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TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology
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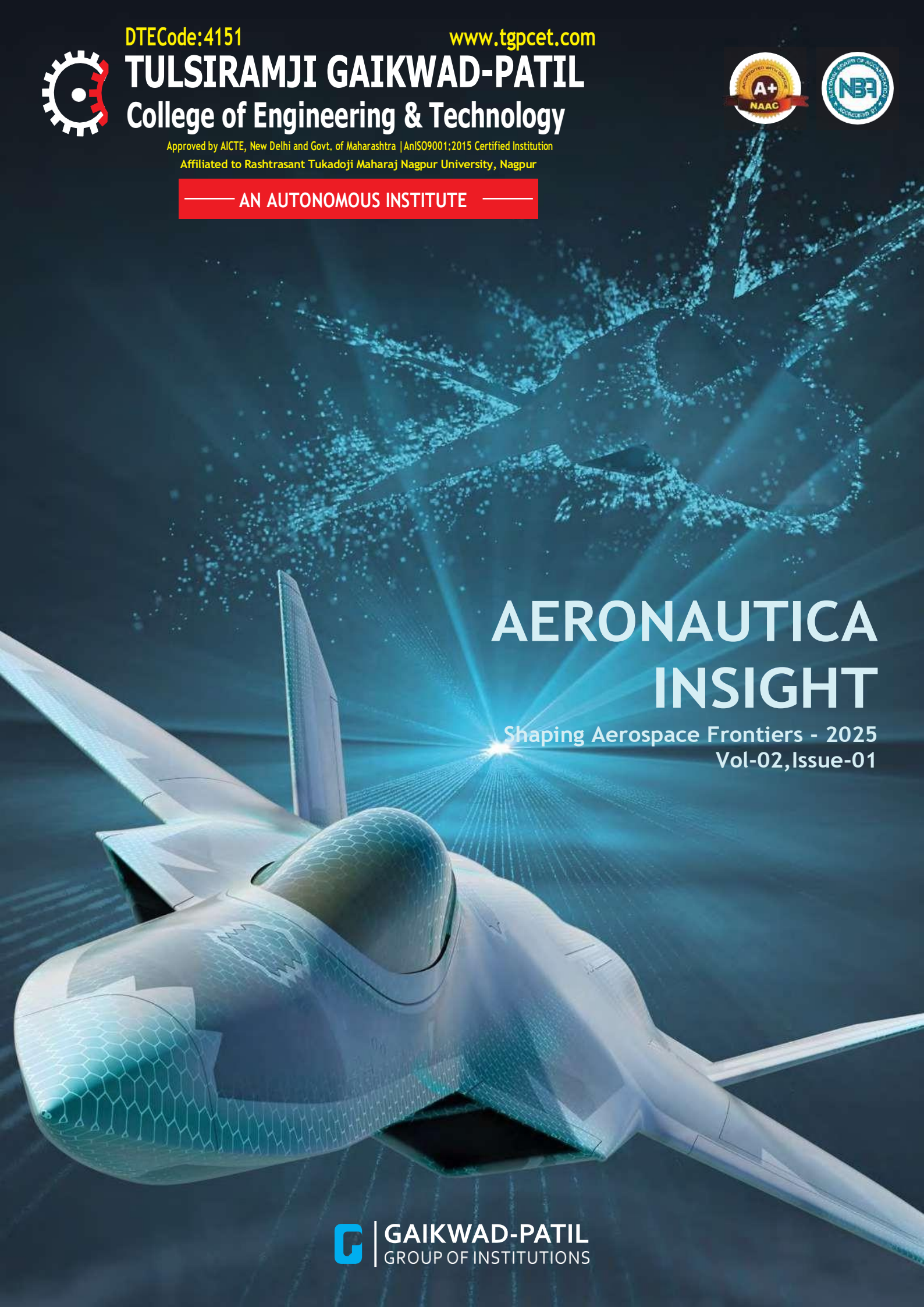
Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
AN AUTONOMOUS INSTITUTE

AERONAUTICA INSIGHT

Shaping Aerospace Frontiers - 2025

Vol-02, Issue-01



GAIKWAD-PATIL
GROUP OF INSTITUTIONS

Vision & Mission

Vision of the Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of the Institute

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To foster technically skilled Aeronautical Engineers of the utmost academic principles, to convene the needs of academia, industry and society.

Mission of the Department

- Impart quality technical education and unique inter disciplinary experiences.
- Develop the analytical, computational and design capabilities to provide sustainable solutions.
- Expose the students to the current trends and opportunities in the Aerospace industry.
- Inculcate professional responsibility based on an innate ethical value system.

PEO's & PSO's

PEO's

Graduates will be able to

PEO1 : Undergraduate students will acquire knowledge to investigate and solve Aeronautical Engineering problems using basics of applied science and engineering.

PEO2: Undergraduate students will utilize the modern technology and techniques to explore new skills and ideas to satisfy the need of society as well as industry.

PEO3: Undergraduatestudentswillgetfinestemploymentopportunitiesinthefieldof Aeronautical Engineering.

PEO4: Todeveloptheenvironmentofsocietalandethicalvaluestoconcernwithengineering issues.

PEO5 : Under graduate students will contribute in the domain-specific and inter-disciplinary research through the project based learning.

PSO's

Graduates will be able to

PSO 1: Develop profound working knowledge to solve a combination of complex problems in aerodynamics, propulsion, structures, flight mechanics and allied courses.

PSO 2: Be equipped to use CAE packages, simulation languages and advanced tools to solve practical design and analysis problems.

PSO3: Undergraduates will be able to utilize the extensive knowledge of design, manufacturing, testing or maintenance of systems and subsystems to pursue a career in aeronautical engineering.

PEO's & PSO's

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Graduates will be able to

PEO1 : Undergraduate students will acquire knowledge to investigate and solve Aeronautical Engineering problems using basics of applied science and engineering.

PEO2: Undergraduate students will utilize the modern technology and techniques to explore new skills and ideas to satisfy the need of society as well as industry.

PEO3: Undergraduate students will get finest employment opportunities in the field of Aeronautical Engineering.

PEO4: To develop the environment of societal and ethical values to concern with engineering issues.

PEO5 : Under graduate students will contribute in the domain-specific and inter-disciplinary research through the project based learning.

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About TGPCET

Tulsiramji Gaikwad-Patil College of Engineering and Technology (TGPCET) was established in the year 2007 by Vidarbha Bahu-uddeshiya Shikshan Sanstha (VBSS), aregistered society. It is a self financed Private Engineering College, which is affiliated to Rashtrasant Tukadoji Maharaj Nagpur University (RTMNU)Nagpur and is approved by All India Council for Technical Education, New Delhi. The college is approved by Directorate of Technical Education (DTE), Mumbai, Maharashtra State. The Institute is Accredited with A+ (3.32 CGPA) by NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL(NAAC).An Autonomous Institute affiliated to RTM Nagpur University, Nagpur.

The College offers four years UG programs in Nine disciplines of engineering viz. Bio-Technology(B.Tech), Aeronautical Engineering (AE), Computer Science and Engineering (CSE), Information Technology (IT), Electronics and Communication Engineering (ECE), Mechanical Engineering (ME), Civil Engineering (CE), Electrical Engineering (EE) Computer Science and Engineering (Data Science).

TGPCET offers Eight PG programs in engineering viz. Computer Science and Engineering (CSE), Integrated Power System (IPS), Structural Engineering (SE), Electronics and Communication Engineering (ECE),Artificial Intelligence, Machine Learning (AIML) & Mechanical Engineering design(MED),Aeronautical Engineering(AERO) and Electric Vehicle (EVT) and also offers Two years PG programs in Master of Business Administration(MBA)as well as Two years Master in Computer Application(MCA).

In addition TGPCET conducts three years Diploma programs in six disciplines of engineering such as Civil Engineering (CE), Mechanical Engineering (ME), Computer Science and Engineering (CSE) and Electrical Engineering (EE), Electronics and Communication Engineering (ECE) and Information Technology (IT).

College is located in the midst of Multimodal International Cargo Hub and Airport (MIHAN) and also in the vicinity of Butibori Industrial area, Nagpur.

This sanstha is started by the dedicated and renowned academicians genuinely committed to impart quality technicaleducationtothestudents,whoareaspiringforcarrierinEngineering,TechnologyandManagement.

Collegeoffersadditionalcoursesbeyondsyllabustoexposethestudentstowardstheindustrialclimateby conducting courses in C++ with PYTHON, C#.NET, Java, Oracle-SQL and Administration, CCNA, PLC SCADA, MATLAB,AUTOCAD,STAADPRO,CREO,PHP.

The college has signed MoU with Charusat University, Gujrat Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola and Vignan's University, Guntur to excel the academic and research capability of staff and students in the emerging fields of Science, Engineering and Agriculture.

The staff having versatile rich experience in teaching, research and industry are educating students of all sections of society to foster Quality Education and to build high moral standards.

B.Tech | B.Arch | M.Tech | MBA | MCA | Polytechnic | BAMS | D.Pharm | B.Pharm | B.ScNursing | Physiotherapy

About Department

The Department of Aeronautical Engineering was established in 2020 with an intake of 60 students in the UG course. The department has also started a PG program in Aeronautical Engineering with an intake of 12 in the year 2023. Aeronautical engineering involves researching, designing, constructing, testing, and manufacturing of the aircraft within Earth's atmosphere. It also covers the investigation into aerodynamic elements of aircraft, including behaviors and related factors such as control surfaces, lift, airfoil, and drag. The Department aims to cultivate expertise in specialized fields within aeronautical engineering, including aircraft structural design, aerodynamics, propulsion systems, and guidance and control systems, with an emphasis on research and innovation.

The aeronautical engineering department features several specialized labs: Aero-Thermodynamics Lab, Fluid Mechanics and Machinery Lab, Aerodynamics Lab, Aircraft Structures Lab, Propulsion Lab and CAD/CAE Lab, offering students hands-on experience in advanced research and practical applications. The department has well qualified and experienced faculties from IITs, NITs and Government institutes having excellent academic as well as research contribution. The aeronautical engineering department offers a vibrant and enriching environment for students.

The student-run Aerocious forum hosts guest lectures and workshops, while the drone club organizes competitions and projects, providing opportunities for practical experience and fostering innovation in drone technology and applications. The department encourages students to engage in research and publish papers. They are also motivated to participate in international and national conferences, providing them with valuable opportunities to present their work, network with industry professionals, and stay informed about the latest advancements in the field.

MESSAGE

Dr. MOHAN GAIKWAD-PATIL
Chairman, Gaikwad-Patil Group

With more than twenty years of experience in education system to his credit ,established the Gaikwad-Patil Group of Institutions in Nagpur to cater to the quality education needs of the youth in Vidarbh. His early experience of teaching in an engineering college made him acutely aware of the dissonance between engineering education in the country and the requirements of the industry. He therefore began with a dream of starting an engineering college that equips students with knowledge ,skills and attitudes relevant to the industry. That dream has manifested today in the form of two engineering colleges, well known in the region for their constants striving to impart quality and industry-relevant education to their students. Hardly in his early forties, Dr. Gaikwad is the young and dynamic face of the Group. His contagious enthusiasm and unflagging drive is truly inspiring.

Dr. P .L .NAKTODE
Principal

It gives me immense pleasure and pride in welcoming you to Tulsiramji Gaikwad-Patil College of Engineering & Technology, one of the rapidly growing institutions in Vidarbha, dedicated to fostering technical education in the region. The vision of our institution is to empower youths and to produce technically skilled manpower with very high moral values that are not only employable but are also capable of creating employment for masses. Our mission is to provide outcome-based education by providing all necessary inputs, facilities and environment to empower our students in all possible ways. We understand that co-curricular and extra-curricular activities help in enhancing ones personality. This institution provides an environment for nurturing these activities so that young men and women get an opportunity to upgrade their skills and show cases their talent. To strengthen the wings of our students we have dynamic and dedicated workforce. Tulsiramji Gaikwad-Patil College of Engineering & Technology is committed to employing, developing and retaining the best teachers.

Dr Pragati Patil Bedekar
Vice Principal

Albert Einstein said, "Education is not about learning of facts but training young minds to think."There is a big difference between cramming up facts and learning them so that they can be applied in productive ways. At TGPCET, we try to work towards holistic development of our students by providing them the tools and experiences that encourage our students to think. The aim is to create empowered minds so that students are able to decide what is good for them, differentiate between right and wrong, choose opportunities that help build them up and enable them to live in harmony with all existence. As the Vice Principal, I am delighted that the institute's values align with my own personal values, including the importance of trust, respect, innovation and a sense of community.

HoD Desk

It is with great pleasure and enthusiasm that I extend a warm welcome to each of you as we embark on yet another exciting edition of "Aeronautica Insight," the official magazine of the Aeronautical Engineering Department at TGPCET, Nagpur.

As the Head of the Aeronautical Engineering Department, I take immense pride in presenting this platform that encapsulates the spirit, achievements, and aspirations of our vibrant department. "Aeronautica Insight" serves as a window into the world of aeronautical innovation, academic prowess, and collaborative endeavors that define our department's identity.

Aeronautical Engineering is a field that thrives on the pursuit of knowledge and the relentless quest for pushing the boundaries of what is possible. In this edition, we showcase the academic excellence achieved by our students and faculty, both in the classrooms and through groundbreaking research initiatives. From theoretical concepts to real-world applications, we aim to provide our readers with a comprehensive view of the dynamic field of Aeronautical Engineering.

Our faculty members, who are not only educators but also mentors and guides, play a pivotal role in shaping the academic journey of our students. Through their dedication and expertise, they inspire a love for learning and foster an environment where curiosity and critical thinking are celebrated.

"Aeronautica Insight" also highlights the numerous extracurricular activities, workshops, and events that contribute to the holistic development of our students. We believe in nurturing well-rounded individuals, and this magazinereflectsthemyriadtalentsandachievementsofourstudentsbeyondtheacademicrealm.

Collaboration lies at the heart of innovation, and we are proud to showcase the partnerships and collaborations that our department has forged with industry leaders, research institutions, and alumni. These collaborations not only provide valuable opportunities for our students but also contribute to the advancements in aerospace technology.

I extend my gratitude to the editorial team for their tireless efforts in curating this magazine, and to all contributors for sharing their insights and experiences. "Aeronautica Insight" is not just a publication; it is a testament to the collective spirit and achievements of the Aeronautical Engineering Department at TGPCET.

I encourage all readers to delve into the pages of this magazine, explore the stories within, and gain a deeper understanding of the exciting world of Aeronautical Engineering. May this edition inspire you, inform you, and spark your curiosity.Wishing you an enlightening and enjoyable reading experience!

Prof. Vishwajeet Ambade, B.E., M-Tech, PhD*.
Assistant Professor and Head of Department

Editor Desk

Welcome to the latest edition of "Aeronautica Insight," the heartbeat of the Aeronautical Engineering Department at TGPCET. As editors, it is our privilege to present a tapestry of narratives that reflect the dynamic and ever-evolving natureofaerospacetechnologyandthecollectivespiritofouracademiccommunity.

In the realm of Aeronautical Engineering, where innovation meets precision, every project is a journey, every challenge is an opportunity, and every discovery is a triumph. As you flip through the pages of this magazine, we invite you to embark on a journey with us—an exploration of the frontiers of aerospace science and engineering.

Our contributors, adverse and talented group of individuals, have poured their passion in to these pages. From insightful research articles to captivating stories of personal experiences, each piece offers a unique perspective on the multifaceted world of Aeronautical Engineering. We extend our sincere gratitude to these individuals for sharing their expertise, shedding light on complex concepts, and bringing the magic of aviation to life.

At the heart of our department is a community of dedicated faculty, staff, and students who work tirelessly to push the boundaries of knowledge. "Aeronautica Insight" is a celebration of their achievements, a showcase of their collaborative efforts, and a testament to the pursuit of excellence that defines our academic environment. We believe in nurturing not only skilled engineers but also creative thinkers, problem solvers, and leaders who will shape the future of aerospace technology.

This magazine is more than just a compilation of articles; it is a reflection of our commitment to fostering a holistic learning experience. Beyond the classroom, we highlight the extracurricular activities, workshops, and events that contribute to the all-encompassing development of our students. It is in these diverse experiences that future leaders in Aeronautical Engineering are forged.

As editors, we would like to express our gratitude to the entire editorial team for their dedication and hardwork. Designers, writers, photographers—each played a crucial rol0- bringing this publication to life. Their creative efforts have given "Aeronautica Insight" avisual and narrative richness that we hope you will find engaging and inspiring.

To our readers, we extend an invitation to immerse yourselves in the stories within these pages, to explore the challenges and triumphs, and to share in the excitement of Aeronautical Engineering. Thank you for being a part of our journey, and we hope you find this edition of "Aeronautica Insight" both informative and enjoyable.
Happy reading!

Prof.Jonna Naresh
B.E.,M-Tech., PhD*

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Publication

Title: Impact of Al2O3 Nanofluid on Vibration and Temperature Reduction in Machining

Authors: Laukik P. Raut1 · Shilpa M. Vinchurkar1 · Vednath P. Kalbande1 · Manoj S. Choudhari2 · Neha Purohit3 · Prachi Tawele4 · Nilesh Awate

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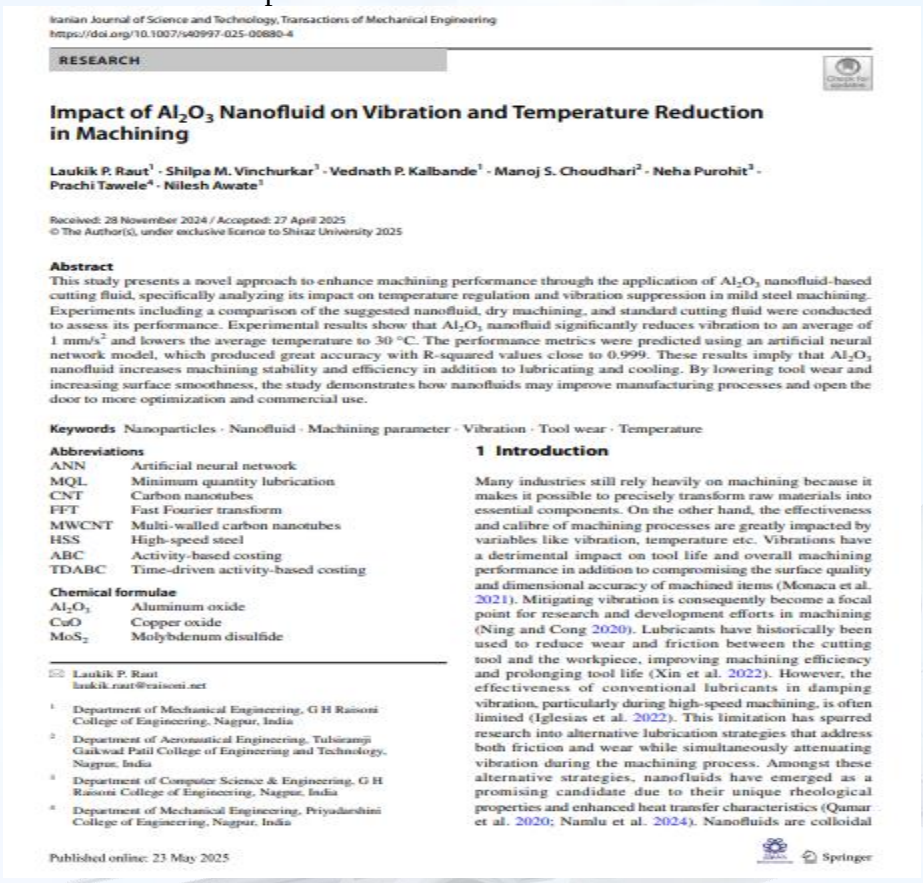
Abstract:

This study presents a novel approach to enhance machining performance through the application of Al2O3 nanofluid-based cutting fluid, specifically analyzing its impact on temperature regulation and vibration suppression in mild steel machining. Experiments including a comparison of the suggested nanofluid, dry machining, and standard cutting fluid were conducted to assess its performance. Experimental results show that Al2O3 nanofuid significantly reduces vibration to an average of 1 mm/s2 and lowers the average temperature to 30 °C. The performance metrics were predicted using an artificial neural network model, which produced great accuracy with R-squared values close to 0.999. These results imply that Al2O3 nanofluid increases machining stability and efficiency in addition to lubricating and cooling. By lowering tool wear and increasing surface smoothness, the study demonstrates how nanofluids may improve manufacturing processes and open the door to more optimization and commercial use. Keywords Nan particles · Nanofluid · Machining parameter · Vibration · Tool wear · Temperature



Iranian Journal of Science and Technology, Transactions of Mechanical Engineering
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RESEARCH

Impact of Al_2O_3 Nanofluid on Vibration and Temperature Reduction in Machining

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Abstract
This study presents a novel approach to enhance machining performance through the application of Al_2O_3 nanofluid-based cutting fluid, specifically analyzing its impact on temperature regulation and vibration suppression in mild steel machining. Experiments including a comparison of the suggested nanofluid, dry machining, and standard cutting fluid were conducted to assess its performance. Experimental results show that Al_2O_3 nanofluid significantly reduces vibration to an average of 1 mm/s^2 and lowers the average temperature to 30 °C. The performance metrics were predicted using an artificial neural network model, which produced great accuracy with R-squared values close to 0.999. These results imply that Al_2O_3 nanofluid increases machining stability and efficiency in addition to lubricating and cooling. By lowering tool wear and increasing surface smoothness, the study demonstrates how nanofluids may improve manufacturing processes and open the door to more optimization and commercial use.

Keywords Nanoparticles · Nanofluid · Machining parameter · Vibration · Tool wear · Temperature

Abbreviations

ANN	Artificial neural network
MQL	Minimum quantity lubrication
CNT	Carbon nanotubes
FFT	Fast Fourier transform
MWCNT	Multi-walled carbon nanotubes
HSS	High-speed steel
ABC	Activity-based costing
TDABC	Time-driven activity-based costing

Chemical formulae

Al_2O_3	Aluminum oxide
CuO	Copper oxide
MoS_2	Molybdenum disulfide

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1 Introduction

Many industries still rely heavily on machining because it makes it possible to precisely transform raw materials into essential components. On the other hand, the effectiveness and calibre of machining processes are greatly impacted by variables like vibration, temperature etc. Vibrations have a detrimental impact on tool life and overall machining performance in addition to compromising the surface quality and dimensional accuracy of machined items (Monaca et al. 2021). Mitigating vibration is consequently become a focal point for research and development efforts in machining (Ning and Cong 2020). Lubricants have historically been used to reduce wear and friction between the cutting tool and the workpiece, improving machining efficiency and prolonging tool life (Xin et al. 2022). However, the effectiveness of conventional lubricants in damping vibration, particularly during high-speed machining, is often limited (Iglesias et al. 2022). This limitation has spurred research into alternative lubrication strategies that address both friction and wear while simultaneously attenuating vibration during the machining process. Amongst these alternative strategies, nanofluids have emerged as a promising candidate due to their unique rheological properties and enhanced heat transfer characteristics (Qamar et al. 2020; Namlu et al. 2024). Nanofluids are colloidal

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Title: Mechanical Testing and Characterization of Paraffin Wax with Polypropylene Binder 158 and Aluminum Additive

Authors: Himani Harpal, Kalpit P. Kaurase, Vishwajeet Ambade

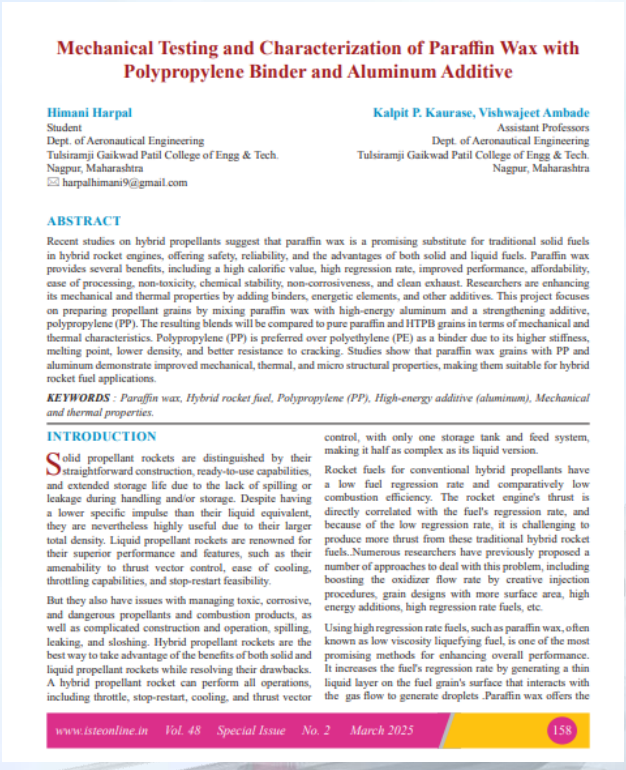
Journal; INDIAN JOURNAL OF TECHNICAL EDUCATION Volume 48 • Special Issue • No 2 • March 2025

Indexed In: UGC Care

ISSN 0971-3034

Abstract:

ABSTRACT Recent studies on hybrid propellants suggest that paraffin wax is a promising substitute for traditional solid fuels in hybrid rocket engines, offering safety, reliability, and the advantages of both solid and liquid fuels. Paraffin wax provides several benefits, including a high calorific value, high regression rate, improved performance, affordability, ease of processing, non-toxicity, chemical stability, non-corrosiveness, and clean exhaust. Researchers are enhancing its mechanical and thermal properties by adding binders, energetic elements, and other additives. This project focuses on preparing propellant grains by mixing paraffin wax with high-energy aluminum and a strengthening additive, polypropylene (PP). The resulting blends will be compared to pure paraffin and HTPB grains in terms of mechanical and thermal characteristics. Polypropylene (PP) is preferred over polyethylene (PE) as a binder due to its higher stiffness, melting point, lower density, and better resistance to cracking. Studies show that paraffin wax grains with PP and aluminum demonstrate improved mechanical, thermal, and micro structural properties, making them suitable for hybrid rocket fuel applications. KEYWORDS : Paraffin wax, Hybrid rocket fuel, Polypropylene (PP), High-energy additive (aluminum), Mechanical and thermal properties



Mechanical Testing and Characterization of Paraffin Wax with Polypropylene Binder and Aluminum Additive

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ABSTRACT

Recent studies on hybrid propellants suggest that paraffin wax is a promising substitute for traditional solid fuels in hybrid rocket engines, offering safety, reliability, and the advantages of both solid and liquid fuels. Paraffin wax provides several benefits, including a high calorific value, high regression rate, improved performance, affordability, ease of processing, non-toxicity, chemical stability, non-corrosiveness, and clean exhaust. Researchers are enhancing its mechanical and thermal properties by adding binders, energetic elements, and other additives. This project focuses on preparing propellant grains by mixing paraffin wax with high-energy aluminum and a strengthening additive, polypropylene (PP). The resulting blends will be compared to pure paraffin and HTPB grains in terms of mechanical and thermal characteristics. Polypropylene (PP) is preferred over polyethylene (PE) as a binder due to its higher stiffness, melting point, lower density, and better resistance to cracking. Studies show that paraffin wax grains with PP and aluminum demonstrate improved mechanical, thermal, and micro structural properties, making them suitable for hybrid rocket fuel applications.

KEYWORDS : Paraffin wax, Hybrid rocket fuel, Polypropylene (PP), High-energy additive (aluminum), Mechanical and thermal properties.

INTRODUCTION

Solid propellant rockets are distinguished by their straightforward construction, ready-to-use capabilities, and extended storage life due to the lack of spilling or leakage during handling and/or storage. Despite having a lower specific impulse than their liquid equivalent, they are nevertheless highly useful due to their larger total density. Liquid propellant rockets are renowned for their superior performance and features, such as their amenability to thrust vector control, ease of cooling, throttling capabilities, and stop-restart feasibility.

But they also have issues with managing toxic, corrosive, and dangerous propellants and combustion products, as well as complicated construction and operation, spilling, leaking, and sloshing. Hybrid propellant rockets are the best way to take advantage of the benefits of both solid and liquid propellant rockets while resolving their drawbacks. A hybrid propellant rocket can perform all operations, including throttle, stop-restart, cooling, and thrust vector control, with only one storage tank and feed system, making it half as complex as its liquid version.

Rocket fuels for conventional hybrid propellants have a low fuel regression rate and comparatively low combustion efficiency. The rocket engine's thrust is directly correlated with the fuel's regression rate, and because of the low regression rate, it is challenging to produce more thrust from these traditional hybrid rocket fuels. Numerous researchers have previously proposed a number of approaches to deal with this problem, including boosting the oxidizer flow rate by creative injection procedures, grain designs with more surface area, high energy additions, high regression rate fuels, etc.

Using high regression rate fuels, such as paraffin wax, often known as low viscosity liquefying fuel, is one of the most promising methods for enhancing overall performance. It increases the fuel's regression rate by generating a thin liquid layer on the fuel grain's surface that interacts with the gas flow to generate droplets .Paraffin wax offers the

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Patents/Design Registration

Design Registration - UK

Title of Design:-AI-Driven Wearable Device

Design Registration Details:

- Design Number: 6356165
- Registered Under: UK Registered Designs Act 1949
- Date of Registration: 29 March 2024
- Grant Date: 17 June 2024
- International Design Classification:
  - Class 10: Clocks, Watches, Measuring Instruments
  - Subclass 02: Watches and Wrist Watches

Registered Contributors:

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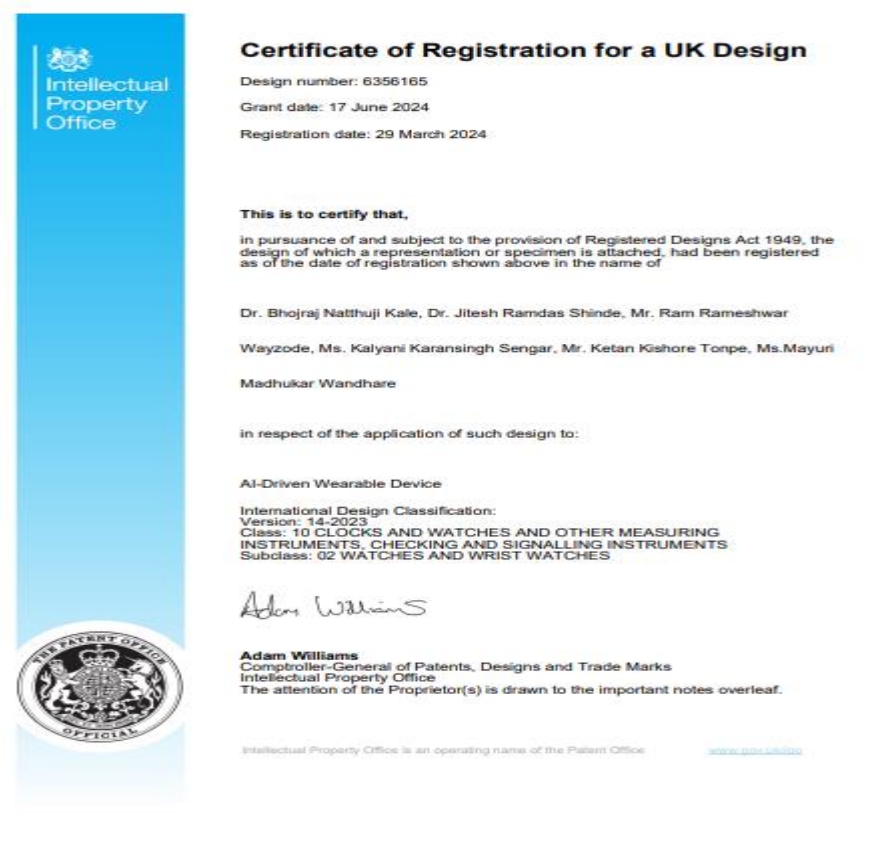
- Mr. Ketan Kishore Tonpe

Certifying Body:UK Intellectual Property Office



Intellectual Property Office

Certificate of Registration for a UK Design

Design number: 6356165

Grant date: 17 June 2024

Registration date: 29 March 2024

This is to certify that,

in pursuance of and subject to the provision of Registered Designs Act 1949, the design of which a representation or specimen is attached, had been registered as of the date of registration shown above in the name of

Dr. Bhojraj Natthuji Kale, Dr. Jitesh Ramdas Shinde, Mr. Ram Rameshwar Wayzode, Ms. Kalyani Karansingh Sengar, Mr. Ketan Kishore Tonpe, Ms.Mayuri Madhukar Wandhare

in respect of the application of such design to:

AI-Driven Wearable Device

International Design Classification:
Version: 14-2023
Class: 10 CLOCKS AND WATCHES AND OTHER MEASURING INSTRUMENTS, CHECKING AND SIGNALLING INSTRUMENTS
Subclass: 02 WATCHES AND WRIST WATCHES

Adam Williams
Comptroller-General of Patents, Designs and Trade Marks
Intellectual Property Office
The attention of the Proprietor(s) is drawn to the important notes overleaf.

Book Chapter Publication

Title of the Chapter: Nanoparticles as Effective Fuel Additive for Internal Combustion Engine: A Review

Authors:

- Dr. Bhojraj N. Kale
- Dr. Vivek G. Parhate
- Mr. Ram Wayzode
- Ms. Kalyani Sengar
- **Ms. Mayuri Wandhare**
- Mr. Ketan Tonpe

Book Title: Technological Innovations & Applications in Industry 4.0

- Edition: 1st Edition
- First Published: 2025
- Publisher: CRC Press (Taylor and Francis Group)
- eBook ISBN: 9781003567653
- Total Pages: **6**

ABSTRACT

A colloidal dispersion of nanoparticles scattered over a liquid medium is called nanofluid. It enhances the characteristics of heat transport and encourages great energy efficiency in a variety of technical applications. Because of its outstanding thermo physical qualities, adding nanofluid to diesel as well as biodiesel to serve as an additive for internal combustion engines has become a popular strategy in nearby years, particularly in the automobile industry to encourage increased combustion efficiency along with pollution reduction. Numerous studies have already shown that addition of nanoparticles into diesel/biodiesel fuel enhanced the general properties of the engine. The overall aim of this work is to offer an overview of recent research on the impact of nanoparticles on fuel characteristics and engine performance. A summary of the benefits and potential applications of nanofluid as an additional fuel is also provided in this article.

Chapter

Nanoparticles as effective fuel additive for internal combustion engine: a review

By Bhojraj N. Kale, Vivek G. Parhate, Ram Wayzode, Kalyani Sengar, Mayuri Wndhare, Ketan Tonpe

Book Technological Innovations & Applications in Industry 4.0

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Smart Aero elastic Blades: Harnessing Magneto rheological Elastomers for Next-Gen Aerospace Stability

In the relentless pursuit of safer and more efficient aerospace structures, innovation often lies in smart materials. One such advancement is the integration of Magneto rheological Elastomers (MREs) into rotating composite sandwich blades—offering intelligent vibration damping and adaptive structural performance. This research investigates the aero elastic stability of rotating tapered composite sandwich blades embedded with MRE cores under supersonic flow conditions.

The study explores the aero elastic response and dynamic stability of carbon-epoxy composite blades with varying MR core configurations. The unique aspect of the research lies in its examination of non-conservative axial loads and magnetic field influences on blade performance during high-speed rotation.

The blade is modeled using Timoshenko beam theory, capturing shear deformation and rotary inertia effects. A finite element method (FEM) is developed to simulate vibration and flutter behavior under complex loading scenarios. Material configuration: 4-ply laminated carbon-epoxy face sheets sandwiching an MRE core. To ensure credibility, preliminary FEM results are validated through: Laboratory-scale experimental setup, 3D finite element analysis for high-fidelity verification.

These steps establish a strong foundation for real-world applicability of the findings. The analysis highlights the influence of the following parameters on critical aerodynamic pressure and damping:
Magnetic field intensity, Taper ratio of the blade, MR layer thickness, Rotational speed
A complex interaction of centrifugal forces, aerodynamic loads, and magneto elastic forces defines the dynamic response of the blade. A neural network-based surrogate model is trained to map the input-output relationship between design parameters and blade performance. Using this model: A genetic algorithm is applied for multi-objective optimization. The goal is to maximize aerodynamic stability and enhance damping capabilities.
This study marks a significant step toward intelligent rotor blade design for helicopters and turbo machinery, where real-time adaptability and aero elastic robustness are critical. The integration of MREs provides a pathway to programmable damping and adaptive response under extreme aerodynamic conditions, potentially revolutionizing modern aero elastic applications.

Prof. Naresh Jonna
Assistant Professor

Aero-Thermal Analysis in Jet Engines

Jet engines represent the pinnacle of thermal-fluid engineering, where the principles of thermodynamics meet the demands of high-speed propulsion. The thermal behavior of air as it flows through a jet engine is a critical factor in determining the engine's performance, fuel efficiency, and reliability. This article explores the aero-thermal fundamentals in jet propulsion, the Brayton cycle, and advanced turbine cooling techniques.

At the heart of jet propulsion is the Brayton Cycle, an idealized thermodynamic cycle that models the operation of a gas turbine engine. It involves four key processes:

Isentropic Compression (via the compressor)

Constant Pressure Combustion (in the combustion chamber)

Isentropic Expansion (through the turbine)

Exhaust to produce thrust (via the nozzle)

Each of these steps involves heat transfer and pressure variations that are crucial for thrust generation and engine efficiency.As air passes through the compressor, it is pressurized and its temperature rises. In the combustion chamber, this high-pressure air mixes with fuel and is ignited, reaching temperatures of over 1500°C. The turbine then extracts energy from these hot gases to power the compressor and other systems.

Thermal efficiency and material integrity depend on:

Managing peak combustion temperatures

Minimizing thermal losses

Controlling flow dynamics and heat transfer across components

Turbine Cooling Techniques

Since turbine blades are exposed to extreme heat, cooling becomes a vital engineering task.

Real-World Applications

Jet engines such as the GE90 (used in Boeing 777) or Rolls-Royce Trent XWB (Airbus A350) showcase advanced thermal management and turbine cooling designs. These engines optimize combustion efficiency while keeping structural integrity intact under extreme thermal loads.

Moreover, military aircraft like the F-22 Raptor use variable-cycle engines and advanced cooling to maintain performance during supercruise and stealth operations.

Prof. Mayuri Wandhare Dhoble
Assistant Professor

"Evolution and Components of Modern Aircraft Navigation Systems"

Navigation is the backbone of aviation. Without accurate and reliable navigation systems, aircraft would be unable to safely traverse global skies, especially under poor visibility or over long distances. From traditional compasses to satellite-based positioning, aircraft navigation systems have evolved into sophisticated technologies that ensure safety, efficiency, and accuracy in every flight.

Evolution of Aircraft Navigation

Dead Reckoning-Early aviators used estimates of time, speed, and direction to calculate position—a technique known as dead reckoning.
Radio Navigation-The introduction of VOR (VHF Omni directional Range) and DME (Distance Measuring Equipment) allowed aircraft to fix their positions using ground-based stations.
Inertial Navigation Systems (INS)-By using gyroscopes and accelerometers, INS allows navigation without relying on external signals—ideal for long-distance or military flights.
Global Positioning System (GPS)-Today, GPS has revolutionized navigation by offering real-time, satellite-based position tracking with remarkable accuracy, often within a few meters.

Major Components of Modern Navigation Systems

VOR/DME Receivers-Help pilots determine aircraft bearing and distance from ground stations.
Flight Management System (FMS)-Integrates GPS, INS, and navigation databases to automate flight planning and execution.
Attitude and Heading Reference Systems (AHRS)-Provide 3D orientation data using gyros and magnetometers.
Autopilot Integration-Allows navigation data to guide flight paths, especially on commercial airliners.
Air Data Computers (ADC)-Provide altitude, airspeed, and temperature, aiding accurate navigation.
Role of Satellite Navigation (GNSS)
Most modern aircraft use GNSS (Global Navigation Satellite Systems)—including GPS, GLONASS, Galileo, and BeiDou—to determine precise global positions. Aircraft use WAAS/EGNOS systems to improve GPS accuracy and integrity for precision approaches.

Example:

During low-visibility conditions, a GPS-based RNP approach allows landing without reliance on ground-based ILS infrastructure.

Application in Commercial and Military Aircraft

Commercial Aviation-Airlines use advanced FMS linked to GPS and inertial systems for fuel-efficient routing, time-based arrivals, and terrain avoidance .Military Aviation-Stealth aircraft use INS-GPS hybrid systems with anti-jamming features and encrypted positioning. UAVs and Drones Rely on lightweight GPS/IMU combos for autonomous navigation, enabling missions in remote or hazardous areas.

Prof. Shrikant D. Kathwate
Assistant Professor

Case Study: Deployment of UAV Swarms in Post-Earthquake Disaster Response

Background

On October 30, 2020, a 7.0 magnitude earthquake struck the Aegean Sea, affecting parts of Greece and Turkey. In the wake of the disaster, traditional ground-based rescue efforts were hindered due to collapsed infrastructure, blocked roads, and continued aftershocks. In this complex environment, Unmanned Aerial Vehicles (UAVs) proved invaluable.

Objective

To evaluate the effectiveness of deploying UAV swarms for rapid situational assessment, search and rescue operations, and humanitarian aid delivery.

UAV Systems Used

Fixed-Wing UAVs: Long-range surveillance with high-endurance flight time (up to 10 hours).
Quadcopters/Multirotors: High maneuverability, ideal for urban mapping and close-range observation.
Hybrid VTOL UAVs: Used for parcel delivery (food, water, medicine).

Payloads included:

- Multispectral and thermal imaging cameras
- 3D LiDAR scanners
- Communication relay modules
- Emergency supply drop mechanisms

Implementation Strategy

Swarm Intelligence: A network of over 20 UAVs operated semi-autonomously using a decentralized command protocol. Swarm behavior allowed area coverage up to 100 km² within 2 hours.
Edge AI Integration: Onboard AI systems classified debris, detected human movement, and identified heat signatures.
Real-time Data Relay: UAVs transmitted information to a central control unit via satellite uplinks and mobile LTE networks.

Outcomes

Victim Localization: Over 150 people located within 24 hours by analyzing thermal and acoustic signals.
Aid Efficiency: Over 300 kg of supplies delivered to 40 inaccessible zones.
Mapping and Damage Assessment: Generated high-resolution 3D models for structural engineers within 48 hours.

Prof. Himani Harpal
Assistant Professor

STUDENT ARTICLE

Urban Air Mobility (UAM): The Future of Transportation Takes Flight

In the rapidly advancing world of aeronautics, *Urban Air Mobility (UAM)* stands out as a transformative concept promising to reshape the way people and goods move within cities. Imagine air taxis zipping above traffic, drones delivering emergency supplies to congested areas, or electric vertical take-off and landing (eVTOL) vehicles operating like flying cabs. UAM is no longer a distant dream; it's an emerging reality supported by aerospace giants, startups, and national governments.

Global Developments

United States: NASA's UAM Grand Challenge has brought together major aerospace players like Boeing, Bell, and Joby Aviation to develop and test UAM ecosystems.
Europe: Projects like EHang and Volocopter are advancing pilotless air taxi trials in German and French cities.
Asia: Japan and South Korea aim to deploy air taxis by 2025, leveraging domestic tech and transport systems.

India's Entry into UAM

India is also exploring UAM potential. The Ministry of Civil Aviation and private players like ePlane Company and TechEagle are working on prototypes. Notably:
IIT-Madras startup ePlane is building India's first electric flying taxi aimed at urban commuting.
Drone corridors and air traffic policy frameworks are being explored under India's Drone Rules 2021.
Urban congestion in metros like Bangalore and Mumbai makes India an ideal market for UAM solutions.

Future Outlook

By 2035, it is estimated that urban air mobility could generate $1.5 trillion in economic value globally. With smart city integration and supportive policies, UAM could complement metro systems, reduce pollution, and cut travel time dramatically. For aeronautical engineers, it presents a dynamic opportunity in aircraft design, autonomous control systems, and AI-driven airspace management.

Urban Air Mobility is not just an aviation breakthrough—it's a societal shift. For aerospace students and professionals, UAM offers a fresh canvas for innovation. Whether designing quieter rotors, managing urban air traffic, or building next-gen batteries, the future of flight lies just above the rooftops.

Miss Sakshi Khandwe
8th Sem Aeronautical Engineering

Evolution of Supersonic Aircraft – The Next Mach Leap”

From the legendary Concorde to futuristic aircraft like Boom Supersonic’s Overture, humanity continues to push the boundaries of speed. Supersonic flight refers to travel faster than the speed of sound (Mach 1).

Historical Highlights:

1947: Chuck Yeager breaks the sound barrier in Bell X-1. On October 14, 1947, U.S. Air Force pilot Chuck Yeager became the first person to fly faster than the speed of sound in level flight. He achieved this milestone in the Bell X-1, a rocket-powered research aircraft launched from a B-29 bomber.

1976: Concorde begins commercial supersonic service. The Concorde, developed jointly by British and French aerospace firms, began commercial flights in 1976. With a cruising speed of Mach 2.04 (about 1,354 mph) and a sleek delta-wing design, Concorde reduced transatlantic flight time to under 3.5 hours. It was a symbol of technological achievement and luxury air travel.

2003: Concorde retires due to high operational costs. After 27 years of service, Concorde was retired in 2003. Contributing factors included high fuel consumption, limited passenger capacity, rising maintenance costs, and a decline in passenger demand following the 2000 crash and post-9/11 travel downturn. Environmental concerns and restricted overland routes due to sonic booms also played a role.

Modern Innovations:

Boom Overture: Aiming for Mach 1.7, using sustainable aviation fuel.

NASA X-59 QueSST: Designed to minimize sonic booms, promoting overland supersonic travel.

Challenges Ahead:

Environmental noise regulations.

High development and operating costs.

Efficient engine and material technologies.

Supersonic aviation is no longer science fiction. With new technology, eco-conscious designs, and growing interest, the return of supersonic commercial flight is closer than ever.

Mr. Harshad Wandhre

8th Sem Aeronautical Engineering

GUEST LECTURE

Guest Lecture on "Entrepreneurship and Advance Opportunities in Drone Technologies Sector" conducted at Department of Aeronautical Engineering, TGPCET, Nagpur

1.	Date	20th September 2024
2.	Venue	Department of Aeronautical Engineering, TGPCET, Nagpur
3.	Organized By	Aerocious Forum, Department of Aeronautical Engineering
4.	Guest Name & Designation	Mr. Smitesh Chinchore, Co-Founder & CTO, Aerovenia Pvt. Ltd., Nagpur
5.	Company Name	Aerovenia Pvt. Ltd., Nagpur
6.	Topics Covered	Entrepreneurship in Drone Sector, Drone Swarming, Hybrid VTOL Drones, Python in Drone Automation , Multidisciplinary Approach, Future Market Trends, AI & Neural Networks
7.	Student Participation	78

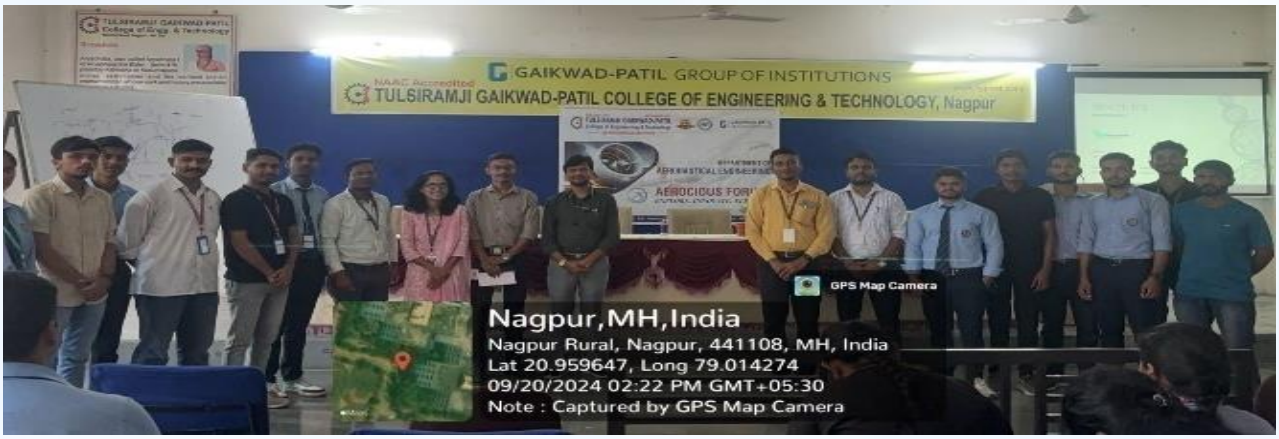
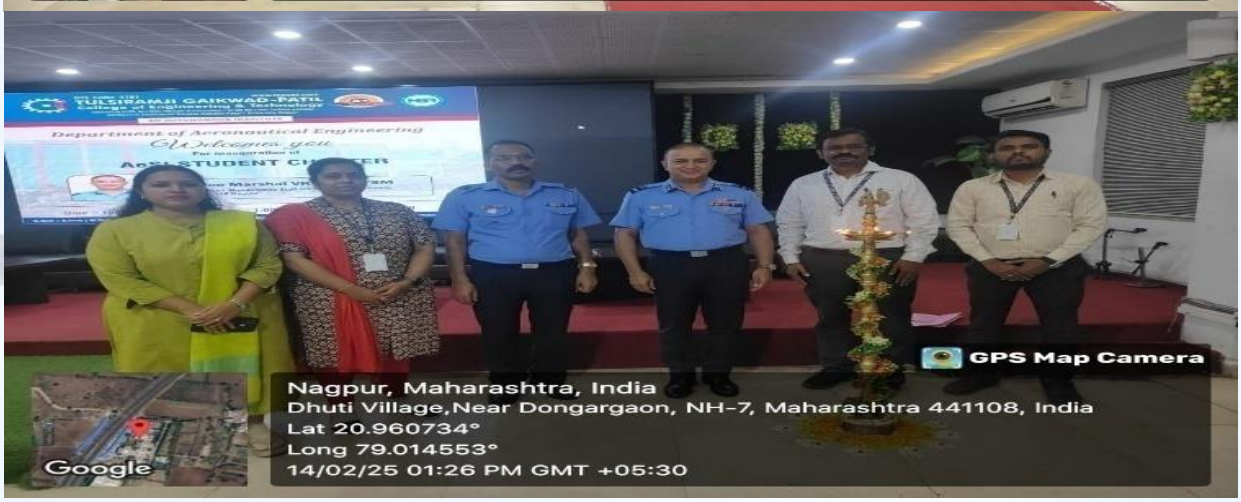


Photo session after the Guest Lecture with the expert

AeSI Student Chapter Installation & Expert Lecture on "Career Opportunities in the Indian Air Force"

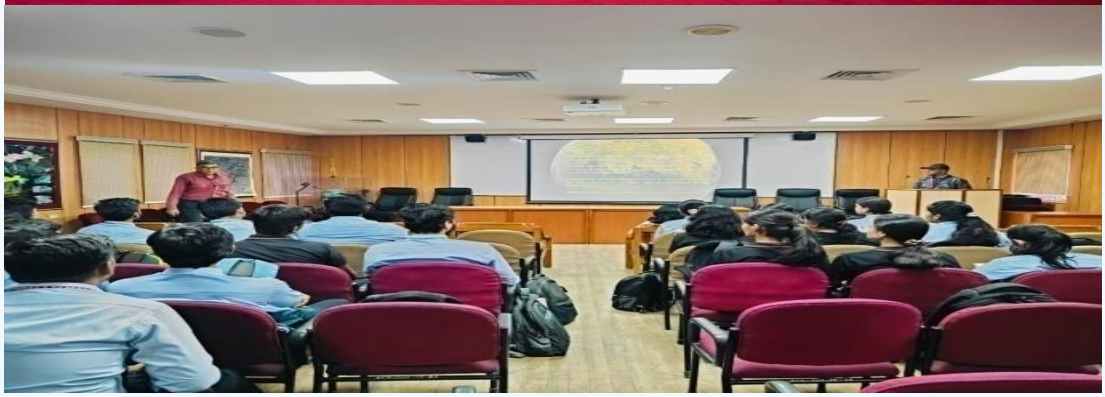
Date	14th February 2025
Venue	Department of Aeronautical Engineering, TGPCET, Nagpur
Organized By	Department of Aeronautical Engineering in collaboration with AeSI Nagpur Chapter
Guest Name & Designation	Air Vice Marshal VRS Raju, VSM, Deputy Senior Maintenance Staff Officer, HQ Maintenance Command, IAF, Nagpur
Purpose of Event	Installation of AeSI Student Chapter and guidance on career opportunities in the Indian Air Force
Student Participation	70+ Students actively participated



INDUSTRIAL VISIT

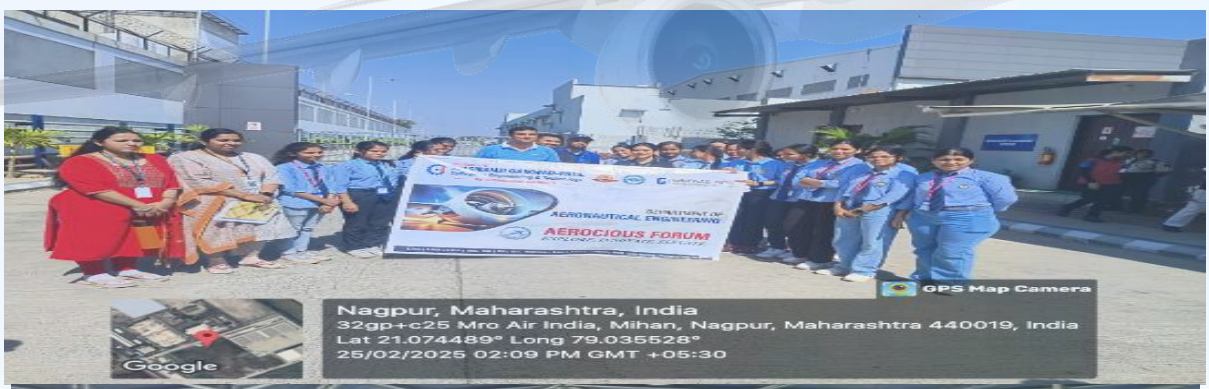
Industrial Visit to "Regional remote sensing center," at ISRO-RRSC, Nagpur

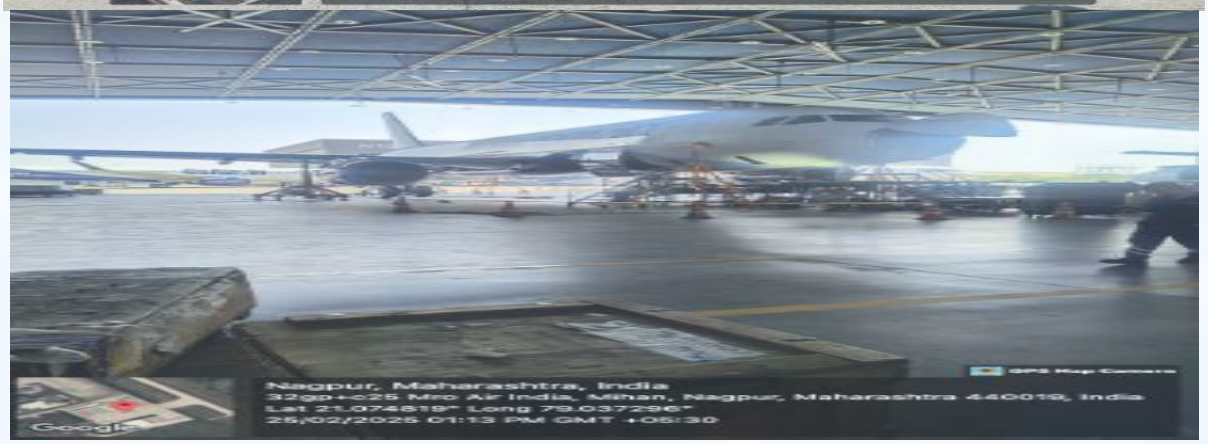
Title:	Industrial Visit to ISRO – Regional Remote Sensing Centre (RRSC), Nagpur
Aim:	To provide students with real-time exposure to remote sensing applications, satellite technologies, and India's achievements in space exploration through an industrial visit to ISRO-RRSC, Nagpur.
Summary Paragraph:	On **27th March 2025**, the Department of Aeronautical Engineering, TGPCET, organized an enriching industrial visit to the **Regional Remote Sensing Centre (RRSC), ISRO, Nagpur**, exclusively for 2nd, 3rd, and final-year B.Tech Aeronautical Engineering students. The visit was inaugurated by **Dr. Sadana Jain**, Senior Scientist, who briefed students about ISRO's mission structure and the significance of remote sensing in national development. The highlight of the session was an interactive overview of India's Chandrayaan-1, 2, and 3 missions. Students also explored an exhibition led by **Mr. Shrivastav**, where live satellite models, fuel systems, and data reception modules were showcased. The visit served as a strong academic-industry bridge, connecting theoretical space concepts with real-world ISRO applications.
Outcome	• Students gained hands-on insight into the workings of satellite missions and remote sensing technology. • The session fulfilled **Program Outcomes (POs)** like modern tool usage, engineering application, and societal relevance of aerospace missions. • Encouraged students toward careers in **ISRO**, **DRDO**, and **satellite research sectors**.



Industrial Visit to AAR Indamer Technics Pvt. Ltd., Nagpur

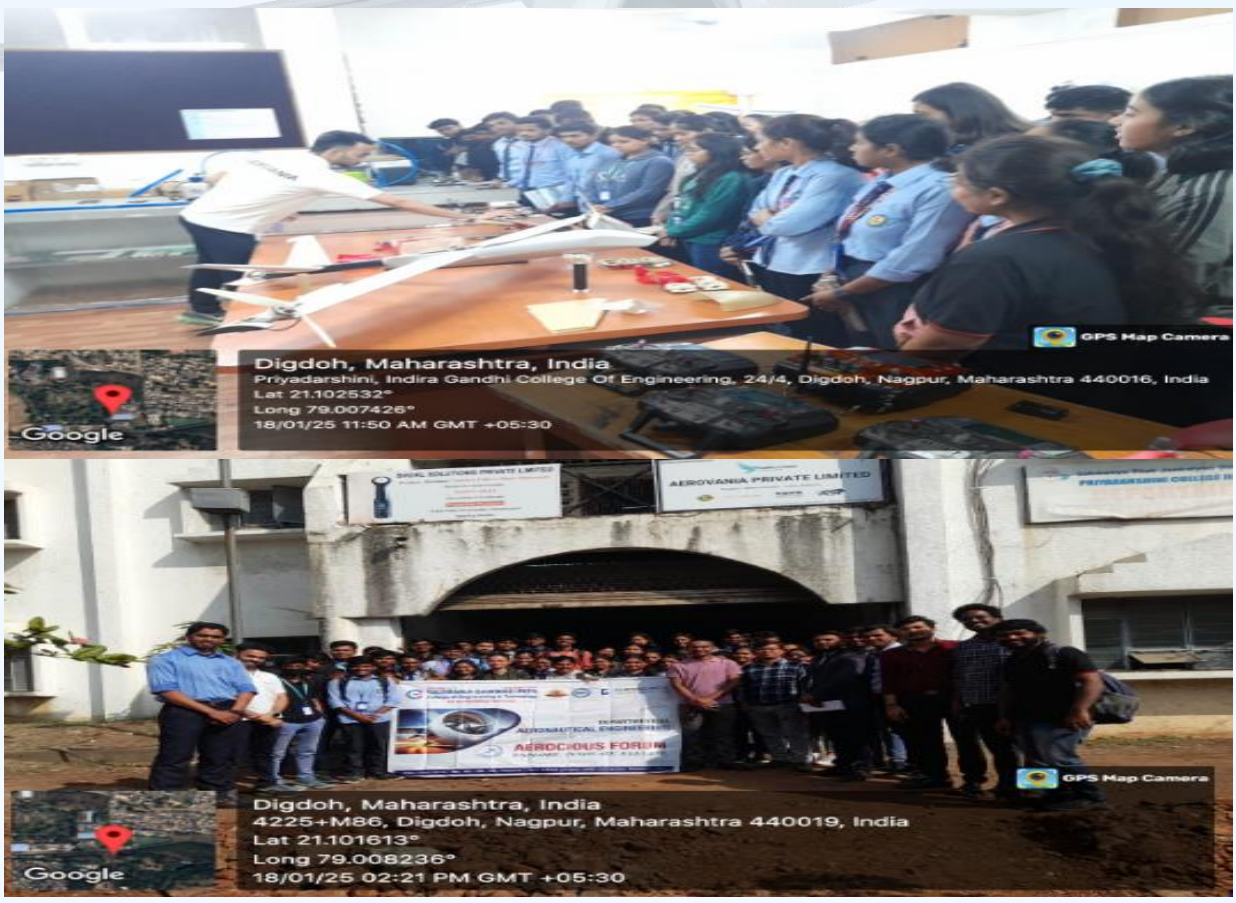
Title:	Industrial Visit to AAR Indamer Technics Pvt. Ltd., Nagpur
Aim:	To provide students with practical exposure to the aircraft maintenance, repair, and overhaul (MRO) environment and familiarize them with industry practices and regulatory standards.
Summary Paragraph:	The Department of Aeronautical Engineering at TGPCET organized an industrial visit to AAR Indamer Technics Pvt. Ltd., Nagpur, on 25th February 2025 for second and third-year students. The visit offered valuable insights into aircraft maintenance, repair, and overhaul (MRO) operations. Students observed real-time servicing procedures, including structural inspections, avionics checks, and NDT applications. The hands-on exposure enhanced their understanding of aviation safety, regulatory compliance, and modern maintenance technologies.
Outcome	• Students developed practical insights into real-time MRO operations, enhancing their industry readiness. • The visit fulfilled **Program Outcomes (POs)** like modern tool usage, industrial exposure, and aviation safety awareness. • Motivated students to explore careers in aircraft maintenance, NDT, quality assurance, and aviation safety compliance.





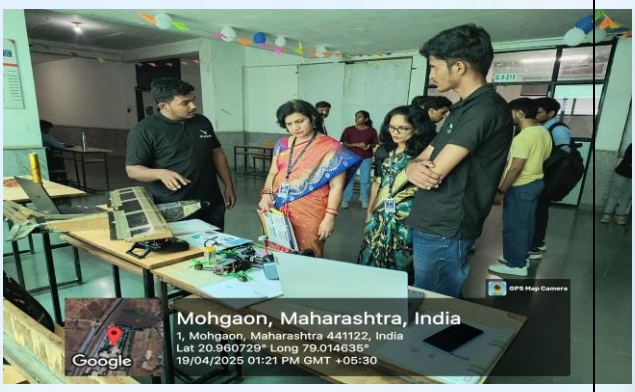
Industrial Visit to Aerovania Pvt. Ltd. Incubation Center, PCE Nagpur

Title:	**Industrial Visit to Aerovania Pvt. Ltd., Nagpur**
Aim:	To provide students with practical exposure to UAV technologies and advanced composite material applications in drone manufacturing.
Summary Paragraph:	On **18th January 2025**, the Department of Aeronautical Engineering at TGPCET organized an insightful industrial visit to **Aerovania Pvt. Ltd.**, located at the PCE Incubation Center, Nagpur, for 4th and 6th semester students. Aerovania is an innovative startup working on unmanned aerial vehicles (UAVs) using **eco-friendly, fire-resistant fibers** and advanced **composite materials**. The visit familiarized students with cutting-edge manufacturing techniques such as **pre-preg technology** and **vacuum bagging** used in UAV fabrication. Students explored how modern material science is applied to enhance the performance, safety, and sustainability of drones, bridging classroom learning with real-world UAV design and production.
Outcome:	• Students gained hands-on understanding of smart material integration in UAV development. • Exposure to sustainable and advanced composite manufacturing processes. • Strengthened knowledge of UAV applications in defense, surveillance, and environmental monitoring.

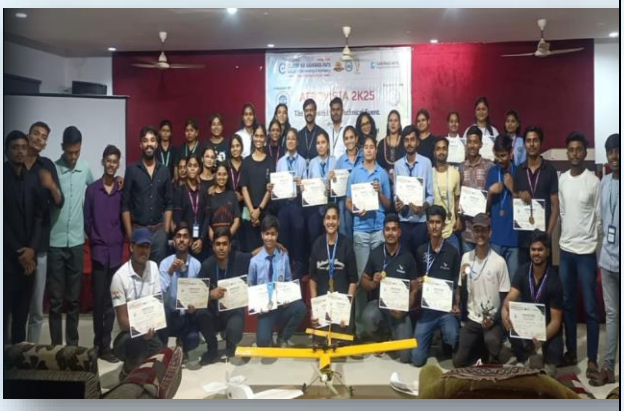


GLIMPSE OF AEROVISTA 2K25”

Title:	**AeroVista-2K25 – National Level Technical Symposium**
Aim:	To provide a national platform for aeronautical engineering students to showcase their creativity, technical skills, and innovations through aerospace-themed competitions and collaborative activities.
Summary Paragraph:	On **19th April 2025**, the Department of Aeronautical Engineering at TGPCET, in association with **AeSI Nagpur Chapter** and the student forum **Aerocious**, successfully organized **AeroVista-2K25**, a national-level technical symposium. The event served as a hub for innovation, collaboration, and technical excellence, drawing participation from students across India. Competitions such as **Slide Wars (AI in Aviation)**, **CADathon (CATIA Design)**, **Vision Craft (Project Display)**, **Aero Morph (Drone Flying)**, and **E-Sports** were held to challenge students’ analytical and practical abilities. The event was inaugurated by **Dr. Gaurav Dhingra**, Technical Service Manager at AAR Indamer, Nagpur. Guided by **Prof. Vishwjeet Ambade (HoD)** and coordinated by faculty and student teams, AeroVista-2K25 attracted over **150 participants**, showcasing the growing enthusiasm and talent in aerospace innovation.
Outcomes:	Students gained hands-on exposure to AI, CAD modeling, drone technologies, and real-world project applications. Boosted interpersonal, communication, and team coordination skills through national-level collaboration. Encouraged competitive spirit, creativity, and innovation through awards and public recognition.



Project Completion Judge by Dr. SnehalAbhaynak Dean CSR



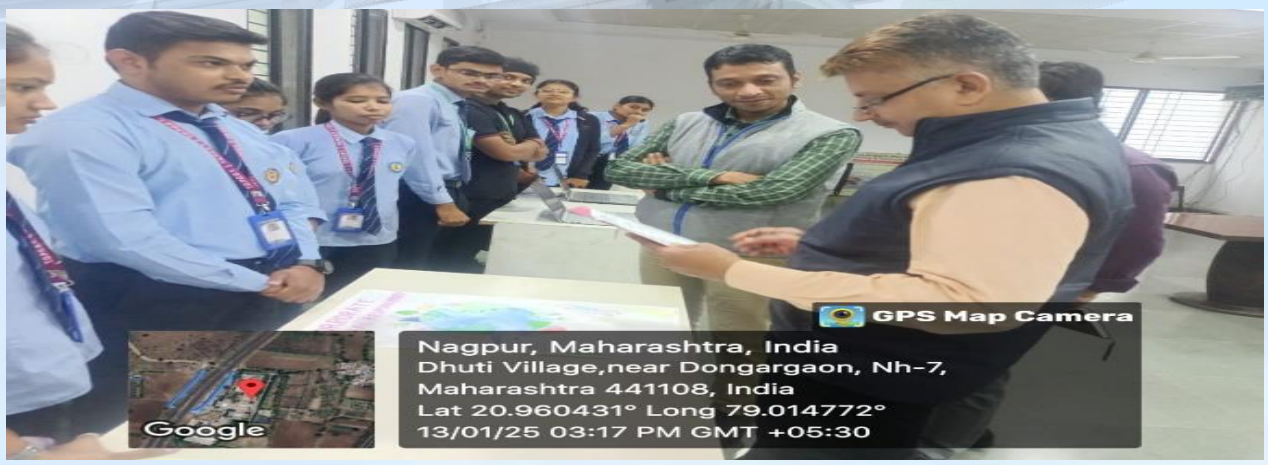
Valedictory Function and Prize distribution

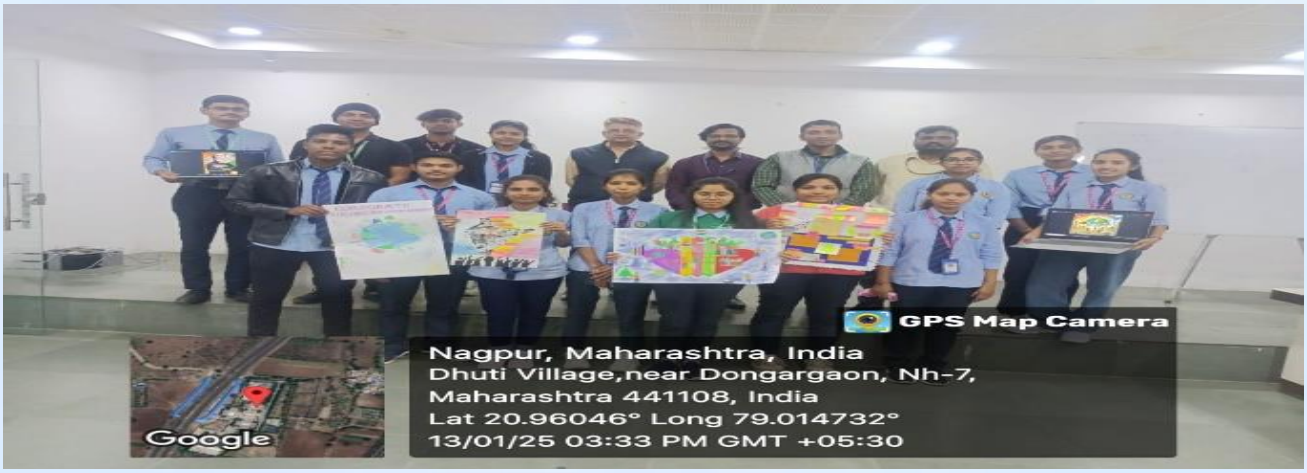
Aircraft Manufacturing"

Title:	**Two-Day Hands-on Workshop on Composite & Nanofiber Materials for Aerospace Applications**
Aim:	To introduce students to composite and nanofiber materials and provide hands-on training in their fabrication, thereby bridging the gap between academic knowledge and practical aerospace industry practices.
Summary Paragraph:	On **17th–18th January 2025**, the Department of Aeronautical Engineering at TGPCET, in collaboration with **Aerovania Pvt. Ltd.**, organized an immersive two-day hands-on workshop focused on **composite and nanofiber materials** used in aerospace structures. The workshop featured expert guidance from **Mr. Smitesh Chinchore**, Co-Founder and CTO of Aerovania Pvt. Ltd., and was inaugurated by **Mr. Tapassu Meshram**, President of the Aerocious Forum. The event was smoothly coordinated by a dedicated team of faculty and student leaders. Students were exposed to advanced manufacturing processes including **pre-preg technology**, **vacuum bagging**, and the use of **fire-resistant synthetic and natural fibers**. The workshop created a strong foundation for students to apply materials science concepts in real-world aerospace engineering contexts.
Outcomes:	• Gained hands-on experience in handling and fabricating composite and nanofiber materials. • Understood the application of pre-preg and vacuum bagging techniques. • Acquired practical skills relevant to aerospace materials design, safety, and performance analysis.

Poster Presentation Competition on the occasion of National Youth Day

Title:	Poster Presentation Competition on "Role of Youths in Nation Building"
Aim:	To celebrate **National Youth Day** by encouraging students to creatively express their views on youth-driven development, responsibility, and innovation in shaping the nation's future.
Summary Paragraph:	On **13th January 2025**, to commemorate the birth anniversary of **Swami Vivekananda**, the Department of Aeronautical Engineering at TGPCET organized a **Poster Presentation Competition** on the theme **"Role of Youths in Nation Building."** The event aimed to inspire students to reflect on their responsibilities as active citizens and future leaders. Over **30 students from multiple departments** participated with great enthusiasm. The event was inaugurated and judged by **Dr. Prashant Thakre (Controller of Examinations)**, who appreciated the creativity and awareness displayed by the participants. The posters highlighted key areas such as **education and skill development, environmental sustainability, youth empowerment, and civic duties.** The event successfully promoted awareness, collaboration, and creativity among the student community.
Outcomes:	• **Awareness:** Students gained insights into the vital role youth play in national growth and development. • **Skills:** The activity enhanced creativity, public communication, and teamwork. • **Networking:** Fostered interdepartmental collaboration and exchange of ideas. • **Inspiration:** Encouraged youth to engage in nation-building and future social initiatives.





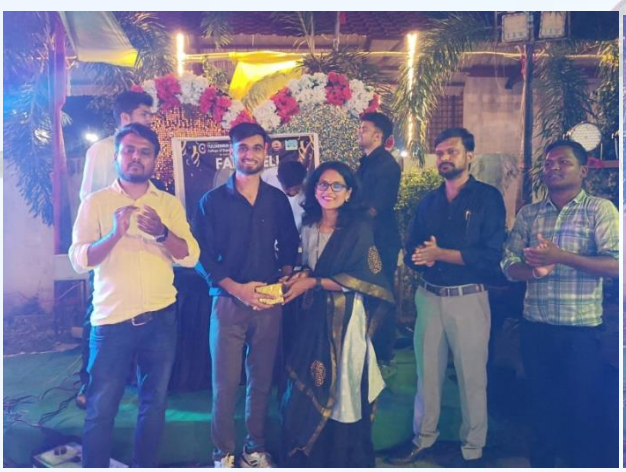
From Campus to Career: Farewell Moments

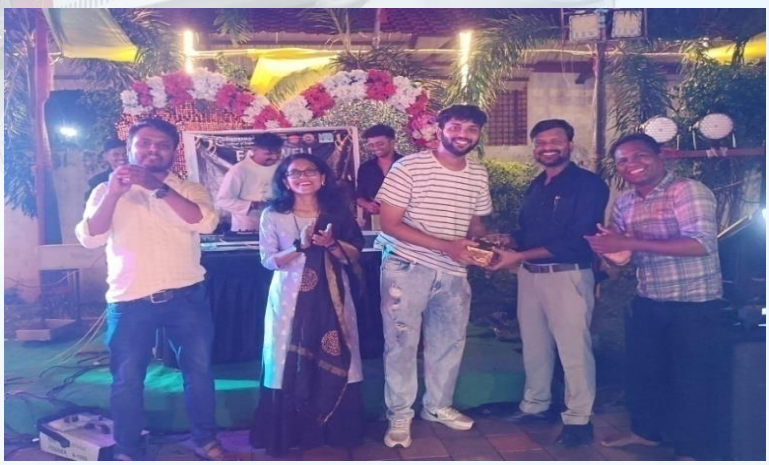
The Department of Aeronautical Engineering bid a fond farewell to the final year students in a warm and memorable event. The celebration was filled with emotions, laughter, and a touch of nostalgia as juniors came together to express their gratitude and good wishes.

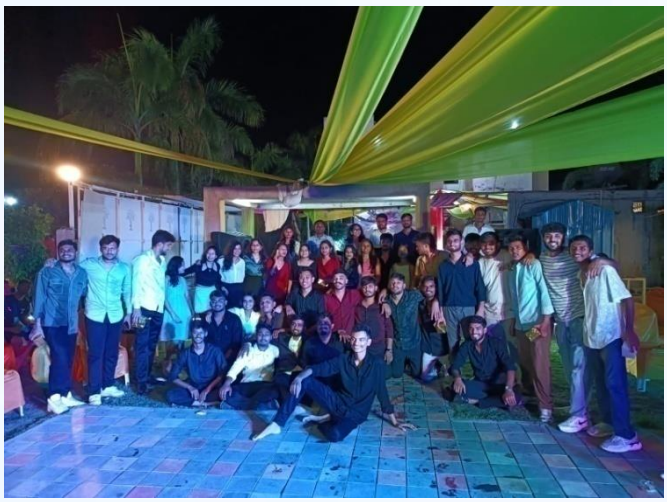
The event began with a welcome speech by faculty members, followed by vibrant cultural performances, games, and a heartfelt video montage showcasing cherished memories of the outgoing batch. Students shared their experiences, reflecting on the journey that shaped their academic and personal growth.

Prof. Vishwjeet Ambade, HoD (AE), addressed the students with inspiring words, encouraging them to chase their dreams and uphold the values learned during their time at TGPCET. The evening concluded with the distribution of mementos and a group photograph that captured smiles, tears, and lifelong bonds.

Farewell 2025 was not just a goodbye—it was a celebration of a new beginning. The department wishes the graduating students success, happiness, and clear skies ahead in their professional journey.

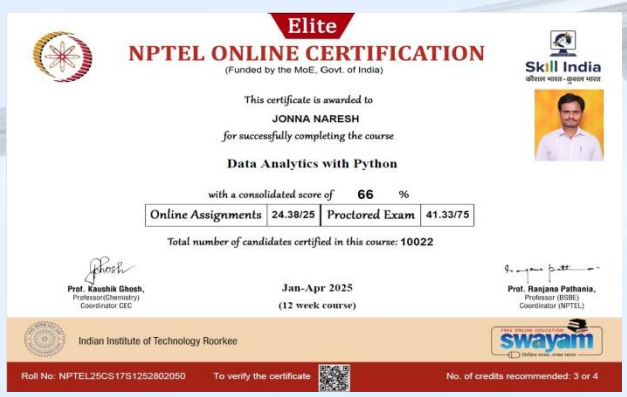


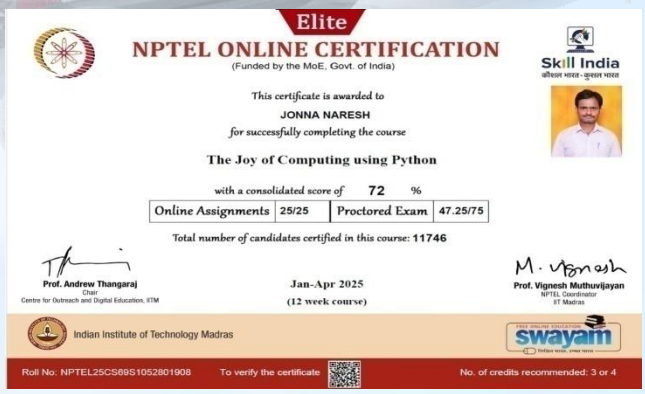


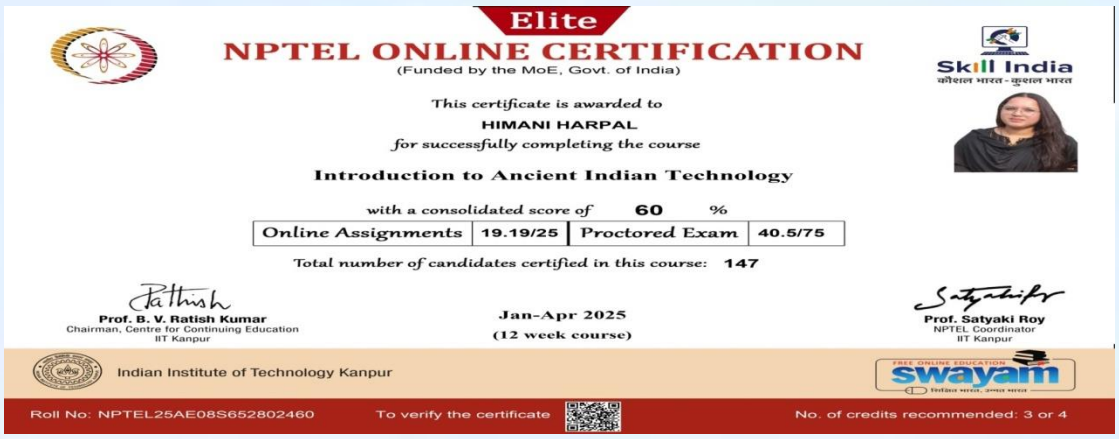


NPTEL / SWAYAM / MOOCs Certifications – Faculty Achievements

S-No	Name of Faculty	Certificate	Subject
1	Prof. Jonna Naresh	Elite with 72%	The Joy of Computing Using Python (IIT Madras)
2	Prof. Jonna Naresh	Elite with 66%	Data Analytics with Python (IIT Roorkee)
3	Prof. Himani Harpal	Elite with 60%	Ancient Indian Technology by (IIT Kanpur)


Elite
NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)
Skill India
This certificate is awarded to
JONNA NARESH
for successfully completing the course
Data Analytics with Python
with a consolidated score of 66 %
Online Assignments 24.38/25 | Proctored Exam 41.33/75
Total number of candidates certified in this course: 10022
Prof. Kaushik Ghosh, Professor(Chemistry) Coordinator CEC
Jan-Apr 2025
(12 week course)
Prof. Ranjana Pathania, Professor (BSBE) Coordinator (NPTEL)
Indian Institute of Technology Roorkee
swayam
Roll No: NPTEL25CS17S125280205O To verify the certificate No. of credits recommended: 3 or 4


Elite
NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)
Skill India
This certificate is awarded to
JONNA NARESH
for successfully completing the course
The Joy of Computing using Python
with a consolidated score of 72 %
Online Assignments 25/25 | Proctored Exam 47.25/75
Total number of candidates certified in this course: 11746
Prof. Andrew Thangaraj, Chair, Centre for Outreach and Digital Education, IITM
Jan-Apr 2025
(12 week course)
Prof. Vignesh Muthuvijayan, NPTEL Coordinator, IIT Madras
Indian Institute of Technology Madras
swayam
Roll No: NPTEL25CS89S1052801908 To verify the certificate No. of credits recommended: 3 or 4


Elite
NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)
Skill India
This certificate is awarded to
HIMANI HARPAL
for successfully completing the course
Introduction to Ancient Indian Technology
with a consolidated score of 60 %
Online Assignments 19.19/25 | Proctored Exam 40.5/75
Total number of candidates certified in this course: 147
Prof. B. V. Ratish Kumar, Chairman, Centre for Continuing Education, IIT Kanpur
Jan-Apr 2025
(12 week course)
Prof. Satyaki Roy, NPTEL Coordinator, IIT Kanpur
Indian Institute of Technology Kanpur
swayam
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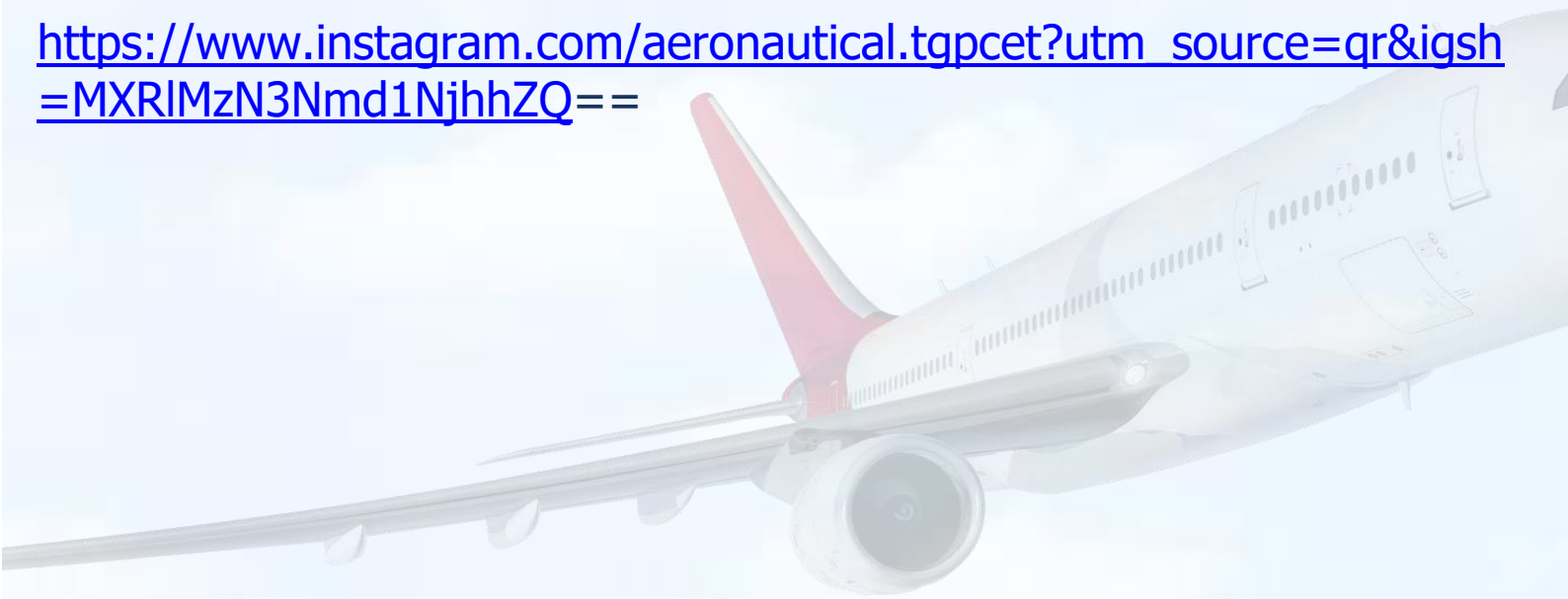
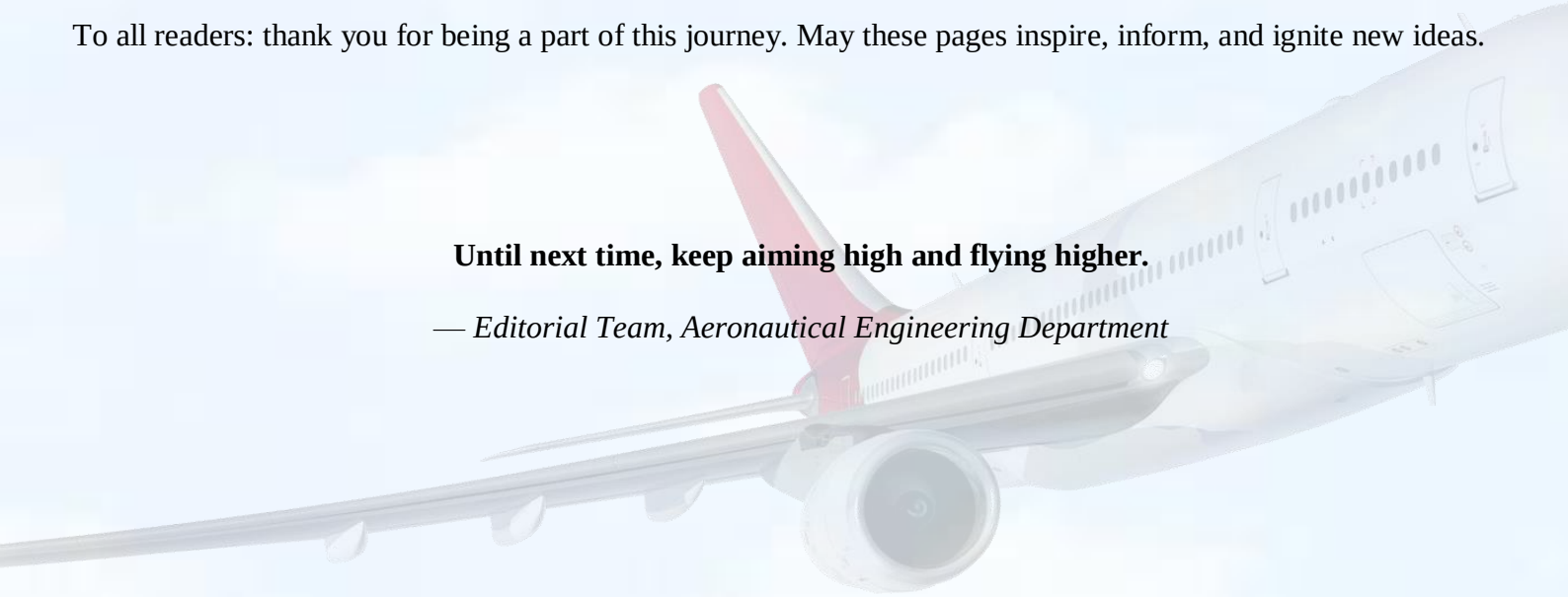


Message from the Editorial Team

As we turn the final page of this edition, we reflect on the passion, creativity, and teamwork that brought it to life. This magazine is more than just words and pictures—it's a mirror of our department's spirit, achievements, and dreams.

To all readers: thank you for being a part of this journey. May these pages inspire, inform, and ignite new ideas.



Until next time, keep aiming high and flying higher.

— Editorial Team, Aeronautical Engineering Department