ME-401 Summer Training Report

A project report submitted in partial fulfilment of the requirements for the degree of

Bachelor of Technology

by

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(Roll No. 220103006)

Under the supervision of

Fiat India Automobiles Pvt Ltd.

MIDC Ranjangaon, Pune

May 19 2025 – June 18 2025

Department of Mechanical Engineering

Indian Institute of Technology Guwahati

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TATA MOTORS

STELLANTIS

FIAPL/T&D/VT2024/0574

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr. Akshar Chauhan,** student at **Indian Institute Of Technology, Guwahati** has successfully completed his internship with us from **19th May 2025 to 18th July 2025.**

During this period, he was placed in **"PWT- Common Support Resources",** and his assignment was on **"Chip Separation In Block Machining"**

We found him to be sincere and hard working.

We wish him success in all his future endeavors.

Ashish Sharma
DGM Human Resources

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Received by
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Acknowledgment

I would like to express my deepest gratitude to my mentors and colleagues at Fiat India Automobiles Pvt Ltd, Pune, for providing me with the opportunity to work on an impactful project during my two month internship. I am especially thankful for their constant support, guidance, and encouragement throughout the course of my work. This experience has significantly enhanced my technical knowledge as well as my understanding of real-world industry development and practical applications.

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ABSTRACT

The purpose of this internship was to design a cost-effective method for separating aluminium and cast iron chips generated during the machining of 1.2L engine blocks at Fiat India Automobiles Pvt. Ltd. (FIAPL). The project involved analyzing the central coolant filtration system and identifying limitations in handling mixed chips, which deteriorate due to exothermic reactions if left unsegregated. A systematic methodology was developed, beginning with pre-treatment using a centrifugal chip dryer to reduce coolant carryover, followed by primary separation through a double magnetic drum separator for cast iron recovery, and a downstream eddy current separator to purify aluminium chips. The proposed design demonstrated recovery rates of 95–98% purity for cast iron and 92–95% for aluminium, with coolant recovery exceeding 95%. A techno-commercial study estimated the system's cost at ₹54.5 lakh, highlighting its industrial feasibility, economic benefits, and contribution to sustainable waste management. This internship provided practical exposure to industrial-scale separation technologies, design integration, and techno-economic evaluation in the automobile manufacturing sector.

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Chapter 1: Introduction

1.1 Motivation

In automobile manufacturing, the machining of engine blocks generates a significant quantity of mixed aluminium and cast iron chips. These chips, if not segregated promptly, undergo degradation due to exothermic reactions between the two metals, reducing their recycling value and increasing disposal costs. Developing an efficient and sustainable chip separation method is therefore crucial not only for minimizing waste but also for recovering valuable materials that can be reused in the production cycle.

1.2 Objectives

The primary objectives of this internship were:

1. *To study the existing **central coolant filtration system** and identify challenges in chip handling.*
2. *To design an **industrial-scale separation process** for aluminium and cast iron chips.*
3. *To propose and evaluate technologies such as **centrifugal chip dryers, magnetic drum separators, and eddy current separators** for efficient segregation.*
4. *To conduct a **techno-commercial analysis** of the proposed system and evaluate its economic feasibility.*
5. *To gain practical exposure to **automobile manufacturing operations, industrial design integration, and waste management practices**.*

1.3 Outline of the Report

This report begins with a literature review of chip generation and separation techniques used in machining operations. It then describes the methodology adopted during the internship, including process flow design and selection of equipment. The subsequent chapter presents the techno-commercial evaluation and expected results of the proposed system. Finally, the report concludes with interpretations, industrial implications, and future scope for implementing chip separation solutions in large-scale automobile manufacturing.

Chapter 2: Literature Review

In modern automobile manufacturing, machining processes such as cylinder block production generate large volumes of metal chips that must be managed effectively. Traditionally, these chips are collected through coolant filtration systems, where aluminium and cast iron scraps are mixed. However, the inability to separate them efficiently results in rapid degradation, reduced scrap value, and increased disposal costs.

Over the years, several ***chip handling and separation techniques*** *have been studied and implemented. Central coolant filtration systems, pre-separators, and Hydro-Vac filters are widely used for removing large particles and contaminants from coolant streams. While effective in coolant recovery, they do not ensure segregation of different chip materials.*

To overcome this limitation, industries have adopted ***magnetic drum separators*** *for extracting ferromagnetic particles such as cast iron from mixed chips. This technique provides high recovery rates for iron but requires additional processes to address non-ferrous materials.* ***Eddy current separators*** *have also been introduced to separate aluminium chips by inducing repulsive forces through alternating magnetic fields. When combined, these technologies allow for high-purity recovery of both cast iron and aluminium.*

Furthermore, pre-treatment systems such as ***centrifugal chip dryers*** *improve the efficiency of these separation methods by reducing coolant carryover and ensuring that chips are processed in a near-dry state. This integration of mechanical separation methods enhances recyclability, reduces waste disposal costs, and supports sustainable manufacturing practices in the automobile sector.*

Chapter 3: Methodology

The internship followed a structured approach:

1. ***Learning Phase:***

*Acquired an understanding of the **cylinder block machining process** and the functioning of the **central coolant filtration system** used at FIAPL. Studied the nature of mixed aluminium and cast iron chips, their interaction with coolant, and the challenges posed by degradation during storage.*

2. ***Exploration Phase:***

*Conducted a detailed study of existing **chip handling and separation technologies** such as centrifugal dryers, magnetic drum separators, and eddy current separators. Evaluated their industrial applicability, throughput capacity, and compatibility with wet/dry chips in order to identify the most suitable methods for FIAPL's production line.*

3. ***Implementation Phase:***

*Proposed a **multi-stage separation system** consisting of a centrifugal chip dryer (for coolant removal), a magnetic drum separator (for cast iron recovery), and an eddy current separator (for aluminium purification). Designed process flow diagrams, estimated throughput (~~3.5 TPH), and integrated automation requirements. A **techno-commercial analysis** was carried out to estimate costs (~~₹54.5 lakh) and calculate expected recovery efficiencies (Cast iron: 95–98% purity; Aluminium: 92–95% purity; Coolant: 95%+).*

Chapter 4: Results and Discussion

The proposed chip separation system demonstrated significant improvements in material recovery and waste management efficiency. The integration of a centrifugal chip dryer reduced coolant carryover by more than 90%, enabling efficient downstream processing and reclaiming coolant for reuse. The magnetic drum separator successfully recovered cast iron chips with a purity of 95–98%, while the eddy current separator enhanced aluminium recovery to 92–95% purity, with potential for further improvement through secondary processing.

The system also ensured coolant recovery exceeding 95%, reducing dependency on fresh coolant supply and lowering operational costs. A techno-commercial evaluation estimated the total setup cost at approximately ₹54.5 lakh, which is economically justified by the reduced waste disposal expenses and additional revenue streams from selling high-purity scrap materials.

Beyond technical results, the internship provided valuable exposure to industrial-scale separation technologies, process flow design, and cost-benefit analysis. The project highlighted how sustainable engineering practices can not only minimize environmental impact but also improve profitability in automobile manufacturing.

Chapter 5: Conclusion and Future Scope

Conclusion

This internship at Fiat India Automobiles Pvt. Ltd. (FIAPL), Pune, provided an excellent opportunity to understand the challenges of chip handling in automobile manufacturing and to design a cost-effective solution for mixed aluminium and cast iron chip separation. The proposed multi-stage system — comprising a centrifugal chip dryer, magnetic drum separator, and eddy current separator — demonstrated the potential to recover cast iron and aluminium with over 90% purity and reclaim more than 95% of coolant.

The techno-commercial evaluation highlighted the feasibility of implementing such a system at an industrial scale, with an estimated investment of ₹54.5 lakh justified by the reduction in waste disposal costs and the creation of revenue from high-quality scrap. This project not only emphasized the technical aspects of design and process optimization but also reinforced the importance of sustainable engineering practices in modern manufacturing.

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