UPL

UPL UNIVERSITY OF SUSTAINABLE TECHNOLOGY

Rotary Ankleshwar

Kathan

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KATHAN

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VISION

To nurture ethically skilled students for better contribution to the industry, business and the upliftment of society.
To develop knowledgeable and professionally competent engineers to meet global challenges .

MISSION

To provide an environment of academic excellence in Engineering and Technology through complete dedication to all round growth of students and develop sustainable solutions.

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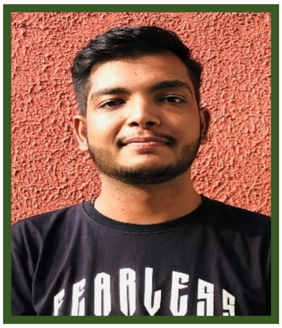
Editorial message

It is the talent and outcome of our students which is reflected through KATHAN. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas. Our magazine is balanced collection of technical and literary activities sports and cultural activities, poems, stories, academic achievement, etc.

We seek opportunities for our students to stretch their minds and hearts beyond limits, and to build values that lead to a harmonious existence.

We see ourselves as one big family, where all are united in a spirit of Science and technology. In today's competitive world, we do not know what the future holds for us, but all that we know is that our students will hold the future….

Student Editors



Yash Jadav
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Meet Rathod
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CT

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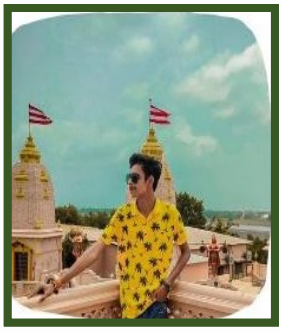

Jeet Parmar
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Reva Fest-2025

UPL University of Sustainable Technology celebrated its fourth grand annual festival, "**Reva Fest-2025**", with great enthusiasm on 04th April 2025. This annual festival was organized under the university's canopy, during which cultural programs were presented by the students and faculty members of the university.

The chief guest of this annual festival Shri K. Kumaravel, President and Unit Head, Birla Copper, Dahej, as well as the Guests of Honour, Shri Sunil Chari- MD, Rossari Biotech Limited & Shri Tushar Shah, DG, Rotary District-3060 and **Mrs. Sandra Shroff**, Chairman Emeritus, Shri **Ashok Panjwani**, President, UPL University, Trustees Bhupendra Dalwadi and Kishore Surti, distinguished members of the Management Committee, Provost, Registrar, Deans, University office bearers, faculty, staff, students and representatives of various industries graced the event with their presence. Provost Prof. Shrikant Wagh welcomed the guests with a bouquet and delivered the keynote address.

Reva Fest-2025

The program, included various dance fests and music fests on the theme of Stage Technocrat, along with the distribution of awards to the **best students and the Star of SRICT alumni**.

During their speeches, the guests encouraged the students through their inspiring words for their all-around development and emphasized the enhancement of skills and technical knowledge acquired during their studies.

The Reva Fest-2025 festival was jointly coordinated by the University's Department of **Chemical Technology and the Team ARTIMEDES**.

Abhyutthan-2025

The Mechanical Engineering Department of UPL University of Sustainable Technology successfully organized the prestigious academic award ceremony, "**Abhyutthan 2025**," on March 19, 2025, at the Diamond Children Theatre, GIDC, Ankleshwar.

The event honored students from Diploma Engineering, Bachelor of Engineering, Master of Engineering, B.Sc. Chemistry, B. Sc. Microbiology, and M.Sc. Organic Chemistry for their outstanding academic achievements.

The morning session featured **Mr. Prafullachandra Bhamare** (General Manager – HR, Dormer Pramet, Ankleshwar) as the chief guest, while the evening session was graced by **Ms. Asmani Surve** (Vice President - Human Capital, Goldi Solar Pvt. Ltd.). The ceremony was executed in the presence of the honorable Chairman Mr. Ashok Panjwani.

The award ceremony was a proud and significant event organized by UPL University of Sustainable Technology, recognizing 705 students with prize money totaling INR 345,050.

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PLI Felicitation Program

The **Peer Learning Initiative** (**PLI**) **Felicitation Program** for the term June-Dec. 2024, was successfully conducted on 11th March 2025 at UPL University of Sustainable Technology, recognizing the exceptional contributions of students involved in the Peer Learning Initiative. This initiative emphasized the significance of peer-oriented learning in fostering academic and professional growth

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Technical Article

Introducing Green Chemicals into Pain Reliever Ointments

This project centers around the formulation and evaluation of a novel topical pain reliever ointment using Diclofenac Sodium as the active pharmaceutical ingredient (API) combined with a carefully selected blend of natural excipients. Diclofenac sodium is a widely used non-steroidal anti-inflammatory drug (NSAID), well known for its effectiveness in treating localized pain and inflammation, especially in conditions such as arthritis, muscle strain, and sports injuries. However, many existing commercial formulations rely heavily on synthetic excipients, gelling agents, and preservatives, which may cause skin irritation or discomfort upon prolonged use. This project aims to develop a safer, more biocompatible alternative that retains the therapeutic benefits of diclofenac while enhancing skin tolerability and environmental sustainability.

The proposed formulation employs Aloe Vera gel as the base component, chosen for its excellent soothing, moisturizing, and anti-inflammatory properties. Glycerin is used as a humectant to retain moisture and improve skin feel, making the ointment more hydrating and comfortable to use. To maintain the physical integrity and consistency of the formulation, xanthan gum, a natural polysaccharide, is included as a stabilizer. Phenoxyethanol is incorporated as a mild preservative that offers effective microbial protection without the risks associated with parabens. Vitamin E serves a dual role as an antioxidant to prevent oxidative degradation and as a skin-nourishing agent. Lastly, peppermint oil is added for its natural cooling effect and mild analgesic properties, enhancing both the sensory and therapeutic experience of the product.

The importance of this formulation lies in its ability to provide a natural, patient-friendly alternative to conventional diclofenac ointments.

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By replacing synthetic excipients with naturally derived components, the risk of skin irritation is reduced, making the product suitable for sensitive skin and long-term application. Additionally, the aesthetic and sensory characteristics of the ointment are improved, promoting better patient compliance. Aloe Vera and glycerin contribute to a smooth, non-greasy, and moisturizing feel, while peppermint oil enhances the initial relief sensation upon application.

Another key reason this formulation is significant is its alignment with current trends in sustainable and green pharmaceutical development. Using biodegradable, non-toxic excipients not only benefits users but also contributes to reducing the environmental footprint of pharmaceutical products. Furthermore, preliminary patent and literature reviews indicate that this specific combination of ingredients has not yet been documented, highlighting its novelty and potential for intellectual property protection. This opens doors for further research, development, and even commercialization.

In conclusion, this project integrates pharmaceutical efficacy with natural ingredient synergy to deliver a holistic pain relief solution. It bridges the gap between modern drug delivery and consumer demand for clean-label, sustainable, and skin-friendly products. The formulation process, supported by careful selection of excipients, ensures a stable, effective, and cosmetically elegant product. Through this innovation, the project contributes to advancing topical therapy options that are not only therapeutically effective but also safer and more pleasant to use in daily life.

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Technical Article

Decolorization & COD reduction of Acid Dyes Effluent

Industrial activities such as textile, leather, paper, and cosmetics manufacturing are among the largest contributors to water pollution through the release of dye-laden wastewater. These effluents are typically characterized by their intense color, high toxicity, and elevated levels of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD). Acid dyes, in particular, are complex and non-biodegradable, making their treatment both crucial and challenging.

The aim of this project is to investigate and implement effective methods for decolorization and COD reduction of acid dye effluents, thereby mitigating their environmental impact. The treatment process under study involves the open reflux method—a chemical treatment technique that facilitates the breakdown and removal of harmful compounds within the effluent. The overall goal is to reduce the concentration of hazardous dyes and organic pollutants to levels safe for environmental discharge or potential reuse.

The methodology incorporates a comparative study of various physical, chemical, and biological approaches to identify the most effective treatment solutions. Physical methods such as coagulation, flocculation, adsorption, and membrane filtration offer simplicity and efficiency in color removal. Biological treatments, including microbial and fungal degradation, provide environmentally sustainable options with minimal sludge generation, although they are less effective for complex synthetic dyes. Chemical processes, particularly coagulation-flocculation using agents like alum and ferric chloride, are studied for their effectiveness in removing both color and suspended solids.

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Technical Article

The expected outcome of the project includes a dye removal efficiency exceeding 90% and a significant reduction in COD levels. Such results would not only render the treated water safe for discharge but also provide an economically viable and scalable treatment model for small and medium-sized industries.

Importance of the Project

This project addresses a critical environmental challenge: the pollution of water bodies by dye effluents. The significance lies in its contribution to sustainable development, particularly in industrial zones such as Ankleshwar, Gujarat—home to numerous dye manufacturing units. Untreated or poorly treated dye wastewater poses severe threats to aquatic ecosystems, disrupts photosynthesis in water bodies, and can cause long-term health issues in humans due to the presence of carcinogenic and mutagenic compounds.

By focusing on COD reduction and decolorization, the project directly contributes to improving water quality, conserving aquatic life, and reducing health risks associated with water pollution. Moreover, the project aligns with global goals for sustainable industry practices and water resource management.

This work also fosters the development of affordable and replicable treatment technologies, which is particularly important for developing countries facing both environmental and economic constraints. Ultimately, the project contributes to a cleaner, safer environment and supports the implementation of green chemistry and pollution control practices in industrial operations.

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Technical Article

Advancements in Refrigeration Technology: A Glimpse into the Future

1. Introduction

The refrigeration industry is undergoing significant transformations, driven by the need for energy efficiency, environmental sustainability, and technological innovation. This article delves into the latest advancements in refrigeration technology, highlighting novel cooling methods, innovative materials, and emerging trends that promise to redefine the future of refrigeration.

Refrigeration plays a pivotal role in various sectors, including food preservation, healthcare, and industrial processes. Traditional refrigeration systems, primarily based on vapor-compression cycles, have been effective but come with challenges such as high energy consumption and the use of refrigerants with significant global warming potential (GWP). Recent research and development efforts aim to address these challenges by exploring alternative cooling technologies and materials.

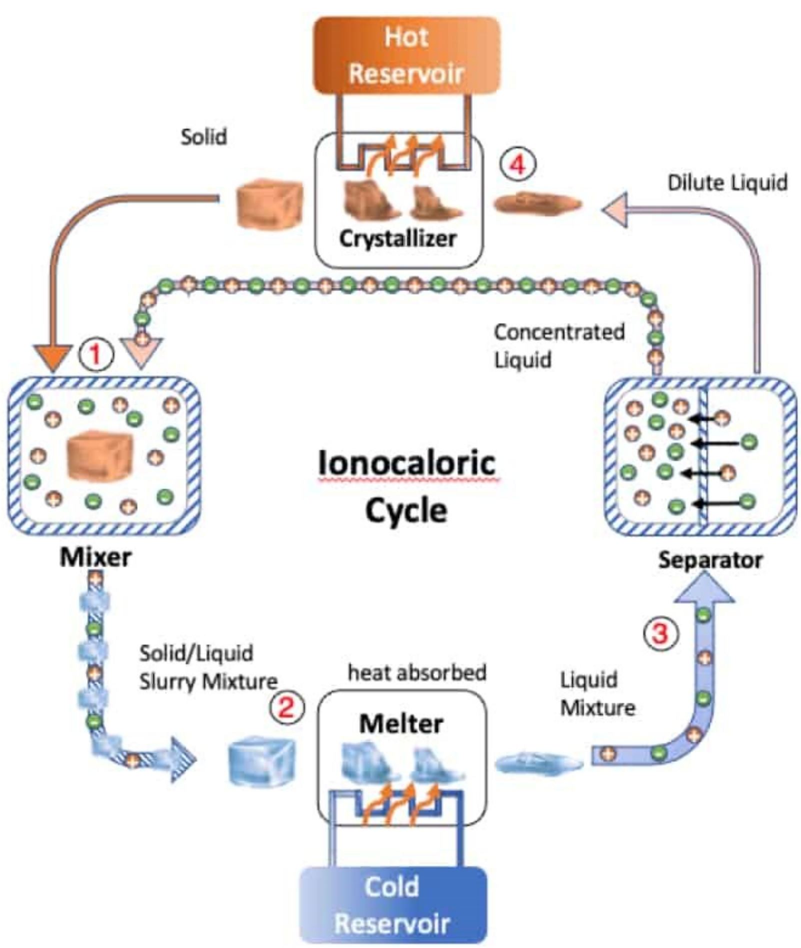
2. Emerging Cooling Technologies

2.1. Solid-State Cooling

Solid-state cooling technologies are gaining attention as potential replacements for conventional refrigeration methods. One notable innovation is the development of solid-state cooling systems based on shape memory alloys (SMAs). These systems utilize the unique properties of SMAs to achieve cooling without the need for traditional refrigerants. The advantages include zero GWP, non-toxicity, non-flammability, and enhanced energy efficiency. Companies like Exergyn are at the forefront of this technology, developing SMA-based cooling solutions that promise durability and reusability.

2.2. Ionocaloric Refrigeration

Ionocaloric refrigeration is an innovative approach that leverages the ionocaloric effect, where the addition or removal of ions induces a thermal response in a material. This method involves manipulating the electrochemical potential to achieve significant temperature changes, offering a sustainable alternative to traditional refrigeration systems. The ionocaloric cycle comprises processes such as isentropic mixing, isothermal melting, isentropic separation, and isothermal crystallization, collectively enabling efficient cooling. Materials like ethylene carbonate combined with sodium iodide have demonstrated promising results in this domain. (en.wikipedia.org*)



Ionocaloric Refrigeration (*Source: Physics world)

3. Innovative Materials in Refrigeration

3.1. SlimTech Insulation

Whirlpool Corporation has introduced SlimTech insulation, a proprietary vacuum-insulated structure technology that replaces conventional polyurethane foam in refrigerators. This advancement reduces refrigerator wall thickness by up to 66%, resulting in a 25% increase in interior capacity. Additionally, SlimTech insulation enhances energy efficiency and allows for sleek metal interiors, moving away from traditional molded plastic designs. The JennAir brand is set to feature this technology, with refrigerators expected to be available in 2025. (foodandwine.com*)

4. Trends in Refrigeration for Food Preservation

The primary objective of food preservation is to inhibit the growth of microorganisms and slow down enzymatic reactions that cause spoilage. Refrigeration has become an essential part of the food chain, with ongoing research focusing on enhancing refrigeration technologies to improve food preservation. Recent studies have reviewed various trends in this field, emphasizing the importance of maintaining optimal storage conditions to extend the shelf life of perishable commodities. (researchgate.net*)

5. Conclusion

The refrigeration field is witnessing rapid advancements aimed at improving efficiency, sustainability, and functionality. Innovations such as solid-state cooling technologies, ionocaloric refrigeration, and advanced insulation materials are paving the way for the next generation of refrigeration systems.

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As these technologies continue to evolve, they hold the promise of transforming refrigeration practices across various industries, contributing to a sustainable environment.

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Technical Article

Automated AI at Last: Ending the Era of Manual Prompt Tuning

In large language models (LLMs), prompt tuning is a critical but often labor-intensive process. Traditionally, manually adjusting prompts to optimize performance has been time-consuming, inconsistent, and prone to scalability issues. However, the advent of Stable Prompt a cutting-edge framework for automated prompt optimization, seeks to revolutionize how LLMs are fine-tuned, offering a solution to many of the challenges faced by developers and organizations.

The Challenges of Manual Prompt Tuning

Manual prompt tuning for LLMs presents significant challenges that hinder efficiency and scalability:

- **Time-consuming process**: Each prompt requires iterative trial and error to achieve optimal performance. This can take hours, days, or even weeks depending on the complexity of the task.
- **Inconsistency in results**: Manual tuning often leads to unpredictable outcomes, as results vary widely across different users, tasks, and datasets.
- **Limited scalability**: As the scope of applications grows, managing and tuning multiple prompts for diverse use cases becomes nearly impossible.
- **Expert dependency**: Effective tuning requires domain expertise, creating a bottleneck when specialized knowledge is unavailable.

Dynamic task challenges: Static prompts struggle to adapt to real-time changes in tasks or user needs, leading to suboptimal outputs.

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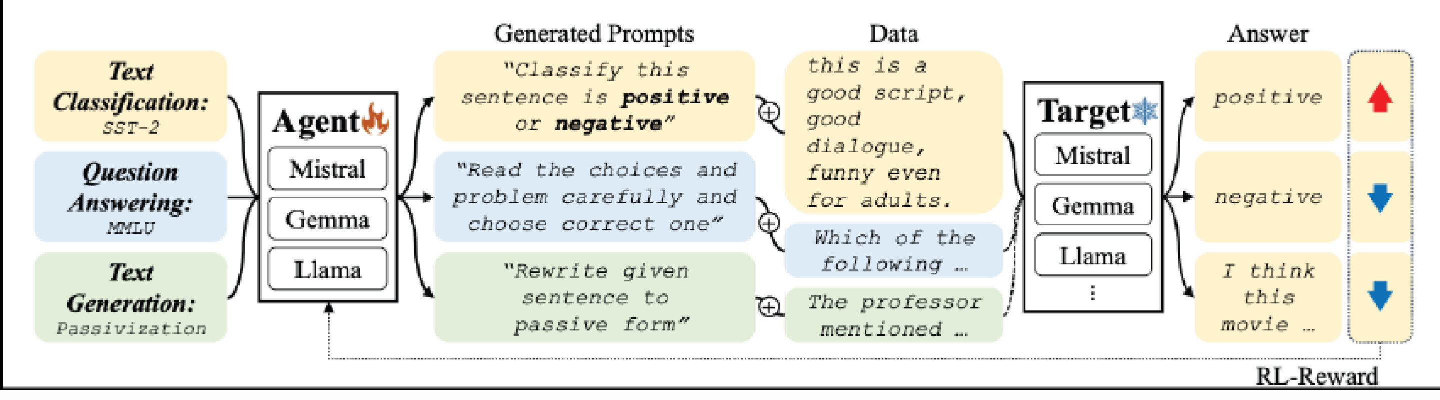
What is the solution?

Stable Prompt is a cutting-edge framework designed to revolutionize how prompts are optimized for large language models (LLMs). It strikes a balance between training stability and search space, mitigating the instability of RL and producing high-performance prompts.

- **Automated prompt tuning**: Eliminates manual efforts by dynamically optimizing prompts through reinforcement learning.
- **Reinforcement Learning core**: Uses feedback loops to refine prompts in real-time for improved results.
- **Stability-performance balance**: Overcomes the instability of traditional RL methods, ensuring reliable and consistent optimization.
- **High-performance prompts**: Produces refined, task-specific prompts that maximize LLM output quality.
- **Dynamic and scalable**: Adapts to diverse tasks, evolving with changing requirements for seamless scalability.



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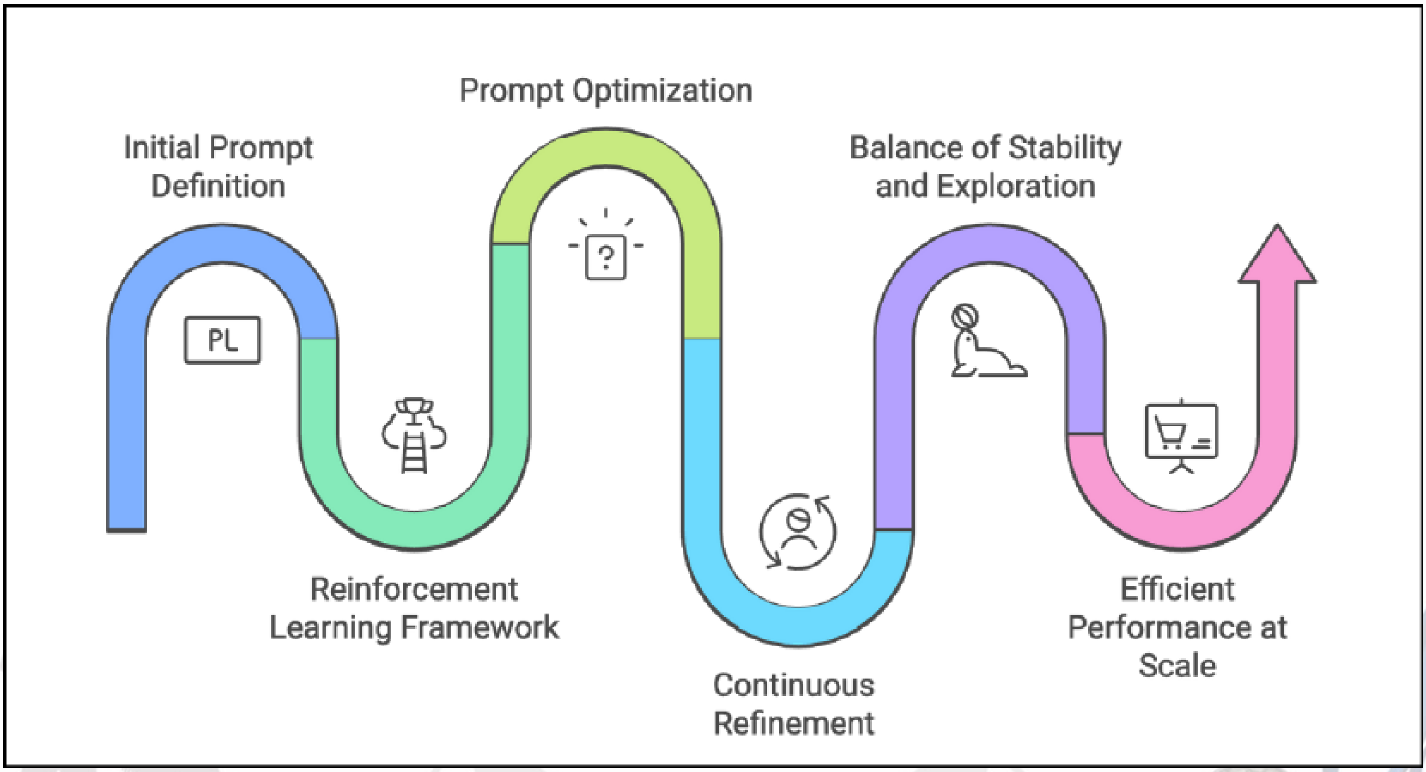
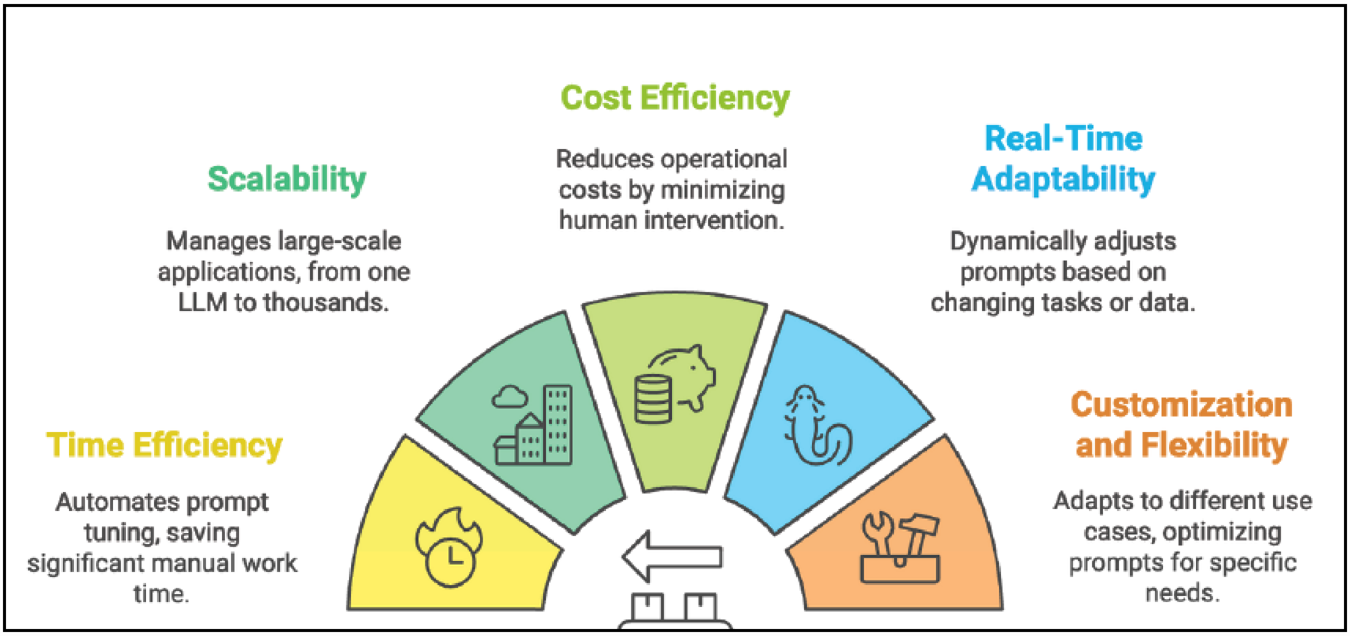
How it works?

- **Initial prompt definition**: Start with a baseline prompt to generate LLM output for a specific task or query.
- **Reinforcement Learning framework**: Evaluate generated output and assign a reward based on accuracy, relevance, and quality.
- **Prompt optimization**: Adjust the prompt dynamically based on the feedback to improve the output in the next iteration.
- **Continuous refinement**: Learn and adapt from each cycle, making smarter prompt adjustments over time.
- **Balance of stability and exploration**: Maintain stable output quality while exploring different prompt variations to find the best fit.
- **Efficient performance at scale**: Optimize multiple prompts simultaneously for different use cases, ensuring scalability.



What are the key benefits?

- **Time efficiency**: Automates prompt tuning, saving days or weeks of manual work.
- **Scalability**: Handles large-scale applications, from one LLM to thousands.
- **Cost efficiency**: Reduces operational costs by minimizing the need for human intervention.
- **Real-time adaptability**: Dynamically adjusts prompts based on changing tasks or data.
- **Improved stability and performance**: Balances exploration and stability for high performance and reliability.
- **Customization and flexibility**: Adapts to different use cases, optimizing prompts for specific needs.



Real-world applications

- **Customer support automation:** Generates accurate, personalized responses for chatbots, enhancing customer satisfaction.
- **Content generation**: Refines prompts for creative writing, copywriting, and social media content, ensuring high-quality output.

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- **Healthcare and medical diagnostics**: Fine-tune prompts for AI-powered diagnostic tools and virtual health assistants, ensuring accurate medical responses.
- **Educational tools and tutoring systems**: Personalizes learning experiences by dynamically adjusting prompts based on student needs.
- **Market research and consumer insights**: Refines prompts for market research tools, generating deeper insights from consumer feedback.
- **Legal document analysis**: Enhances prompts for legal document review, speeding up contract analysis and compliance checks.
- **E-commerce product recommendations**: Fine-tune prompts for personalized shopping experiences, improving product recommendations and conversions.

Conclusion

Stable Prompt marks the end of manual prompt tuning and introduces a simpler, faster way to optimize AI. Using automation and reinforcement learning, helps businesses create high-quality prompts that can adapt as needs change. Whether it's for customer support, content creation, healthcare, or other areas, Stable Prompt makes it easier and more efficient to get the best results from AI. It's a game-changer for anyone looking to improve their AI without the hassle of manual tuning.

Awadh Kishor Singh,
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Technical Article

Advancements in Green Catalysis for Sustainable Chemical Processes

Introduction

As global awareness of environmental issues continues to rise, the chemical industry is under increasing pressure to adopt sustainable practices. One of the most promising approaches toward achieving sustainability is green catalysis—the use of environmentally friendly catalysts that promote chemical reactions with minimal waste and energy consumption. Green catalysis not only contributes to reducing harmful emissions and byproducts but also plays a vital role in improving process efficiency. This article explores recent advancements in green catalysis, its various applications, and the benefits and limitations associated with its implementation in chemical processes.

Definition and Principles of Green Catalysis

Green catalysis refers to the design and application of catalysts that align with the principles of green chemistry. These include the use of non-toxic, abundant materials, energy efficiency, and the minimization of hazardous waste. Green catalysts are designed to function under mild conditions, which reduces energy consumption and improves overall process sustainability.

Types of Green Catalysts

- Biocatalysts (Enzymes): Enzymes offer high specificity and work under mild conditions, making them ideal for pharmaceutical and fine chemical production.

- Heterogeneous Catalysts: These can be easily separated and reused, which minimizes waste and energy use.

- Organocatalysts: These metal-free catalysts offer an eco-friendly alternative in organic synthesis.

- Photocatalysts: Activated by light, these are used in environmental applications like pollutant degradation and water splitting.

Recent Technological Advancements

- Nano-catalysis: The use of nanomaterials has improved catalytic efficiency due to increased surface area and tunable properties.

- Metal-Organic Frameworks (MOFs): These porous materials provide high surface areas and can be tailored for specific reactions.

- Green Solvents: Development of solvent-free or water-based catalytic systems to reduce toxic solvent use.

- Hybrid Catalytic Systems: Combining biocatalysts and synthetic catalysts to optimize performance in complex reactions.

Industrial Applications

- Petrochemical Industry: Green catalysts are being used to improve fuel refining with less environmental impact.

- Pharmaceuticals: Synthesis of active pharmaceutical ingredients (APIs) with fewer steps and less waste.

- Agricultural Chemicals: Production of pesticides and fertilizers using eco-friendly catalysts.

- Environmental Remediation: Catalysts are used for CO_2 capture, pollutant degradation, and water purification.

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Advantages of Green Catalysis

- Reduced Environmental Impact: Lower greenhouse gas emissions and waste generation.

- Improved Efficiency: Faster reactions with higher selectivity and yield.

- Energy Conservation: Catalysts work under mild temperatures and pressures.

- Cost Savings: Reusability and fewer purification steps reduce operational costs.

- Regulatory Compliance: Helps industries meet environmental regulations.

Disadvantages of Green Catalysis

- High Initial Costs: Development and scale-up of green catalysts can be expensive.

- Limited Stability: Some green catalysts, especially enzymes, may be unstable under industrial conditions.

- Reusability Challenges: Some catalysts degrade after several cycles, affecting process efficiency.

- Technical Barriers: Integration into existing processes may require significant modifications.

Conclusion

Green catalysis represents a critical component of the future of sustainable chemical engineering. With continual research and technological innovation, green catalysts are becoming more efficient, selective, and economically viable.

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While challenges remain in terms of cost, stability, and integration, the benefits they offer make them a worthy investment for industries aiming to reduce their ecological footprint. Advancements in nanotechnology, materials science, and process engineering are expected to further enhance the applicability of green catalysis in the coming years.

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Technical Article

Reactive Distillation: Integrating Reaction and Separation

Introduction

Reactive distillation (RD) is a revolutionary process intensification technique that merges chemical reaction and product separation into a single unit. This hybrid process departs from the traditional sequential method where reactors and separation units such as distillation columns are designed and operated separately. Instead, RD provides a multifunctional approach that can offer substantial economic, environmental, and technical benefits.

As the demand for sustainable, energy-efficient, and cost-effective processes in the chemical and petrochemical industries grows, RD emerges as an innovative solution. By integrating reaction and distillation, RD enhances conversion, reduces energy consumption, and minimizes capital costs. This article explores the fundamental principles, operational dynamics, advantages, disadvantages, and practical applications of reactive distillation, supported by literature and industrial examples.

Fundamental Concepts of Reactive Distillation

Reactive distillation combines two unit operations—chemical reaction and distillation—within the same equipment. The integration is particularly beneficial when the reaction is equilibrium-limited, as continuous removal of products via distillation shifts the reaction equilibrium toward higher conversions, according to Le Chatelier's principle.

The typical configuration of an RD column involves zones for reaction and separation. The reactive zone contains catalyst packing or trays where the chemical reaction occurs.

Above and below this zone are rectifying and stripping sections responsible for purifying the desired product and removing unwanted components. Above and below this zone are rectifying and stripping sections responsible for purifying the desired product and removing unwanted components.

Thermodynamic and Kinetic Considerations

Successful implementation of RD requires careful analysis of both thermodynamic and kinetic aspects. The volatility of components plays a critical role. Ideally, the reactants and products should have significantly different boiling points, enabling effective separation. Additionally, the reaction must proceed at a temperature that coincides with the boiling point range within the column.

Kinetic compatibility is equally vital. The reaction rate must be sufficiently high to achieve meaningful conversion within the residence time of the column. In some cases, specially formulated solid acid or base catalysts are used within the column packing to promote the reaction without causing pressure drop or fouling.

Types of Reactions Suitable for RD

Not all reactions are suitable for integration with distillation. RD is most effective for:

- Equilibrium-limited reactions: such as esterification, etherification, and hydrolysis.

- Reversible reactions: where continuous removal of one product enhances forward reaction.

- Mild exothermic/endothermic reactions: which align well with the thermal profile of the distillation column.

Examples include the synthesis of methyl tert-butyl ether (MTBE), ethyl acetate, and acetic acid.

Process Design and Control

Designing a reactive distillation column is a complex task involving simultaneous optimization of reaction and separation parameters. Key design variables include:

- Number and location of reactive stages

- Catalyst type and loading

- Feed location and composition

- Reflux ratio and reboiler duty

Process simulation tools such as Aspen Plus and HYSYS are frequently employed to model RD systems. These tools incorporate reaction kinetics, vapor-liquid equilibrium (VLE), and mass transfer correlations to predict performance.

Controlling RD columns poses additional challenges due to the strong coupling between reaction and separation. Changes in feed composition or column temperature can impact both reaction rate and separation efficiency. Advanced control strategies such as model predictive control (MPC) and inferential control are often adopted to maintain optimal operation.

Industrial Applications

Reactive distillation has been successfully implemented in several industrial-scale processes:

- MTBE production: One of the earliest and most cited applications, combining isobutylene and methanol in a catalytic distillation column.

- Esterification: Production of esters like ethyl acetate and butyl acetate using acetic acid and alcohols in RD columns.

- Hydrolysis and etherification: Reactions where product removal through distillation drives the reaction forward.

- Biodiesel production: Transesterification of triglycerides with methanol can benefit from RD to enhance yield and purity.

Research Trends and Innovations

Recent research in reactive distillation focuses on expanding its applicability to more complex systems, such as:

- Multicomponent and multi-reaction systems: Addressing interactions between parallel or sequential reactions.

- Azeotropic systems: Utilizing RD to break azeotropes without additional separation units.

- Membrane-assisted RD: Combining membranes with RD to enhance selectivity and separation.

- Dynamic modeling and AI integration: Using machine learning and dynamic simulations for real-time optimization and control.

Advantages of Reactive Distillation

Reactive distillation offers numerous benefits over conventional process configurations:

1. Process Intensification

Combining reaction and separation in a single unit reduces equipment footprint, piping, and auxiliary systems. This leads to a more compact and integrated plant layout.

2. Energy Efficiency

Heat generated by exothermic reactions can be utilized within the distillation column, reducing external energy requirements. Also, the distillation process helps maintain favorable temperatures for reactions.

3. Improved Conversion and Yield

Continuous removal of products shifts equilibrium toward higher conversion. This is particularly useful in reversible and equilibrium-limited reactions.

4. Reduced Capital and Operating Costs

Lower number of equipment and reduced energy usage translate into lower capital investment and operational expenditure.

5. Environmental Benefits

By improving efficiency and reducing waste, RD can contribute to greener chemical processes with lower emissions and byproduct formation.

6. Simplified Process Integration

RD facilitates easier heat integration and process optimization, making it attractive for retrofitting existing plants or designing new, compact processes.

Disadvantages and Limitations

Despite its advantages, reactive distillation is not universally applicable and poses several challenges:

1. Complex Design and Control

The strong interaction between reaction and separation complicates the design and control of RD columns. Small disturbances can lead to significant performance deviations.

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2. Limited Reaction Types

Only certain reactions, typically mild and equilibrium-limited, are suitable for RD. Highly exothermic or endothermic reactions may disrupt the thermal balance of the column.

3. Catalyst Limitations

Catalyst deactivation, fouling, and replacement pose maintenance challenges. Catalyst distribution within the column must be carefully managed to ensure uniform reaction rates.

4. Thermodynamic Constraints

The volatility differences between reactants and products must align with distillation principles. A narrow boiling point difference or formation of azeotropes may limit applicability.

5. Scalability Issues

While RD is effective at laboratory and pilot scale, scaling up to industrial levels requires meticulous attention to heat and mass transfer, pressure drops, and catalyst behavior.

Conclusion

Reactive distillation (RD) combines reaction and separation in one unit, improving efficiency, lowering costs, and supporting sustainability in chemical manufacturing. While it requires deep knowledge of thermodynamics, kinetics, and control systems, RD offers significant benefits for suitable processes. With advancements in catalysts, simulations, and controls, RD's industrial use is expected to expand, supporting a more sustainable chemical industry.

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Literary Section

Heights of Anticipation

In this segment, I recount a genuine incident that occurred with a colleague who had already completed his graduation. He was pursuing his postgraduate studies in Delhi and was on a vacation in his hometown when he noticed something amusing.

During his visit, his sister was in the process of applying for admission to a medical-based course at a government college. On the first day of the admission process, my friend dropped his sister off at the college and promptly returned home to pick up his mother.

Upon returning to the venue, he discovered that the program had already commenced. To his surprise, he found that his sister had been seated in the front row. Due to the heavy rush, my friend and his mother had to occupy the backseat rows as the program progressed.

As the program neared its conclusion, my friend noticed an elderly man sitting beside his mother and son. The man appeared to be in his fifties, and his son was also present with him. My friend was about to embark on his medical course at the same college when he caught sight of the man. In response, the man passed on a warm smile.

Upon seeing the smile, my friend conveyed it to his mother, explaining that the man sitting next to his mother believed that he was going to study at the same college. My friend's mother politely informed him not to engage in such misconceptions. After the program concluded, the middle-aged man approached my friend's mother and inquired, "Is your son a repeater?"

My friend burst into laughter and out of surprise his mother politely responded, "We are here for the admission of our daughter."

Kartik Iyer,
Assistant Professor,
Chemical Engineering

The Impact of Social Media on Mental Health in Students

The proliferation of social media platforms has presented adolescents with new channels for self-expression, communication, and affirmation seeking. Social media platforms like Facebook, Instagram, Snapchat, and Tik-Tok offer a never-ending stream of content that has the power to significantly impact kids' lives and wellbeing. Excessive engagement with social media has been associated with a range of mental health difficulties for teenagers.

Positive Effects of Social Media on Students' Mental Health

- **Connection and Support:**

Social media platforms provide an avenue for students to connect with family, friends, and peers. This is especially true during times of physical separation, such as going away to college, or having friends leave for their respective universities. Having an online support network can offer comfort, and reduce feelings of loneliness and isolation, which can all help ease the transition into college.

- **Information and Awareness:**

Social media can allow college students to stay informed about various current events, mental health issues, self- care techniques, and resources for seeking help. Online communities, at times, can also create safe spaces for individuals to share their struggles and experiences, fostering a sense of belonging.

- **Expression and Creativity:**

Social media platforms can serve as creative outlets for college students to express themselves through art, music, writing, or videos. Engaging in creative endeavors can promote positive mental well-being and self-esteem.

Literary Section

Negative Effects of Social Media on Students' Mental Health

• FOMO:

The fear of missing out (FOMO) on exciting events or opportunities can lead to a sense of inadequacy and loneliness and can create pressure to feel like the student must attend every event.

• Sleep Disruptions:

Excessive use of social media, especially before bedtime, can disrupt sleep patterns among students. Inadequate sleep can lead to increased stress and a decline in overall mental health.

• Addiction and Time Management:

Constant engagement with social media may lead to a lack of time management or even addiction, thus impacting academic performance and overall well- being.

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Literary Section

वो समंदर की लेहरें ।।।।

वो समंदर की लेहरें....जो बिन बोले भी दिल का हाल जान लेती है।

यू तो अक्सर वो आसमान साथ रेहता हैं,पर वो समंदर के किनारों का असर कहां आसमान सा लगता हैं।

जब भी देखती हूं वो समंदर को मैं अपने ख्वाबों में, की जब भी देखती हूं वो समंदर को मैं अपने ख्वाबों में,

हर बाते भूल के सिर्फ उसी में खो सी जाती हूं,

में सोचती हूं वो समंदर कुछ केह रहा हैं,

हर वो बात जो बिन बोले मैं समझ जाती हूं,

उस समंदर में पता नहीं क्या सुरूर है, बस वो सबसे बेहतरीन जगह के नाम से मशहूर है, और वहा का जो सुकून है वो ना जाने कहां का गुरुर हैं।

वो समंदर यूंही अपने आप में मशगुल हैं।।

लोग आते है यहां अपनी यादें लेने या अपनी यादें बनाने या यू कहूं कि यादें ताज़ा करने।।

वो यादों में खुशी के साथ गम भी छुपा हुआ हैं

वो यादों में दोस्ती के साथ वो अकेलापन भी छुपा हुआ हैं,

काश वो यादें हमें हमेशा याद रेहती,

वो डुबते सूरज की किरणे हमेशा साथ देती, बस यूंही सवालों से भरी हुई हैं ये दुनिया और ये यादें,

CONT...

Literary Section

वो समंदर की लेहरें ||||

इसलिए हर बार में सोचती हूं वो समंदर की लहरें, जो बिन बोले भी
दिल का हाल जान लेती है।

लगता नही था कि वो समंदर में कोई राज़ छुपा है, ना जाने कितने
लोगो का एक ख्वाब सा बसा है

वो खाव्ब में एक आशा लगाए बैठे हुए लोग ये सोचते हुए बैठे है कि
वो समंदर की लहरें जो बिन बोले भी दिल का हाल जान लेती हैं।।

Talk to yourself

When you're happy, you talk to yourself

When you're sad, you talk to yourself

When you feel lonely, you talk to yourself

Because when you talk to yourself you solve all

your problems with your own ways...

Payal Vasava
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Literary Section

The Breath of the Earth

Beneath the soil, where roots entwine,
The Earth exhales, both soft and fine.
A whisper carried on the breeze,
Through emerald leaves and towering trees.

The mountains hum, the rivers sing,
The sky unfolds its endless wing.
With every dawn, new hope is stirred,
In every stream, the future's heard.

But heavy grows the air with pain,
When forests fall like summer rain.
The breath that once was pure and deep,
Now stumbles, thin, begins to weep.

Yet still, the Earth believes in man,
To heal the wounds, revise the plan.
Plant the seed, protect the skies,
Let green once more before our eyes.

CONT...

Literary Section

The breath of Earth is life's own song,

A truth we've known so very long.

To guard this gift, both vast and small,

Is the greatest task of all.

Keya Prajapati
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Literary Article

My Daily Equilibrium

"Life is a balance of holding on and letting go."
— Rumi

In chemical terms, equilibrium is the state in which forward and backward reactions occur at the same rate — a balance, delicate but dynamic. It's not stillness; it's motion in harmony. And perhaps, that is the most accurate description of a student's life.

As a Chemical Engineering student, I've come to realize that equilibrium is not just a principle of chemistry — it is a principle of living.

Every day, I wake up with equations to solve and deadlines to meet. My mind races through formulas, reaction kinetics, and lab reports. But in the background, there are emotions — stress, doubt, fatigue, and the silent question: Am I enough?

This is the forward reaction — the drive to move ahead, to chase success, to make parents proud, to crack interviews, to build a future.

Then comes the reverse reaction — the moments of burnout, the thoughts of giving up, the desire to pause, to breathe, to just be.

And somewhere between these opposing flows lies my equilibrium.

I remember one particular week during my third semester — I had back-to-back submissions, a viva looming, and barely any sleep. I was running on coffee and panic. On the night before the big lab exam, I broke down crying over a titration error that wouldn't go away. But the next morning, my friend surprised me with my favourite snack and a pep talk that turned my whole mind-set around. That moment reminded me: equilibrium isn't about avoiding stress, it's about having the right elements around you to stabilize the chaos.

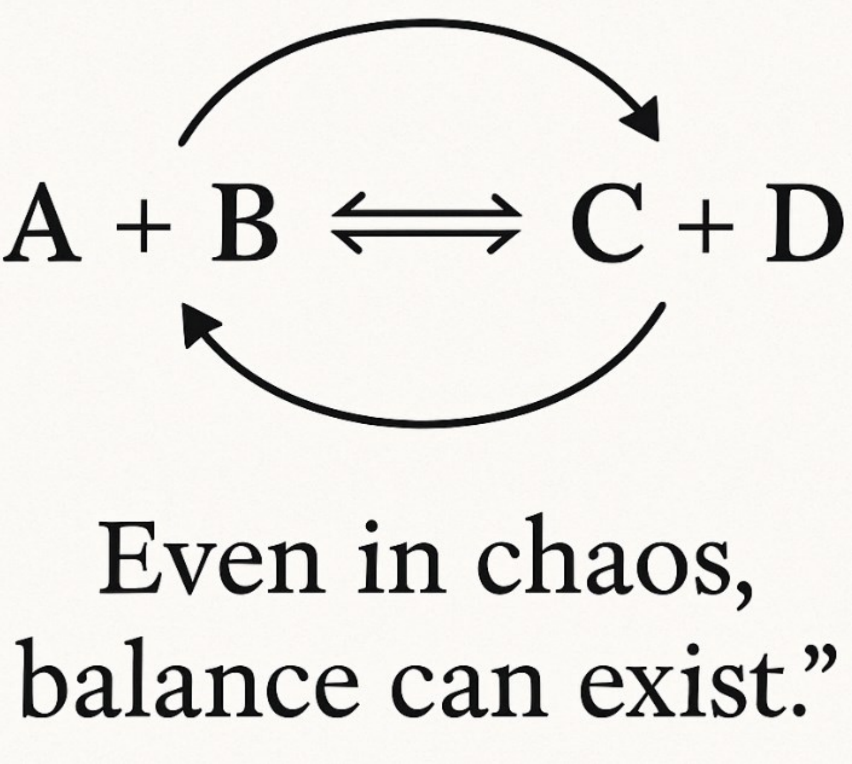
Literary Article

"Success is not the absence of failure; it's the persistence through failure."
— Aisha Tyler

It's not always perfect. Sometimes the system shifts — like when exams come close, or when results don't meet expectations. According to Le Chatelier's Principle, when a system at equilibrium is disturbed, it adjusts to counter the change. Isn't that what we do too?

We adapt. We bounce back. We shift gears, slow down, or speed up — until we find balance again.

In labs, we use catalysts to speed up reactions. In life, maybe friends, family, and small joys act as our catalysts — helping us cope, helping us grow.



"Balance is not something you find, it's something you create."
— Jana Kingsford

Literary Article

Equilibrium is not the absence of struggle — it is the coexistence of ambition and acceptance.

To my fellow students, I say this:

Don't aim for a life with no pressure — instead, aim for a state where your stress and strength are equal and opposite. Where you move forward, but also take time to reflect. Where you react, but also respond.

Because in the grand reaction of life, finding your equilibrium is not just a goal…….It's an art.

And like all art, it's personal. Some days you'll feel perfectly balanced — other days, you'll shift wildly in one direction. That's okay. Just remember, even in the most complex chemical systems, equilibrium can be re-established. So, give yourself grace. Surround yourself with your catalysts. Keep adjusting.

In the end, it's not about having a life without change — it's about learning to balance within the change.

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Literary Section

A Kind Me...

As I woke up,
I saw a dark black sky.
Land full of terror,
no one passing by.
Left all alone in the ocean of fear,
every time fell hard as I tried to dare.
Anger squeezing me inside,
failure pulling back aside.
Every emotion is a new threat,
A fight I can never win I bet!
The fight was within me I saw,
a fight that was eating me raw.
This was the moment of action,
no space for panic and reaction.
Exploring me was the only way.
My qualities uniqueness were a new Ray.
Realise that I am one of a kind,
Then every fight becomes a new delight.
No more afraid and frazzle,
Was proud to make out through to this battle.
The battle was within me, you and everyone,
Just defeated by telling it, that you are best and unique one.

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Sports Gallery

Students' Corner

Art by: Pandey Nitika Dharmendra
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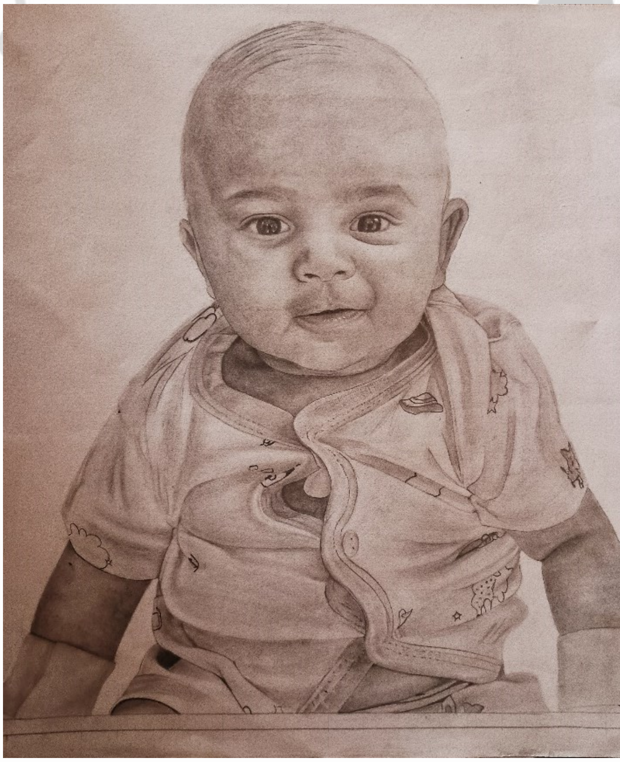
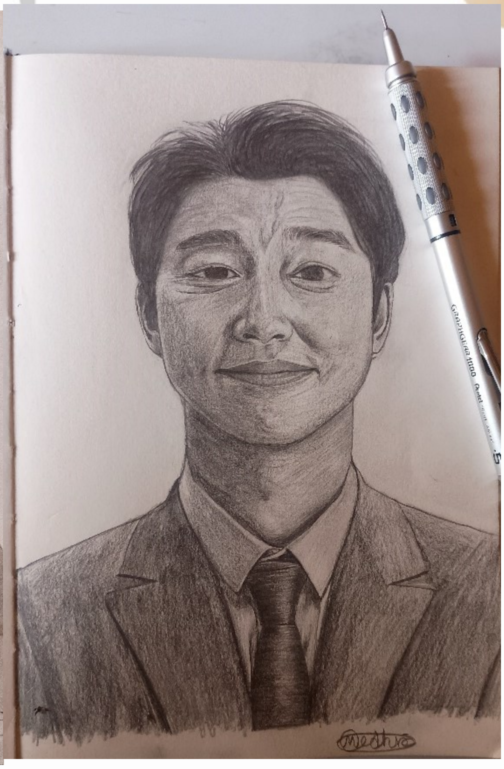
Students' Corner





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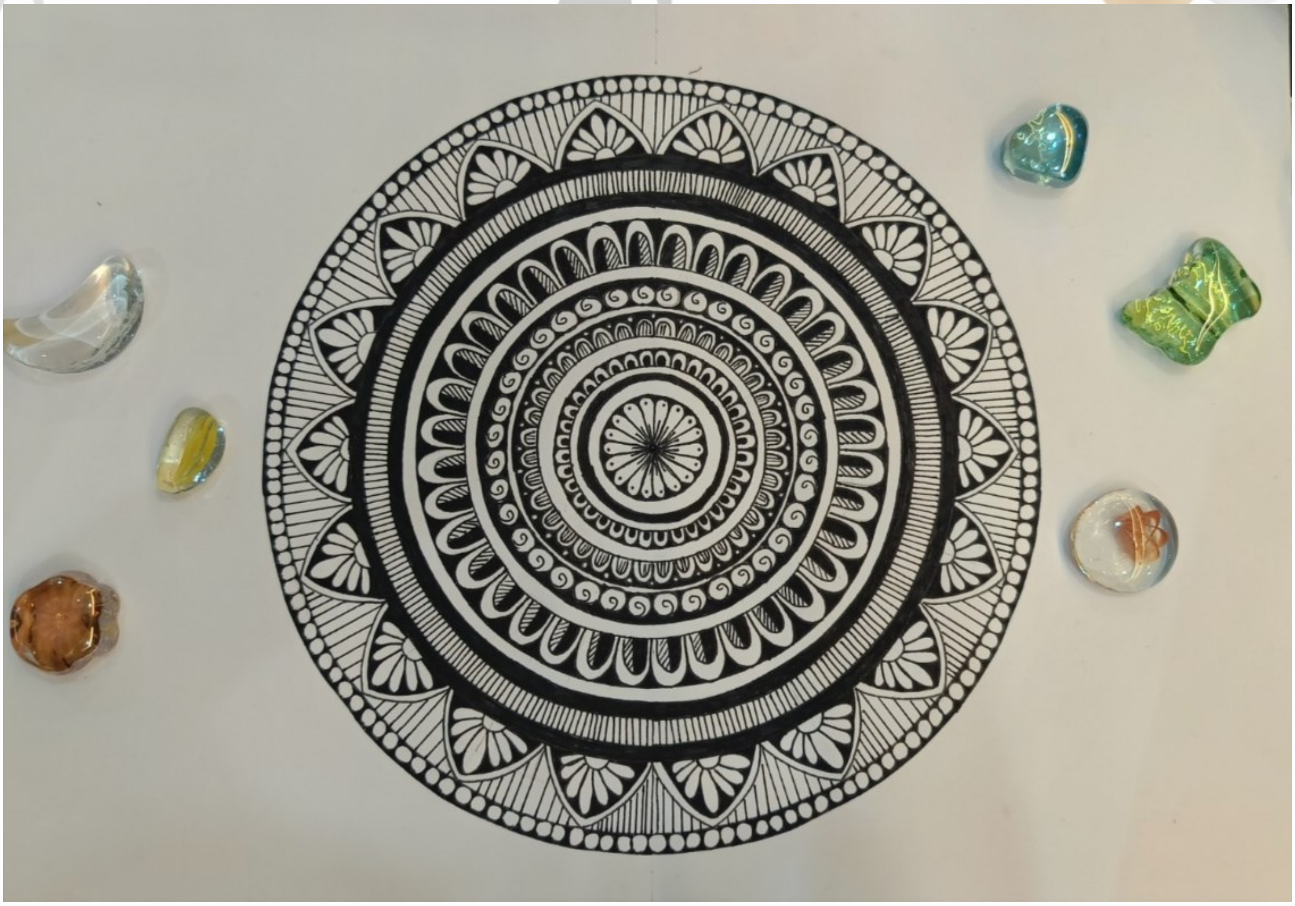
Students' Corner



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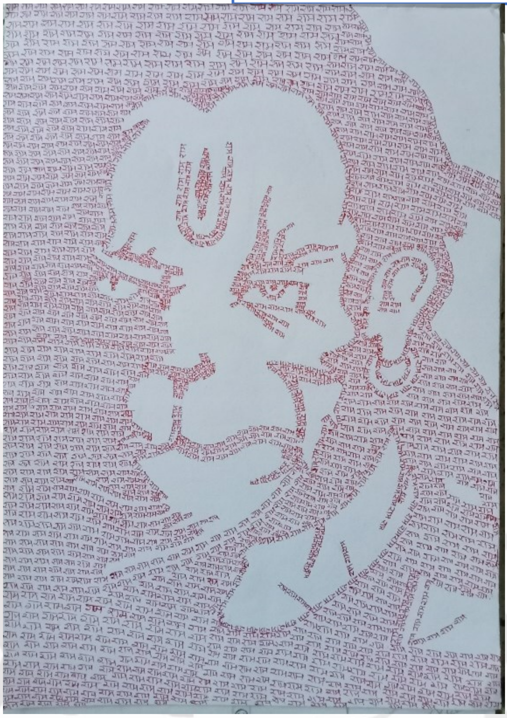

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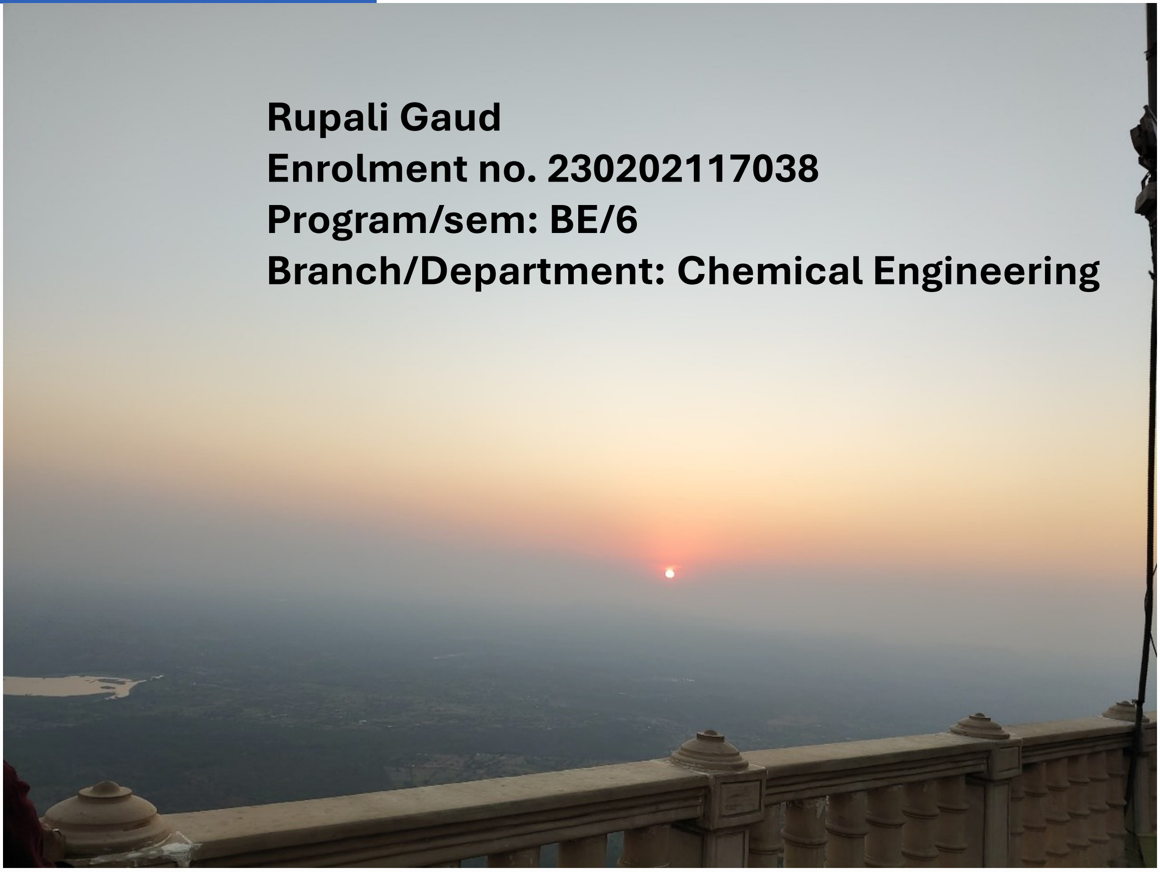
Students' Corner

Photography



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