ChemE Chronicles

VOL.II No.9 June 2026 DEPARTMENTAL NEWSLETTER

FROM HOD'S DESK

PROF. ADITYA KUMAR

It is with immense pleasure that I present the June 2026 edition of ChemE Chronicles, the official newsletter of the Department of Chemical Engineering at IIT (ISM) Dhanbad.

The Alumni ChEnect section features an engaging interview with Purushottam Raj, a B.Tech graduate from our department (Batch 2021–2025), who is currently working as a Production Engineer at Indian Oil Corporation Limited (IOCL).

The Students' Corner celebrates a remarkable achievement by a team of first-year Chemical Engineering students — Shashaank Kumar Gelra, Swarnavo Pal, Siddhant Rathore, and Yasharth Shukla — who secured 7th position among the winning teams at Kinexus 2025, a prestigious national-level hackathon organized by Godrej Pvt. Ltd. Notably, they were the only first-year team to feature in the winners' list, reflecting the strong culture of innovation and problem-solving fostered at IIT (ISM) Dhanbad.

The Feature Article contributed by Prof. Mahendra Nandanwar, in this edition examines the continued relevance of Lead–Acid Batteries in the modern energy landscape, discussing their widespread applications, key advantages such as cost-effectiveness, reliability, and a highly successful recycling ecosystem, as well as the challenges they face in competing with emerging technologies such as lithium-ion batteries.

The ChemE Trivia section provides an informative overview of the PID (Proportional–Integral–Derivative) controller — one of the most widely used automatic control systems in chemical engineering — explaining the roles of its proportional, integral, and derivative actions, and their collective importance in maintaining process stability and efficiency across industrial applications.

This edition also features a rich list of recent Publications by our faculty, reflecting the department's active and diverse research contributions spanning areas such as hydrogen production, catalysis, electrochemistry, process engineering, energy storage, polymer solutions, and environmental applications.

Let us continue working together to promote excellence in education, research, and innovation in the field of chemical engineering.

What's Inside

Chemical Engineering News

India lifts curbs on non-domestic packed LPG, restores supplies to pre-crisis levels

Industrial and commercial consumers get major relief as the government has fully restored non-domestic packed LPG supplies have been relaxed to 50% of pre-crisis consumption levels, significantly easing fuel availability for businesses. The restoration is based on recent reviews showing improved domestic production and imported supplies. Read more..

पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
MINISTRY OF PETROLEUM AND NATURAL GAS
Government of India

India poised to become global bio-economy powerhouse, says DCPC Secretary Tejveer Singh

India has the scientific strength, biodiversity resources and innovation ecosystem needed to emerge as a global leader in the bio-economy and bio-based agricultural input sector, according to Tejveer Singh, Secretary, Department of Chemicals and Petrochemicals (DCPC), Ministry of Chemicals and Fertilizers. Read more…

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Alumni ChEnect

Purushottam Raj

B.TECH [2021-2025]

1 Welcome to the "Alumni ChEnect" interview series! Please tell us in detail about your current job.

After graduating from college, I dedicated myself to preparing for PSU examinations with a strong focus on core engineering fundamentals. Through consistent effort and disciplined preparation, I successfully cleared the CBT examination conducted by IOCL. Currently, I am working as a Production Engineer at Indian Oil Corporation Limited (IOCL). I am posted in the Atmospheric Distillation Unit (ADU), which is one of the primary and most critical units of the refinery. In this role, I am responsible for ensuring smooth and efficient plant operations, maintaining process parameters within safe and optimal limits, coordinating with field and panel teams, and contributing to production reliability and safety compliance

2. Please tell us about your academic journey, starting from school days.

I completed my 10th and 12th from A.S.A.S.V.M., Roorkee. Scoring full marks in Mathematics in my 10th board exams was a major confidence booster and guided me toward choosing engineering as my career path. In 12th grade, I secured more than 95%, which motivated me to aim for IIT.I took a drop year to focus entirely on my IIT preparation. During that time, I relied on several educational YouTube channels to strengthen my concepts and problem-solving skills. That dedicated year of disciplined preparation helped me clear the IIT examination and shaped my academic foundation.

3 Why did you choose chemical engineering? Was it out of passion, or driven by circumstances? Please walk us through your thoughts as a Class 12

After completing my 12th with good marks, I had two options: either join a state government college or take a drop year to prepare for IIT. With strong motivation and support from my parents, I chose the second option. I dedicated that year to disciplined self-study and was able to clear the IIT examination. Honestly, I was not even expecting to secure admission into an IIT, so it was a very rewarding moment for me. Regarding Chemical Engineering, it was not initially my first choice of branch. Several practical factors such as institute ranking, distance from home, and overall opportunities influenced my decision. However, once I joined the branch, I gradually developed genuine interest in the subjects and core engineering concepts. Looking back, what began as a practical decision eventually became a meaningful and valuable academic journey.

4 How has IIT (ISM) Dhanbad helped you in this journey? How did the BTech/MTech/PhD programme here help shape your career path? How did the academic environment and campus life contribute to your personal growth?

I completed my B.Tech in Chemical Engineering from IIT (ISM) Dhanbad, and those four years played a crucial role in shaping both my professional and personal journey.The rigorous academic curriculum strengthened my core fundamentals, while opportunities such as internships provided valuable industrial exposure and practical understanding of real-world processes.One of the most impactful aspects of my academic journey was the choice of electives, particularly Petroleum Refining, which later proved extremely helpful during my PSU interviews. The academic environment at IIT (ISM) encouraged analytical thinking, problem-solving, and conceptual clarity rather than rote learning. Another key factor was the constant guidance and mentorship from professors, who were always approachable and motivated us to think critically and explore beyond textbooks. Beyond academics, campus life helped me develop independence, confidence, time management skills, and the ability to adapt to challenges — qualities that have significantly contributed to my professional growth today.

5. What is your typical work-day like?

I am currently posted in AU-1, which is considered the mother unit of the refinery as it handles the primary crude distillation process. My typical workday begins with a detailed interaction with the previous shift in-charge. During this handover, I review the overall plant status, key operating parameters, any deviations observed, corrective actions taken, and production targets for the day.After understanding the plant condition, I proceed with issuing necessary work permits, ensuring all safety protocols are strictly followed. My daily routine includes regular field visits and panel visits to closely monitor operations. A significant part of my role involves troubleshooting process parameters such as column pressure, temperature profiles, and reflux rates to maintain product quality and operational stability. Continuous monitoring and quick decision-making are essential, as even small deviations in the Atmospheric Distillation Unit can impact the entire refinery performance.

6 . What are the pros and cons of the profession in your honest opinion?

On the positive side, being in a government PSU offers excellent job security and a structured work-life balance. Once the assigned 8-hour shift is over, there is generally no expectation of carrying work home, which allows for personal time and stability. Additionally, the compensation structure is attractive, with various allowances and benefits that add to overall financial security.However, there are some challenges as well. Shift duties can disturb the sleep cycle and require constant adjustment, which can be physically demanding over time. The refinery locations are often in industrial or remote areas, which may not always be ideal from a lifestyle perspective. Also, the six-day work policy can feel intensive compared to some private-sector roles.

7. How has your career evolved since you graduated, and what advice would you give to current chemical engineering students aspiring to follow a similar path?

My career has evolved significantly since graduation. Once you enter the professional world, especially in a core industrial role, the level of responsibility increases substantially. You are not only responsible for critical plant operations but also begin taking important financial and personal decisions in life. The transition from student to working professional brings maturity, accountability, and a deeper understanding of real-world challenges..For chemical engineering students aspiring to join PSUs, my advice would be simple: stay disciplined and trust the process.

Students' corner

1st Year UG ChemEs Shine at Kinexus 2025

A team of first-year Chemical Engineering students from IIT (ISM) Dhanbad has brought recognition to the department by emerging as one of the top winners at Kinexus 2025, a prestigious national-level hackathon organized by Godrej Pvt. Ltd. The competition witnessed remarkable participation from more than 240 teams representing 16 IITs and 5 NITs across India, making it one of the most competitive student innovation challenges in the country.

Competing against some of the nation's brightest engineering minds, the team secured 7th position among the 8 winning teams. What makes this achievement particularly noteworthy is that they were the only first-year student team to feature in the winners' list — a testament to their exceptional technical skills, innovative thinking, and determination.

The team worked on Problem Statement 2, which focused on identifying cost-effective and sustainable alternatives to conventional nickel-based catalysts used in industrial hydrogenation processes. Their proposed solution involved the development of a Ni-Fe bimetallic catalyst supported on SiO_2, aimed at improving catalytic efficiency, reducing costs, enhancing resistance to catalyst poisoning, and minimizing environmental impact. The judging panel was particularly impressed by the solution's industrial relevance, sustainability, and practical applicability.

This achievement not only brings well-deserved recognition to the students but also reflects the strong culture of innovation and problem-solving fostered at IIT (ISM) Dhanbad. Their success serves as an inspiration for fellow students to actively engage in research and industry-focused challenges from the very beginning of their academic journey.

Team Members: Shashaank Kumar Gelra (Team Leader), Swarnavo Pal, Siddhant Rathore, and Yasharth Shukla.

Feature Article

Relevance of Lead–Acid Batteries in the Modern World

Lead–acid batteries (LABs), despite being a technology that is more than a century old, continue to play a vital role in the modern energy landscape. Their widespread adoption, reliability, affordability, and well-established recycling infrastructure have ensured their continued relevance even in the era of advanced battery technologies. As of 2025, lead–acid batteries account for approximately 70% of the global battery storage capacity and represent a market valued at around USD 50–60 billion. Lead–acid batteries are widely employed in automobiles for starting, lighting, and ignition (SLI) applications, where they remain the dominant technology. They are also extensively used in Uninterruptible Power Supply (UPS) systems, telecommunication backup power, grid-scale energy storage, renewable energy integration, and load-leveling applications. They are relatively inexpensive compared to many alternative battery technologies, require minimal maintenance, exhibit low self-discharge rates, and can operate over a wide temperature range (−35°C to 80°C). Furthermore, lead–acid batteries possess one of the most successful recycling ecosystems among industrial products, with more than 95% of spent batteries being recycled. Despite these advantages, lead–acid batteries face increasing competition from newer technologies, particularly lithium-ion batteries. The primary limitation of LABs is their lower specific energy density, typically ranging from 30–50 Wh/kg, compared to 75–250 Wh/kg for lithium-ion batteries. Nevertheless, lead–acid batteries continue to offer compelling advantages in terms of cost, safety, reliability, recyclability, and established manufacturing infrastructure. Their future market position will depend on continued technological advancements aimed at improving energy density, cycle life, and overall performance while maintaining their economic advantages. Given these strengths, lead–acid batteries are expected to remain an important component of the global energy storage portfolio for decades to come, particularly in stationary storage, backup power, and automotive applications.

Prof. Mahendra Nandanwar

ChemE Trivia

PID Controller

A PID (Proportional–Integral–Derivative) controller is one of the most important and widely used automatic control systems in chemical engineering, maintaining process variables such as temperature, pressure, flow rate, liquid level, and pH at their desired values. It operates on feedback control, where the measured process value is continuously compared with the desired setpoint, and any difference is corrected automatically.

The proportional action provides an immediate response to the current error, allowing the process to react quickly to disturbances. The integral action accumulates past errors and eliminates steady-state offset, ensuring accurate and precise control. The derivative action predicts future error trends by considering its rate of change, reducing overshoot, minimizing oscillations, and improving system stability.

PID controllers are simple to implement, cost-effective, and highly reliable, making them the preferred choice in process industries. They are widely used in chemical plants, petroleum refineries, pharmaceutical industries, food and beverage processing, power plants, water and wastewater treatment facilities, and polymer industries. Common applications include controlling reactor temperature, maintaining pressure in process vessels, regulating liquid levels in storage tanks, controlling pipeline flow rates, and ensuring accurate mixing and composition of chemical products.

Proper tuning of controller parameters is essential for optimum performance, ensuring faster response, improved stability, reduced fluctuations, minimal overshoot, and high product quality while enhancing process safety, reducing energy consumption, and increasing plant efficiency. They can be implemented using analog circuits, programmable logic controllers (PLCs), distributed control systems (DCS), and modern digital controllers, making them suitable for both small-scale and large-scale industrial applications.

PID controllers can be adapted to different operating conditions through parameter tuning, and their performance further enhanced using advanced techniques such as auto-tuning, adaptive control, cascade control, feedforward control, and anti-windup protection. Due to their simplicity, robustness, and proven reliability, PID controllers remain the standard control strategy in industrial automation worldwide.

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Editorial Board