ms. Anitha Kumari B. S.
S. D. A.
anithakumaribs.che@bmsce.ac.in

Mr. Hari A. M.
Assistant Instructor
hariam.che@bmsce.ac.in

Mr. Narayana Rao
Assistant Instructor
narayanarao.che@bmsce.ac.in

Mr. Ravi G
Attender
ravig.che@bmsce.ac.in

Mr. Cheluvaraju
Helper
cheluvaraju.che@bmsce.ac.in

Thank you all for helping to prepare young leaders for the world of tomorrow

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4th Year,
Chemical Engineering

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**The best way to predict future is to create it.**


CHEMZONE
2022-23
Thank You