INDUSTRIAL INTERNSHIP TRAINING REPORT

INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN,KASHMERE GATE

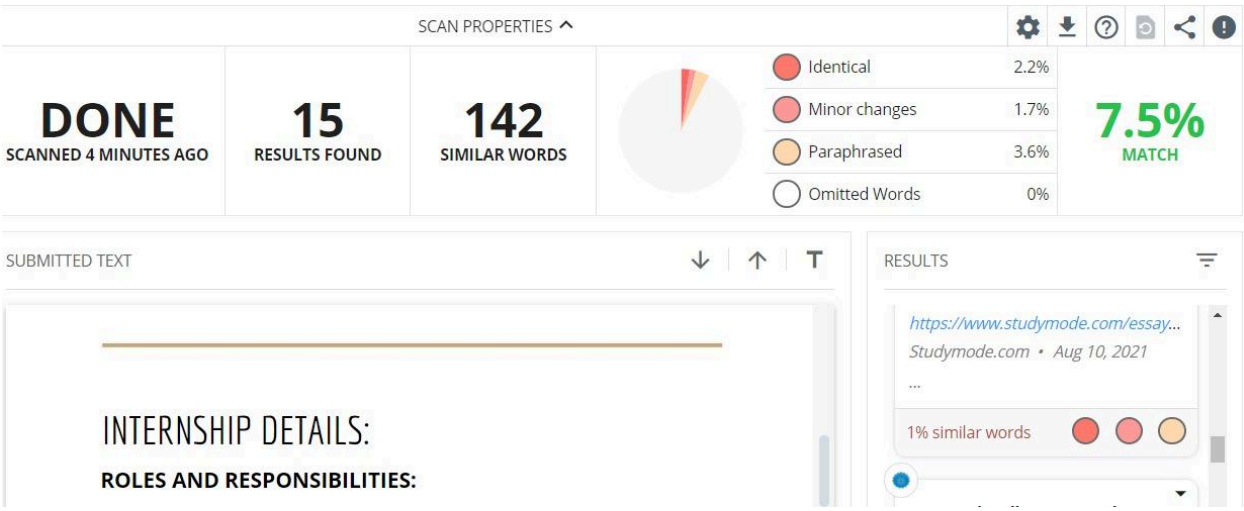
STARTED FROM: Dec’23-Jan’24

MADE BY:

VAISHNAVI RUKHAIYAR (09301042022)

UNDERTAKING REGARDING ANTI-PLAGIARISM:

I, Vaishnavi Rukhaiyar hereby, declare that the material/content presented in the report is free from plagiarism and is properly cited and written in our own words. In case plagiarism is detected at any stage, I shall be solely responsible for it.



ACKNOWLEDGEMENT:

It gives me immense pleasure to express my deep sense of gratitude to all those who have helped and guided me throughout our internship. I am deeply indebted to Mr G.S Prusty for giving me the opportunity to work for and face challenges in order to grow professionally and personally.I also wish to express my gratitude to my mentor Mr. Peeyush Pandey and Mr. Shashi Singh for their valuable suggestions and for sharing their vast reservoir of knowledge and experience during the entire duration of the internship. It was a great learning experience and, as a curtain-raiser to an exciting and rewarding career path.

I would like to express my deepest thanks to all my mentors for their valuable guidance,motivation,constant inspiration and above all for their ever-cooperating attitude that enabled me in bringing up this project work in the present form. My heartfelt gratitude for providing me the opportunity to avail the excellent facilities and infrastructure. I am equally thankful to all other faculty members and non teaching staff of the Mechanical and Automation Department for their guidance and support. I am also thankful to all my family members whose love,affection,blessings and patience encouraged us to carry out this project work successfully. I also extend my gratitude to all our friends for their cooperation.

VAISHNAVI RUKHAIYAR (09301042022)

DECLARATION:

I,Vaishnavi Rukhaiyar solemnly declare that the project report is based on my own work carried out within two weeks of internship training under Mr G S Prusty.I assert the statements made and conclusions drawn are an outcome of my work.I further certify that:

1) The work contained in the report is original and has been done by me under the supervision of my supervisor.
2) The work has not been submitted to any other institution for any other certificate in this university or any other university.
3) I have followed the guidelines provided by the university in writing the report.

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EXECUTIVE SUMMARY:

This report documents the experiences and knowledge gained during industrial training internship in Indian Oil Corporation Limited(IOCL) at Paradip Refinery. During my internship at Paradip Refinery, I had the opportunity to work in the mechanical workshop, where I came to know about the various refinery operations. My internship focused on gaining hands-on experience in plant processes, learning advanced mechanical systems, and understanding the integration of automation and AI in an industrial setting. This report highlights my roles, responsibilities, and key takeaways from this enriching experience.

INTRODUCTION:

BACKGROUND AND CONTEXT:

Indian Oil Corporation Limited is one of India's largest oil and gas companies, with Paradip Refinery being a critical facility in its network. The refinery focuses on the production of high-quality petroleum products through advanced processing units. My role in the mechanical workshop was crucial, as I was involved in maintaining and optimizing machinery used in various stages of refining operations. The growing reliance on automation and AI in industrial applications also allowed me to explore how cutting-edge technologies are being integrated into traditional mechanical systems.

The internship at IOCL Paradip Refinery was an integral part of my academic journey, providing practical exposure to refinery operations, mechanical engineering practices, and technological advancements in the energy sector. This experience allowed me to apply my theoretical knowledge in a real-world context, working alongside industry professionals to optimize mechanical systems and processes. The refinery’s state-of-the-art infrastructure and complex operations provided an ideal environment to enhance my technical and problem-solving skills.

OBJECTIVES OF THE INTERNSHIP:

The primary objectives of my internship were to gain a deep understanding of refinery operations, develop hands-on technical skills, and contribute to the optimization of mechanical systems. I aimed to enhance my knowledge of automation, machine maintenance, and plant safety protocols, while also learning how advanced technologies like AI can improve operational efficiency. Additionally, I sought to improve my communication and teamwork skills by collaborating with industry professionals.

INTERNSHIP DETAILS:

ROLES AND RESPONSIBILITIES:

As a Graduate Engineer Trainee in the mechanical workshop, my responsibilities included assisting with the maintenance and repair of refinery equipment, troubleshooting mechanical issues, and participating in process improvement initiatives. I also tried to understand the optimization of equipment performance by implementing preventive maintenance strategies by the officers. Working closely with senior engineers, I developed a deeper understanding of plant operations and the intricacies of mechanical systems.

LEARNING GOALS:

Throughout the internship, I set clear learning goals to enhance my technical proficiency and problem-solving capabilities. I focused on improving my understanding of mechanical automation, AI integration, and refinery safety protocols. By participating in hands-on projects and working alongside experienced professionals, I achieved significant growth in both my technical and interpersonal skills. This experience has prepared me to tackle more complex engineering challenges in the future.

PLANTS VISITED:

1) Atmospheric and Vacuum Distillation Unit (AVU):

1. UNIT CAPACITY:

AVU Capacity: 15 MMTPA (1802 MT/hr)

Turndown Capacity: 50%

Design Feed cases:

Light crude case: Basrah Light + Oman Export in the ratio 50:50

* Heavy crude case: Kuwait Export + Maya in the ratio 60:40

2. UNIT PURPOSE:

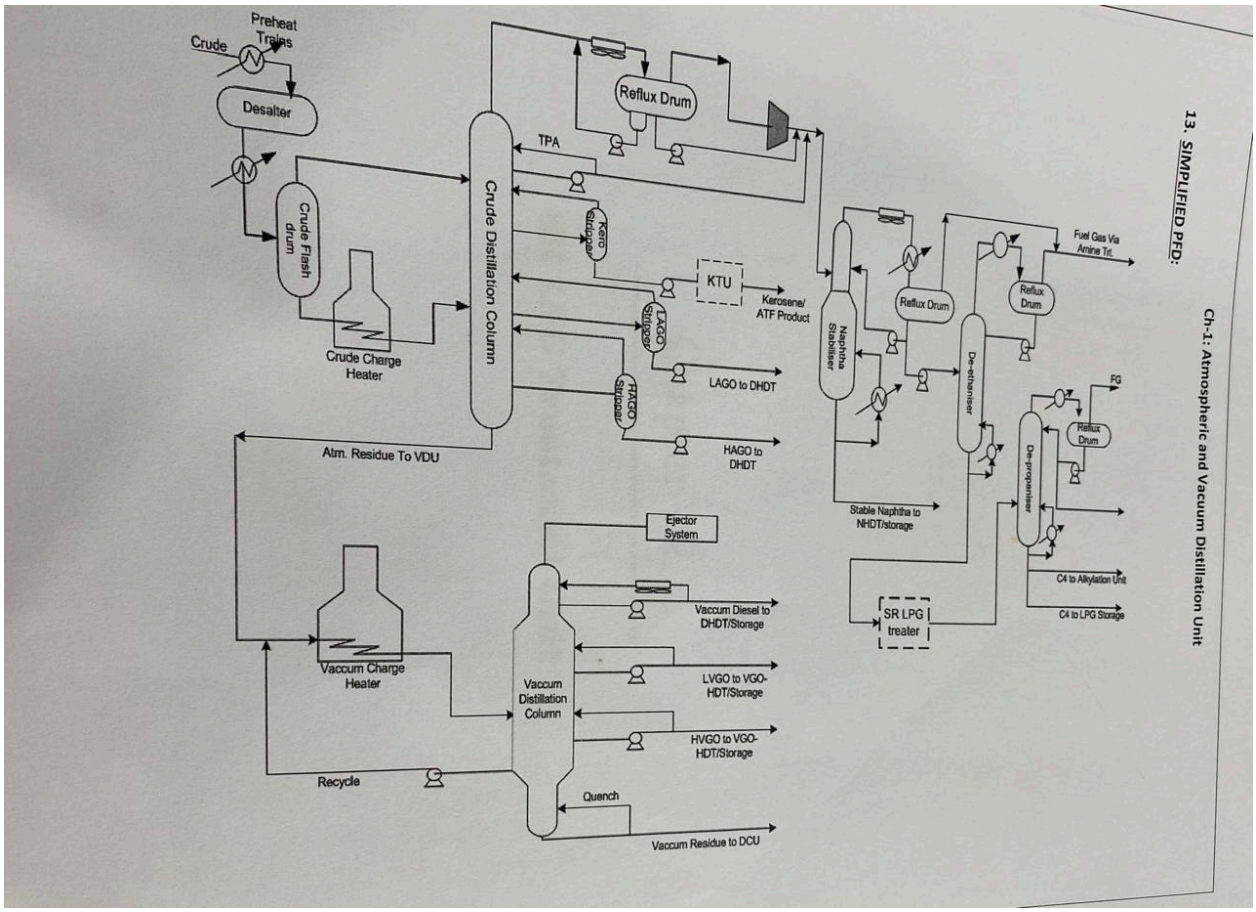
"The objective of the Atmospheric Vacuum Unit lAVU), which comprises of a crude distillation iNsUis (CDU), a vacuum distillation section (VDU) and a naphtha stabilizer and depropanizer section (NSU) is to provide a primary separation of crude oils to produce straight run blend stocks or distillate products and feedstocks for downstream process units like DHDT, NHDT, VGO-HDT, FCC/ INDMAX, DCU etc.

BRIEF PROCESS DESCRIPTION OF AVU:

AVU is called the Mother Unit of the refinery as the Crude oil is first processed in this unit for primary separation of crude oil to produce straight run blend stocks or distillate products (after suitable treating processes) and feedstocks for other downstream process units like DHDT, NHDT, VGO-HDT, FCC/INDMAX, DCU etc.

AVU comprises of a crude distillation section (CDU), a vacuum distillation section (VDU) and a naphtha

* stabilizer and depropanizer section (NSU).



2) Vacuum Gas Oil Hydrotreating Unit:

1. UNIT CAPACITY: 5.4 MMTPA (649.039 MT/h)

On Stream hours: 8320 per year

Turn down capacity: 50% of design capacity

2. UNIT PURPOSE:

Mild hydrocracking of VGO feed for maximizing MS / Propylene yield from IndMax

The main purpose of the VGO Hydrotreater (FCC feed Hydrotreater unit) is to generate high quality feed to the FCC unit by improving the quality of the VGO by removing contaminants and increasing the hydrogen content in the FCC feed.

Following are the benefits of pre-treating/hydro treating FCC feed

* FCC unit has improved operation with feeds containing low contaminants (metals), low sulfur, low nitrogen and high hydrogen.

* Low sulfur in FCC feed, reduces sulfur content in the FCC products and improves FCC yield.

Also may remove the need for further downstream hydro-treating of FCC products to reduce fuel sulfur content.

* Pre-treating the FCC feed also helps to minimize octane losses associated with saturating olefins and aromatics which are undesirable results of hydro-treating the FCC product streams.

* The lower sulfur content of the FCC feed also translates to lower SOx emissions from the FCC regenerator further assisting the refiner in being an environmental steward

* The lower nitrogen content of the pre-treated FCC feed increases catalytic cracking activity which results in higher conversion and FCC gasoline yields.

* Furthermore, a reduction in the metals content of the FCC feed translates to a reduction in FCC catalyst deactivation.

* In countries like India, where middle distillate demand is crucial. VGO Treating or Mild hydrocracking technology offers an opportunity to treat the feed streams to catalytic cracking units while converting some of the feed to cleaner middle distillates.

3) INDMAX (FCC) UNIT:

1. UNIT CAPACITY: 4.17 MMTPA (501.2 MT/h)

Turndown capacity: 50%

2. UNIT PURPOSE:

IndMax FCC unit is a variant of FCC (fluid catalytic cracker) unit. Unit is designed to upgrade heavier distillate feed stocks like VGO/HVGO & HCGO to more valuable light products viz., FCC gasoline, butylene, propylene and ethylene. Heavier feedstock is cracked using heat in the presence of a fluidised circulating catalyst.

The Indmax FCC technology is a unique solution (a mother unit) for vertical integration of refinery and petrochemical complexes.

* FCC gasoline: FCC gasoline is a high octane gasoline. It is one of the main MS blending component

* Butylene: Butylene is an Alkylation unit feed stream

* Propylene: Propylene is feed for Polypropylene production

* Ethylene: Ethylene is the feed for Mono Ethylene Glycol (MEG) production

4) Diesel Hydrotreater (DHDT):

1. DHDT UNIT CAPACITY: 5.2 MMTPA (625 MTPH)

- Turndown Capacity:50%
- Onstream Factor: 8320 hrs

2. UNIT PURPOSE:

The purpose of a DHDT Unit is to Hydrotreat the raw diesel feed for primarily removing sulfur (to <8pmw) & other contaminants and to improve cetane number (51 min) of the diesel product for meeting BS-VI diesel specification.

Hydrotreating process aims at the removal of impurities (metals, heteroatoms viz., Sulfur, Nitrogen, oxygen, and chlorine) present in the distillate fuels-naphtha, kerosene, and diesel-by treating the feed with hydrogen at elevated temperature and pressure in the presence of a catalyst. Hydrotreating at DHDT also improves Diesel product quality w.r.t cetane number (51 min) by saturating olefins & aromatics present in the feed.

5) SR LPG Treatment Unit :

1. UNIT CAPACITY:

SR LPG Treater Unit Capacity: 210 KTPA (25.24 MT/r)

Turndown Capacity: 30%)

On-Stream Factor: 8320 hrs/yr

UOP's Extraction Plus Technology is used for Merox process in this Unit

2. UNIT PURPOSE:

> Feed: LPG Ex AVU & LPG Ex VGO HDT (Crude Source: 50/50 Oman/Basrah)

> Purpose: To treat sour LPG to improve its odor, reduce sulfur content and to meet product specifications requiring negative Doctor Test

Sour LPG feed contains H25 and foul-smelling sulfur compounds called mercaptans (RSH). which are required to be removed (extracted) or converted to less-objectionable compounds called hydrocarbon disulfides.

First, H2S in LPG is removed by LPG Amine Contactor. Next, Merox process in applied for mercaptan removal

Merox is an acronym for Mercaptan Oxidation i.e., conversion of Mercaptans by Oxidation in the presence of proprietary UOP catalyst and in alkaline environment (Caustic Soda). This process is used for liquid-phase. The process is sometimes known as a sweetening process.

Merox is primarily used to sweeten mercaptans from LPG, light Naphthas, kerosene and jet fuel.

SKILLS ACQUIRED:

TECHNICAL SKILLS:

During my internship at IOCL Paradip Refinery, I developed and strengthened my technical skills in mechanical engineering, with a focus on refinery operations and automation. I gained hands-on experience in maintaining and optimizing mechanical systems, troubleshooting refinery equipment, and understanding process flows in units like Atmospheric and Vacuum Distillation (AVU), Vacuum Gas Oil Hydrotreating (VGO HT), and INDMAX (FCC). I also learned how to integrate AI and automation technologies to enhance plant efficiency and equipment performance.

SOFT SKILLS:

Throughout my time at the refinery, I honed essential soft skills such as communication, teamwork, and problem-solving. I collaborated with cross-functional teams, including senior engineers and technicians, and effectively communicate complex technical issues. My role also required adaptability and time management, as I navigated the fast-paced, high-pressure refinery environment while meeting deadlines and contributing to multiple projects.

TECHNOLOGIES USED:

The internship provided me with exposure to advanced refinery technologies and automation tools. I worked with modern equipment for distillation, hydrotreating, and fluid catalytic cracking, and learned how data analytics and AI can improve equipment maintenance and process optimization. Technologies related to machinery control systems, process automation, and monitoring systems were integral to my experience, allowing me to understand how real-time data is used to enhance operational efficiency.

CHALLENGES AND LEARNING EXPERIENCE:

ACHIEVEMENTS AND CHALLENGES DESCRIPTION:

One of my key achievements during the internship was contributing to equipment maintenance strategies . However, the challenges were equally significant. Adapting to the complex technical environment of the refinery and understanding the intricate operations of various units was a steep learning curve. Overcoming this challenge required continuous learning and collaboration with experienced professionals

SKILLS ACQUIRED:

I acquired a range of skills, including proficiency in equipment troubleshooting, preventive maintenance, and process optimization. My ability to understand refinery workflows improved, especially in areas like distillation and hydrotreating. Additionally, I gained skills in safety protocols and quality control, which are critical for working in high-risk industrial environments.

CHALLENGES AND LEARNING EXPERIENCE

One of the most significant challenges I faced was troubleshooting mechanical issues under tight deadlines, which required quick decision-making and adaptability. Working in the Vacuum Gas Oil Hydrotreating Unit (VGO HT) and INDMAX (FCC) Unit presented learning opportunities, especially in understanding how complex processes are automated and integrated. This experience has improved my technical problem-solving abilities and deepened my understanding of refinery operations.

CONCLUSION:

The internship at IOCL Paradip Refinery was a transformative experience that allowed me to apply my theoretical knowledge to real-world challenges. By working across different refinery units, I gained a comprehensive understanding of mechanical systems, automation, and refinery operations. This internship has strengthened my technical and soft skills, making me more confident in my ability to contribute to future engineering projects.

RECOMMENDATIONS:

Based on my experience, I would recommend incorporating more training programs focused on the latest automation technologies in refinery processes. Providing more opportunities for interns to work directly on AI-integrated systems would also enhance learning experiences and prepare them for future industry challenges. Strengthening collaboration between interns and senior engineers can further improve knowledge transfer and skill development.

ACKNOWLEDGEMENTS:

I would like to express my gratitude to the team at IOCL Paradip Refinery, especially the Mechanical Workshop team, for their guidance and support throughout my internship. Special thanks to my mentors Mr Shashi Singh and Mr. Peeyush Pandey and colleagues who provided valuable insights and helped me navigate the complexities of refinery operations. This experience has been instrumental in shaping my technical and professional growth.

REFERENCES:

Throughout my internship at IOCL Paradip Refinery, I received valuable guidance and mentorship from industry professionals and academic advisors. Their insights played a crucial role in enhancing my technical understanding and professional growth. I would like to particularly acknowledge Dr. Subhash Singh, my faculty advisor from IGDTUW, whose expertise in mechanical engineering and constant support greatly contributed to my learning. Additionally, Mr. Shashi Singh, Mechanical Engineer at IOCL Paradip Refinery, provided hands-on guidance in the mechanical workshop, helping me navigate the complexities of refinery operations. Their mentorship was instrumental in making this internship a meaningful learning experience.

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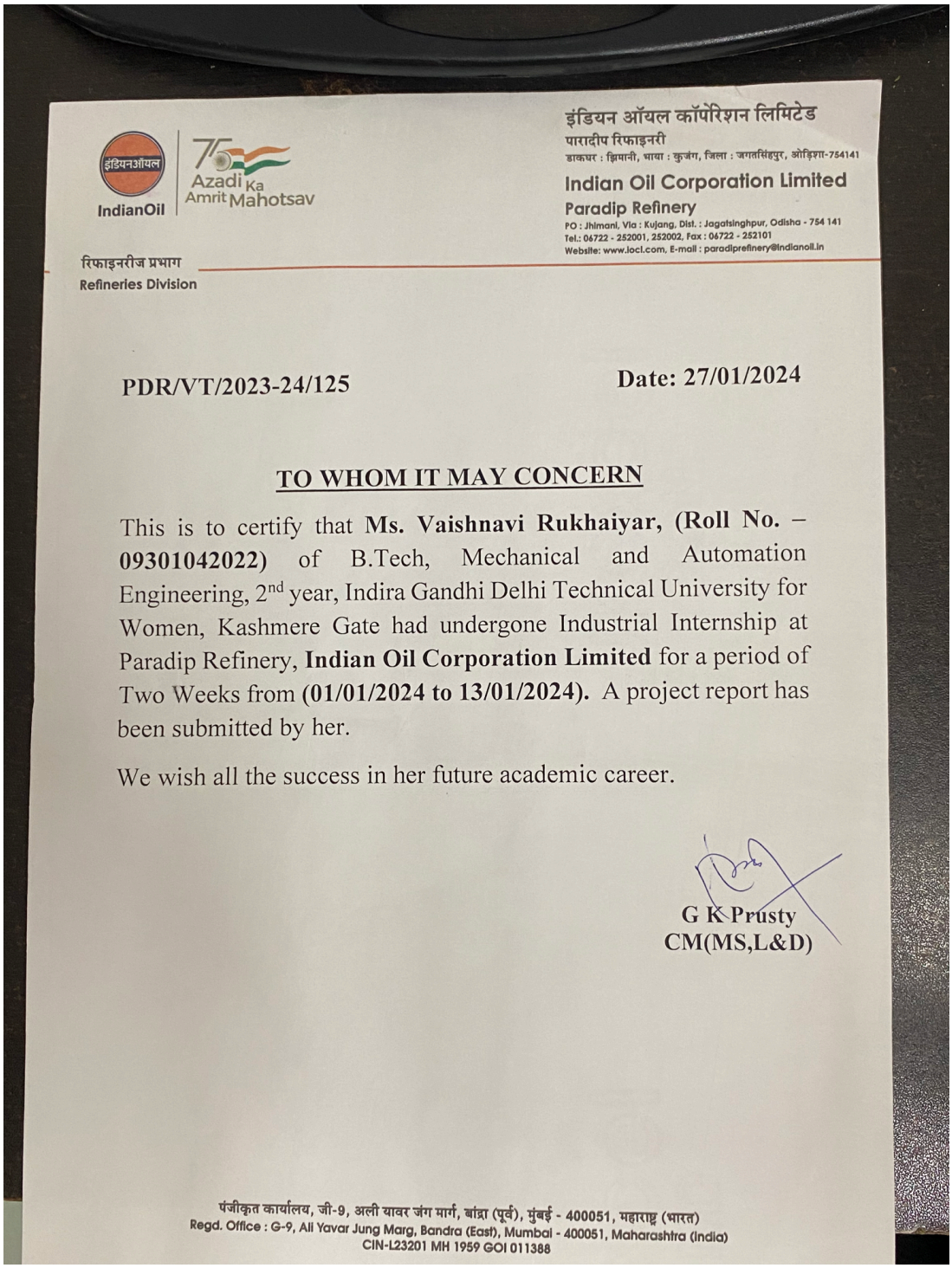

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PDR/VT/2023-24/125 **Date: 27/01/2024**

TO WHOM IT MAY CONCERN

This is to certify that **Ms. Vaishnavi Rukhaiyar, (Roll No. – 09301042022)** of B.Tech, Mechanical and Automation Engineering, 2nd year, Indira Gandhi Delhi Technical University for Women, Kashmere Gate had undergone Industrial Internship at Paradip Refinery, **Indian Oil Corporation Limited** for a period of Two Weeks from **(01/01/2024 to 13/01/2024).** A project report has been submitted by her.

We wish all the success in her future academic career.

G K Prusty
CM(MS,L&D)

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