NAAC Accredited
Vidarbha Bahu-uddeshiya Shikshan Sanstha's
TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology
An Autonomous Institute
DTE CODE 4151
A+ NAAC

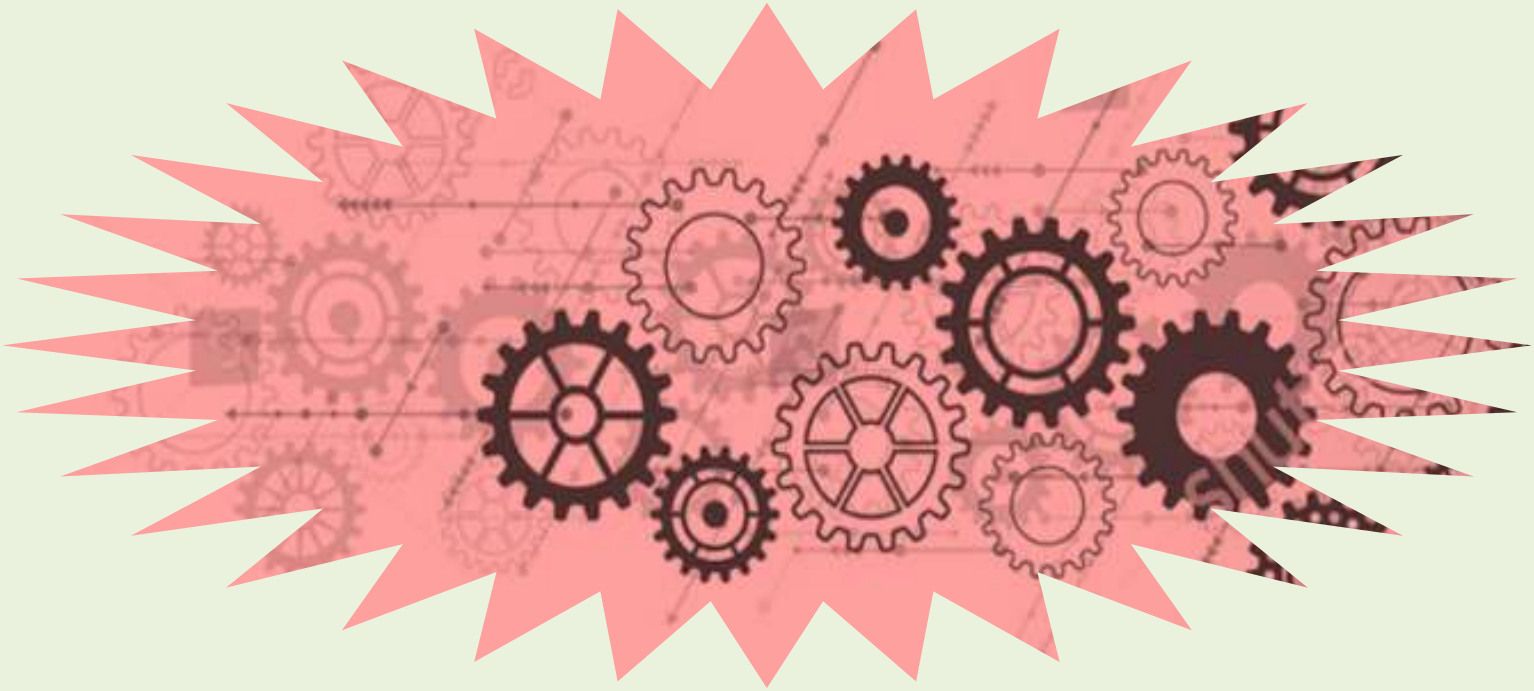
DEPARTMENT OF MECHANICAL ENGINEERING

NBA NATIONAL BOARD OF ACCREDITATION

TECHYUGA

TECHNICAL MAGAZINE

(2024-2025 ODD SEM)



ABOUT THE COLLEGE

Tulsiramji Gaikwad-Patil College of Engineering and Technology (TGPCET) was established in the year 2007 by Vidarbha Bahu-uddeshiya Shikshan Sanstha (VBSS), a registered 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. Also college is approved by Directorate of Technical Education (DTE), Mumbai and 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.

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.

ABOUT THE DEPARTMENT

Establishment in the year: 2011-12, Sanctioned Intake: 90, NAAC Accreditation Status: Yes

Department of Mechanical Engineering was established in 2011 and a B.Tech degree course Mechanical Engineering started with an intake of 60 with the objective of imparting quality education in the field of Mechanical Engineering. The Department is NBA Accredited from session 2023-24.

The focus of the department is towards research and training activity based on advanced manufacturing processes and production, in the field of mechanical designing software, computational fluid dynamics,etc.

The Department has its own departmental Library with a rich collection of books to serve as a ready source of information. With a team of experienced & well-qualified faculty members, the department moulds its students according to the present industrial requirements in various domains such as production, material science, design, ergonomics, so as to provide better employment opportunities. The department of Mechanical Engineering in TGPCET possesses a faculty team of experienced & well-qualified professors, well acquainted with deep subject knowledge, commitment to disseminate quality & value-based education in technical subjects. All faculties work hard on student to meet the requirement of market and groom the student to be job friendly.

The Department imparts high class training & research, providing state of the art practical knowledge to the students. It also promotes active industry-institute collaboration by identifying areas of interest and taking part in sponsored research projects, organizing workshops, STTP’s and involving in live projects.

Prospect: To achieve above objects our designed program requires each student to undergo industrial training at the end of 6th Sem. The students carry out mini projects, dissertations during the Pre-Final Year, and undertake a 6-month project during the Final Year. To add value to the program, the department organizes industrial visits and expert lectures on emerging trends by eminent personalities from industry and academia.

The Department gives an exposure for Consultancy works. The department guides to the students for post graduate (GATE, CAT) entrance exam and various public sector examinations by means of special coaching and expert lectures.

VISION OF THE DEPARTMENT

To Emerge as a Premier Centre in the Field of Mechanical Engineering Education and Produce Competent Engineers

MISSION OF THE DEPARTMENT

- To Impart Quality Technical Education Through Effective Teaching- Learning Process.
- To Provide a Better Environment to Encourage, Innovation and Entrepreneurship.
- To Strengthen Industry Institute Interaction to Meet the Challenges of Industry and Society Environment.
- To Ensure Overall Development of Students and Staff Members by Inculcating Knowledge and Professional Ethics.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates will be able to

PEO1: Demonstrate essential technical skills to identify, analyze and solve problems and design issues in mechanical engineering.

PEO2: Analyze the complex problems in the field of mechanical engineering by using modern tools.

PEO3: Apply mechanical engineering concepts for the betterment of society and environment.

PEO4: Develop professionals having administrative and managerial skills for mechanical engineering and allied industries.

PEO5: Demonstrate the attributes of mechanical engineering in lifelong learning to contribute towards societal needs.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1.**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2.**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6.**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12.**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

HOD MESSAGE

Dr. Vijay Talodhikar
HOD, ME

I take this opportunity to welcome you to the department of Mechanical Engineering which was established in 2011.Our graduates work in the core area such as mining industry, thermal power industry, automobile industry, agricultural sector, shipping industries, aerospace industry and finds its utilities in IT sector for Research and Development activities to meet requirements of present industrial needs.

The primary focus is to impart quality technical educations through effective Teaching Learning process among students .The department having three sponsored Lab 3D Printing, BMW Engine Lab and CNC Lab which is obliging for the superior placement of students as per their domain wise interest. Young, dynamic and experienced faculties provide technical knowledge and facilitate the growth of students. The faculty members display a high level of dedication and enthusiasm towards both teaching and state-of-the-art research.

Department is also having 15 well equipped laboratories including a project laboratory and an Industry sponsored laboratories and research laboratory. Our faculty members have published their research articles in reputed national and international journals. The department is active in organizing the various workshops and seminars for the growth and development of faculty and students. Our department students are also highly encouraged to implement their innovative research ideas with the help of the expert faculty members.

CHIEF EDITOR MESSAGE

Mr. Anuj Muley
Chief Editor

It brings me immense joy & pleasure to introduce the Fourth edition of the departmental technical Magazine ' TECHYUGA ' All the creative energies that came on to this platform in the form of faculty experts & students are finally presenting replica of their enthusiastic hard work through this extravaganza that has come out so organically. Technical & Arts every section shines out differently in its true sense. All the events conducted throughout the year where perfectly planned & executed& the overwhelming response it received said it all! This piece of art would not have been complete without the sheer determination & perseverance of all the students who pushed their limits every time to bring out this artistic reality. Their efforts coupled with immense support from the faculties truly have done justice to carry on the legacy. I am grateful for all the support TECHYUGA has received throughout the year in every possible way from the faculties & Students. I hope the readers of the technical Magazine have a wonderful reading experience & wish this year's edition too receives your love & support like it has always received till date.

Editorial Committee

Prof. Anuj Muley
Chief Editor & Magazine Coordinator

Ms. Brinda Talhar
Student Editor

Mr. Navinya bandhekar
Student Editor

Ms. Sayali Donade
Student Editor

Ms. Rajshree Patil
Student Editor

EDITOR MESSAGE

Ms. Brinda Talhar
Student Content Editor
Student, Third Year, ME

There is no denying that one day my memory of words will turn vague but every page of this Technical Magazine will open a box of memory so vivid! Filled with hard work, dedication & limitless time put in making this one book that I will always be grateful to " TECHYUGA " will make you fall in love with drawings again! It gives me immense pleasure to bring to you an extraordinary & masterly collection of the events, activities, achievements, highlights at the college presented in the Seventh Annual departmental technical Magazine "TECHYUGA 2024". The technical Magazine reflects the identity of TGPCET as well as gives the students & teachers a platform to explore their creativity & imagination. This work is a result of the various phases from planning to data collection to segregation to organization to proofreading to designing. I take this opportunity to express my gratitude to our HOD Dr. Vijay Talodhikar & Mr. Anuj Muley for their constant assistance & guidance.

CONTENTS

Recent Inventions in the Mechanical Engineering

Final Year Students Three Months Internship Completed Certificate

Sr. No.	*Name of Student*	*Project Title*	*Company Name*
1	Abhay Vijay Chauhan	*Design and Optimization of Removable Solar Panel System for Enhanced Renewable Energy Utilization.*	Suntronic Renewables Pvt. Ltd. Nagpur.
2	Adwin Gangaram Sakhare		
3	Sagar Satish Pohane		
4	Rahul Ramesh Shinde		
5	Mayur Satish Kumbhalkar	*Design and Analysis of Guide Plate in the Tractor.*	Precision Trancomponent Pvt. Ltd Nagpur.
6	Pranay Kishaor Darne		
7	Ritik Govinda Dongare		
8	Suhas Damodar Dhone		
9	Amar Gomaji Lonare		
10	Saurabh Manoj Prasad	*Design and Analysis of Gear box and Clutch.*	Jayswal Neco Pvt. Ltd. Buttibori MIDC Nagpur.
11	Saurabh Panchdeo Nishad		
12	Gaurav Dharmdas Nakshine		Jaika Moters Kamti Road Nagpur.
13	Linesh Pramod Giradkar		
14	Chandrashekhar Pardhi	*Design and Fabrication of Jig and Fixture for rear floor Vehicle Component Parts*	V. R. Jamdar Siemense Center of Excellence.
15	Utkarsh Sunhash Kusrame		
16	Taniya Kamal Gautele		Design Review Services, Nagpur.
17	Akash Nandkishor Chaudhari		Jayswal Neco Pvt. Ltd. Buttibori MIDC Nagpur.

Certificates:-

Mechanical Engineers Case Studies

1. **Additive Manufacturing**

Case Study: **GE's 3D-Printed Fuel Nozzle for Jet Engines**

- **Problem**: Conventional manufacturing of fuel nozzles involved 20 individual parts, leading to assembly complexities and weaker joints.
- **Solution**: GE engineers used 3D printing (Selective Laser Melting) to manufacture the nozzle as a single unit, improving structural integrity and reducing weight by 25%.
- **Outcome**: The nozzles lasted five times longer and were 30% more fuel-efficient.
- **Relevance**: Demonstrates how additive manufacturing can reduce assembly costs and enhance performance in aerospace applications.

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2. **Green Manufacturing**

Case Study: **Toyota's Prius Hybrid Manufacturing Process**

- **Problem**: Growing demand for environmentally friendly vehicles.
- **Solution**: Toyota implemented green manufacturing practices, including energy-efficient robotics, recycling programs, and environmentally friendly materials.
- **Outcome**: Reduced carbon emissions by 30% during production and ensured 95% recyclability of vehicle components.
- **Relevance**: A benchmark for sustainable manufacturing processes in automotive engineering.

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3. **Advanced Composite Materials**

Case Study: **Boeing 787 Dreamliner**

- **Problem**: Aircraft weight and fuel efficiency challenges.
- **Solution**: Boeing used advanced composite materials (like carbon fiber-reinforced plastics) for 50% of the Dreamliner's structure.
- **Outcome**: Reduced the aircraft's weight by 20% and improved fuel efficiency by approximately 25%.
- **Relevance**: Highlights the advantages of lightweight materials in aerospace applications.

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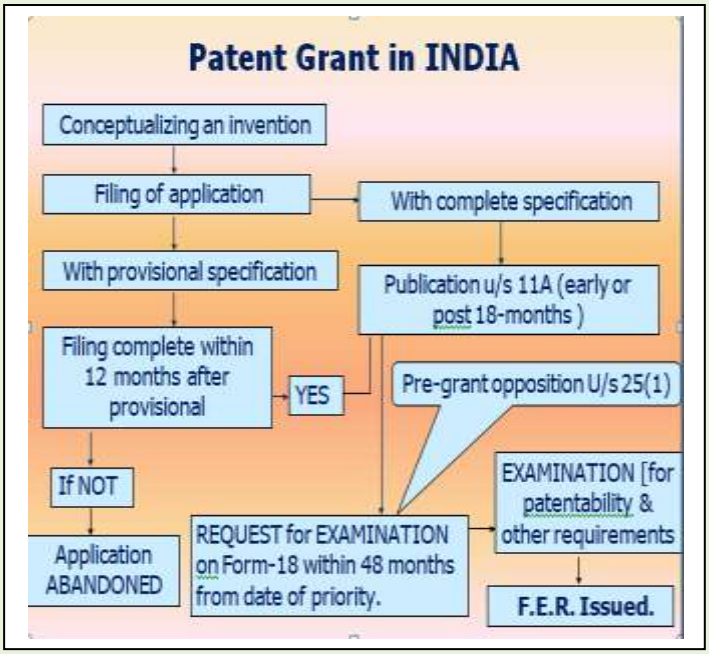
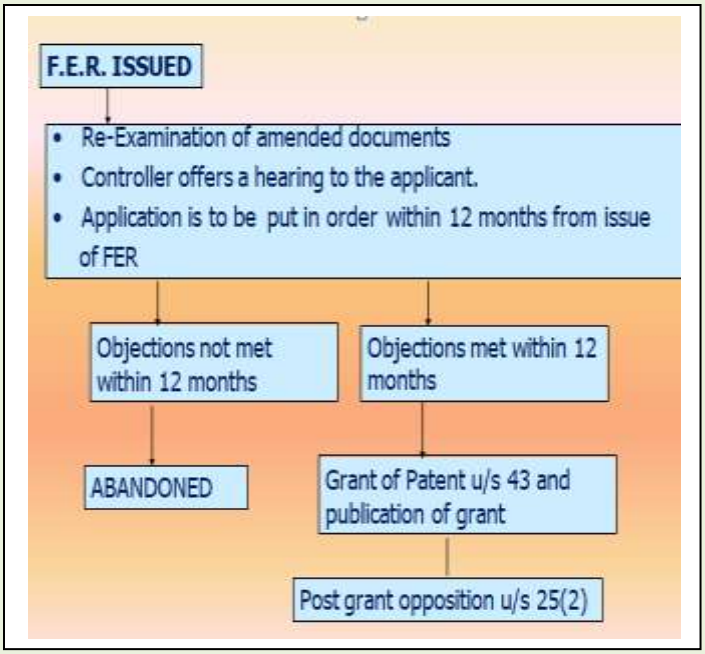
4. **Friction Stir Welding**

Case Study: **SpaceX's Reusable Rockets**

- **Problem**: Creating strong, lightweight joints for rockets without adding excessive weight.
- **Solution**: SpaceX used Friction Stir Welding (FSW) to join aluminum-lithium alloy panels.
- **Outcome**: Reduced production costs and improved joint strength, enabling reusability in rockets.
- **Relevance**: Demonstrates the importance of innovative welding techniques in space exploration.

SOP of Patent Processes





SOP of COPY Write Processes

1) **Application Filing**
   - Submit Form XIV (Application for Registration) online or offline to the Copyright Office.
   - Include details about the work, author, and owner.
2) **Fee Payment**
   - Pay the prescribed registration fee based on the type of work (e.g., literary, artistic, software).
3) **Acknowledgment Receipt**
   - Receive an acknowledgment with a unique diary number for the application.
4) **Mandatory Waiting Period (30 Days)**
   - Wait for 30 days to allow for objections, if any, to be filed by third parties.
5) **Examination by Registrar**
   - The Copyright Office examines the application for completeness and originality.
6) **Objection Handling**
   - **No Objection:** Proceed to next step.
   - **Objection Raised:** Attend a hearing and resolve disputes.
7) **Approval or Rejection**
   - If all is in order, the copyright is approved.
   - Incomplete or disputed applications may be rejected.
8) **Certificate Issuance**
   - Upon approval, the Registrar issues the copyright registration certificate.
9) **Update in Copyright Register**
   - Details of the work are entered into the official Copyright Register.
10) **Legal Protection Activated**
   - The work is now legally protected under the Copyright Act, 1957.

Latest Research in Mechanical Engineering

Mechanical engineering is a dynamic field that continually evolves with advancements in technology and materials. Recent research has led to significant developments in several key areas:

Mechanical Metamaterials

Mechanical metamaterials are engineered structures designed to exhibit properties not found in natural materials. Recent studies have focused on self-assembly fabrication techniques, enabling precise control over feature sizes and scalability. These advancements open possibilities for creating lightweight, strong, and tough materials suitable for various engineering applications.

3D Printed Architected Lattice Structures

The use of high-precision 3D printing technologies, such as Material Jetting (MJ), has facilitated the creation of complex lattice structures with tailored mechanical properties. These architected materials offer opportunities for innovative designs in engineering applications, combining lightweight characteristics with enhanced mechanical performance.

Advancements in Mechanical Engineering Education

The integration of Large Language Models (LLMs) into mechanical engineering education has been explored to enhance conceptual understanding, particularly in mechanics-focused topics. Studies indicate that models like GPT-4 outperform both earlier models and human cohorts in answering mechanics-related questions, suggesting potential as knowledgeable assistants in engineering pedagogy and research.

Compliant Mechanisms in Automated Microscopy

Research into compliant mechanisms has led to the development of XY traverse stages for automated microscopy. These mechanisms offer high precision and reduced mechanical complexity, improving the reliability and accuracy of automated microscopy systems.

Ultra-High Temperature Ceramic Matrix Composites (UHTCMCs)

UHTCMCs are being developed for applications in extreme environments, such as aerospace. These materials exhibit exceptional thermal and mechanical properties, making them suitable for use in severe conditions. Recent research has focused on understanding their mechanical properties through advanced analytical methods.

Educational Stuff

Mechanical Engineering is a vast field, offering a wide range of topics for educational and professional development. Here's an overview of educational content in Mechanical Engineering, tailored to foundational knowledge and advanced topics:

Core Concepts

1. **Engineering Mechanics**
    1. Statics and Dynamics
    2. Strength of Materials
    3. Kinematics and Dynamics of Machinery
2. **Thermal Sciences**
    1. Thermodynamics
    2. Heat Transfer
    3. Fluid Mechanics
3. **Materials Science**
    1. Properties of Materials
    2. Advanced Composite Materials
    3. Failure Mechanics
4. **Manufacturing Engineering**
    1. Conventional Manufacturing Processes
    2. Additive Manufacturing
    3. Green Manufacturing Practices
    4. Welding Technologies (e.g., Friction Stir Welding)
5. **Design and Analysis**
    1. Machine Design
    2. CAD (Computer-Aided Design) and CAM (Computer-Aided Manufacturing)
    3. Finite Element Analysis (FEA)
    4. Design Optimization

Emerging Technologies

1. **Robotics and Automation**
    1. Robotic Welding
    2. Mechatronics and Control Systems
2. **Energy Systems**
    1. Renewable Energy Sources (e.g., Wind Turbines, Solar Energy Systems)
    2. Optimization of Energy Systems
    3. Sustainable Design
3. **Advanced Manufacturing**

    1. Industry 4.0 and Smart Manufacturing
    2. Industrial Internet of Things (IIoT)
    3. Digital Twin Technology

4. **Nanoengineering**
    1. Nanomaterials in Mechanical Applications
    2. Micro-Nano Fabrication Processes

Specialized Applications

1. **Aerospace Engineering**
    1. Aerodynamics
    2. Propulsion Systems
2. **Automotive Engineering**
    1. Internal Combustion Engines
    2. Electric and Hybrid Vehicles
3. **Biomedical Engineering**
    1. Prosthetics Design
    2. Biomechanics
4. **Industrial Design and Product Development**
    1. Product Informatics
    2. Design for Aging Populations

Research and Development

1. **Experimental Studies**
    1. Vibration Analysis
    2. Wind Tunnel Testing
2. **Optimization Techniques**
    1. Genetic Algorithms
    2. Machine Learning in Mechanical Systems
3. **Sustainability**
    1. Lifecycle Assessment of Mechanical Products
    2. Circular Economy Principles

Educational Resources

1. **Textbooks and Journals**
    1. “Engineering Mechanics” by Hibbeler
    2. “Thermodynamics: An Engineering Approach” by Cengel and Boles
    3. ASME Journals, Elsevier, and Springer publications
2. **Simulation Tools**
    1. ANSYS, SolidWorks, AutoCAD, and MATLAB
    2. CFD (Computational Fluid Dynamics) Tools
3. **Online Learning**
    1. NPTEL, Coursera, and edX courses
    2. Industry certifications in specialized tools and methods

Student Corner

Student Article:-I

Title: "Emerging Trends in Mechanical Engineering: Innovations Driving a Sustainable Future"

Introduction

Mechanical engineering has always been at the forefront of innovation, addressing global challenges and advancing technologies. In 2025, the field continues to evolve, focusing on sustainability, automation, and advanced materials. This report explores emerging trends shaping the discipline, including additive manufacturing, renewable energy systems, and robotics.

1. Additive Manufacturing and its Applications

Additive manufacturing (AM), or 3D printing, is revolutionizing production processes. From aerospace components to biomedical implants, AM enables the creation of complex geometries with minimal waste. Advances in materials, such as metal powders and composites, are expanding its applications. Research is now focused on hybrid manufacturing techniques that integrate AM with traditional processes, optimizing both precision and efficiency.

2. Renewable Energy Systems

As the world shifts towards sustainability, renewable energy is a key focus. Mechanical engineers are designing more efficient wind turbines, solar trackers, and energy storage systems. Innovations in Vertical Axis Wind Turbines (VAWTs) are noteworthy, particularly for urban and highway applications. Engineers are optimizing blade designs, materials, and control systems to enhance power output while minimizing environmental impact.

3. Robotics and Automation

Robotics is transforming industries, from manufacturing to healthcare. Collaborative robots, or cobots, are increasingly used in automated assembly lines, ensuring precision and safety. Advances in robotic welding, a highly specialized field, are enabling faster and more reliable production. The integration of AI and machine learning allows robots to adapt and improve their performance over time.

4. Advanced Materials and Smart Structures

The development of advanced materials, including composites and smart materials, is unlocking new possibilities. Lightweight yet durable composites are being used in automotive and aerospace industries to reduce weight and improve fuel efficiency. Smart materials, which respond to environmental changes, are being explored for use in sensors and actuators, creating intelligent systems with enhanced functionality.

Challenges and Opportunities

While these innovations offer immense potential, challenges remain. The cost of implementing new technologies, the need for skilled professionals, and environmental considerations must be addressed. Collaboration between academia, industry, and government is crucial to overcome these hurdles and ensure sustainable development.

Conclusion

In 2025, mechanical engineering continues to adapt and thrive, addressing contemporary challenges with innovative solutions. By embracing new technologies and focusing on sustainability, the field will play a pivotal role in shaping a better future. Aspiring engineers must remain curious, adaptable, and committed to advancing both technology and society.

Mr. Amit Dhole
Student ME 3rd Year

Student Article:-II

Title: "Revolutionizing Renewable Energy: Advances in Vertical Axis Wind Turbine Design and Performance Optimization in 2025"

Abstract

In 2025, the global shift towards renewable energy has driven innovation in wind turbine technology. This report explores the advancements in Vertical Axis Wind Turbines (VAWTs), emphasizing their application in urban and highway environments. By focusing on cutting-edge design techniques, material innovations, and optimization strategies, this study highlights the potential for VAWTs to redefine renewable energy solutions for diverse and challenging conditions.

Introduction

With the increasing demand for sustainable energy, VAWTs are gaining prominence due to their compact design and adaptability. Unlike traditional Horizontal Axis Wind Turbines (HAWTs), VAWTs operate effectively in low and variable wind conditions, making them suitable for urban landscapes and highway medians. This article examines the latest developments in VAWT technology, addressing key challenges such as efficiency, durability, and scalability.

Design Innovations

Recent advancements in computational tools have enabled precise aerodynamic modeling of VAWT blades. Novel materials such as carbon-fiber composites and 3D-printed thermoplastics have improved the structural integrity and reduced manufacturing costs. Blade geometry optimization, including helical and catenary shapes, has enhanced energy capture even in turbulent wind conditions.

Performance Optimization

Integration of real-time monitoring systems, powered by IoT and AI, has revolutionized turbine performance assessment. Algorithms analyze wind patterns, enabling dynamic blade adjustments for optimal efficiency. Experimental studies show that multi-rotor VAWT configurations and hybrid systems combining solar panels and wind turbines are proving successful in maximizing energy output.

Application in Highway Settings

Highways present untapped potential for renewable energy generation. Placing VAWTs along medians utilizes wind generated by vehicular movement. This report explores design considerations specific to highway environments, such as noise reduction, structural stability, and minimal maintenance. Prototypes installed on highways have demonstrated promising results, contributing to local grid systems and reducing carbon footprints.

Challenges and Future Directions

Despite progress, challenges persist in scaling VAWTs for large-scale applications. Research is ongoing to address energy storage issues, ensure cost-effectiveness, and integrate renewable energy systems with existing infrastructure. Collaboration between academia, industry, and governments is vital for overcoming these barriers and accelerating the adoption of VAWTs.

Conclusion

The innovations in VAWT technology in 2025 highlight its role in achieving a sustainable energy future. By leveraging advancements in materials, design, and optimization, VAWTs are poised to transform renewable energy generation, particularly in challenging environments like highways and urban settings.

Ms. Aishwarya Sahare
Student ME 3rd Year

Student Article:-III

Title: "Emerging Trends in Sustainable Mechanical Engineering: Innovations in Energy Systems and Green Manufacturing "

Introduction

Mechanical engineering continues to evolve, with sustainability becoming a pivotal aspect of research and development. This article explores the latest advancements in energy systems, green manufacturing, and material innovations, shedding light on their significance in achieving global sustainability goals.

1. ***Energy Systems: Innovations in Renewable Energy***

- *Advances in Wind Turbine Technology: New designs for vertical and horizontal axis wind turbines (VAWTs and HAWTs) are pushing efficiency limits.*
- *Hydrogen as a Fuel Source: Mechanisms for improving hydrogen storage and application in energy systems.*
- *Thermal Energy Storage Systems: Innovative heat storage materials for efficient power generation.*

2. ***Green Manufacturing Practices***

- *Additive Manufacturing (AM) for Sustainability: Reduced material wastage and energy consumption.*
- *Recycling in Manufacturing: Strategies for recycling composite materials and metals.*
- *Lifecycle Analysis (LCA): Tools for measuring and minimizing environmental impact.*

3. ***Advanced Composite Materials***

- *Biodegradable Composites: Development of natural fiber-based composites for automotive and aerospace applications.*
- *Self-Healing Materials: Enhancing durability and reducing maintenance costs.*
- *Lightweight Alloys: Innovations in titanium, magnesium, and aluminum alloys for energy-efficient designs.*

4. Automation in Mechanical Engineering

- *Robotic Welding and Assembly: Precision-driven manufacturing processes.*
- *AI in Design Optimization: Algorithms for enhancing component designs and reducing costs.*
- *Digital Twins: Virtual replicas for testing mechanical systems in real-time scenarios.*

5. Case Study*: Vertical Axis Wind Turbines for Highways*

This section focuses on the experimental investigation of VAWTs in highway settings, discussing blade shapes, materials, and operational optimization techniques.

6. Challenges and Future Directions

- *Cost vs. Sustainability: Balancing initial costs with long-term benefits.*
- *Policy and Regulations: The need for global cooperation in setting sustainability standards.*
- *Emerging Research Areas: Opportunities in nanotechnology, hybrid energy systems, and quantum mechanics.*

Conclusion

The innovations and practices discussed highlight the transformative role of mechanical engineering in addressing global challenges. By focusing on sustainability, the field is set to revolutionize industries and pave the way for a greener future.

Ms. Rajshree Patil
Student ME 3rd Year

Faculty Article Corner

"Advancements in Mechanical Engineering: Integrating Smart Materials and Additive Manufacturing for Next-Generation Product Development"

Prof. Parmar Bakane
Assistant Professor

Introduction

The field of mechanical engineering has undergone significant transformation in recent years, particularly with the integration of cutting-edge technologies such as smart materials and additive manufacturing (AM). These innovations are revolutionizing the ways products are designed, developed, and manufactured, enabling the creation of highly functional, efficient, and customizable solutions. This article highlights the latest advancements in these areas and explores their implications for future engineering practices.

Smart Materials: The Future of Responsive Design

Smart materials, also known as responsive or adaptive materials, can alter their properties in response to external stimuli, such as changes in temperature, pressure, or electric fields. This unique characteristic opens up new possibilities for creating products that can adapt to their environment, improving performance and functionality. For instance, in aerospace and automotive applications, smart materials can enhance structural integrity by responding to external forces, providing real-time damage detection and self-healing capabilities. Recent advancements in smart materials, such as piezoelectric, shape-memory alloys, and magnetostrictive materials, have led to the development of highly efficient sensors, actuators, and energy harvesters. These materials are being integrated into advanced mechanical systems, allowing for more intelligent and responsive designs. In manufacturing, smart materials are enabling the production of components that can change shape or functionality during operation, thereby optimizing performance in real-time.

Additive Manufacturing: Revolutionizing Product Development

Additive manufacturing, or 3D printing, has revolutionized the way engineers approach product development. By building parts layer by layer from digital models, AM eliminates many of the constraints associated with traditional manufacturing techniques, such as tooling, waste, and complex geometries. The ability to rapidly prototype, test, and iterate designs has accelerated the product development cycle, allowing for more innovative and efficient solutions.

One of the key benefits of AM is its ability to produce highly complex geometries that were previously impossible to achieve with conventional methods. This has opened up new possibilities in industries such as aerospace, medical devices, and automotive engineering, where lightweight, customized, and high-performance parts are crucial. Furthermore, the use of advanced materials in AM, such as high-strength polymers, metal alloys, and composite materials, is enabling the creation of parts with superior mechanical properties.

Future Implications and Challenges

While the integration of smart materials and additive manufacturing holds immense promise, it also presents several challenges. The development of new materials with desirable properties, as well as the optimization of AM processes to handle these materials effectively, remains an ongoing area of research. Additionally, the scalability of these technologies for mass production, cost reduction, and standardization poses significant hurdles.

Conclusion

The integration of smart materials and additive manufacturing is redefining the boundaries of mechanical engineering, enabling the creation of more efficient, customized, and adaptive products. As these technologies continue to evolve, their impact will be felt across various industries, from aerospace to healthcare, automotive, and beyond. Mechanical engineers will play a pivotal role in harnessing the full potential of these innovations, driving the development of next-generation solutions that address the challenges of the future.

"Revolutionizing Mechanical Engineering: Advanced Techniques in Structural Optimization and Material Innovation for Sustainable Design Solutions"

Prof. Praful Randive
Assistant Professor

In recent years, mechanical engineering has experienced a transformative shift with a growing emphasis on sustainability, efficiency, and innovation. One of the driving forces behind this evolution is the integration of advanced materials and cutting-edge optimization techniques, propelling the field into new frontiers beyond traditional renewable energy applications.

This report explores several breakthroughs in mechanical engineering that pave the way for more sustainable, high-performance designs across industries.

1. Innovative Structural Optimization Techniques

The application of artificial intelligence (AI) and machine learning (ML) algorithms in structural optimization is a game-changer for designing components that maximize performance while minimizing material usage and waste. By leveraging AI-driven generative design, engineers can create highly efficient structures with less reliance on traditional trial-and-error methods. This not only improves product life cycles but also reduces the overall environmental footprint.

2. Advanced Composite Materials

Research in composite materials has led to the development of lightweight yet durable components that are crucial for sectors like aerospace, automotive, and construction. The incorporation of natural fibers, bio-based resins, and other eco-friendly materials has gained traction, resulting in significant reductions in carbon emissions. These composites offer strength-to-weight ratios that enhance the performance of mechanical systems while ensuring sustainability.

3. Smart Manufacturing and Additive Manufacturing

Smart manufacturing and additive manufacturing (AM) technologies are revolutionizing the way components are produced. Additive manufacturing, particularly 3D printing, allows for the creation of complex geometries with minimal material wastage, leading to a substantial reduction in energy consumption and resource utilization. The research is focused on developing more efficient printing methods using advanced alloys and polymers that are not only more sustainable but also offer enhanced mechanical properties.

4. Noise and Vibration Control Innovations

Another significant area of research is the optimization of mechanical systems to reduce noise and vibrations, especially in high-performance machinery. By employing new damping materials and innovative vibration isolation techniques, engineers are able to extend the lifespan of mechanical systems and reduce their energy consumption. This area of study is critical in enhancing the performance of products used in industries such as automotive and aerospace.

5. Thermal Management and Heat Transfer Innovations

Thermal management remains a critical challenge in modern mechanical systems, particularly in high-performance engines and electronics. Recent research into advanced heat exchange materials and microchannel designs has led to more efficient cooling solutions, improving the overall energy efficiency of mechanical devices. These innovations are pushing the boundaries of thermodynamics and energy conservation.

Conclusion:

Mechanical engineering is poised for a major transformation through the integration of advanced optimization methods, innovative materials, and smart manufacturing techniques. Research scholars continue to drive progress, finding novel solutions to improve efficiency, reduce environmental impact, and extend the lifespan of mechanical products. As these technologies evolve, the future of mechanical engineering will be defined by a commitment to sustainability, performance, and a profound understanding of the intricate relationship between materials, design, and production processes.

"Advancements in Computational Fluid Dynamics: Optimizing Thermal Management Systems for High-Performance Mechanical Applications"

Prof. Anuj Muley
Assistant Professor

Abstract:
Computational Fluid Dynamics (CFD) has emerged as a transformative tool in the optimization of thermal management systems across various industries. This article delves into cutting-edge CFD applications that focus on improving heat dissipation, fluid flow, and temperature regulation in high-performance mechanical systems. From automotive to aerospace engineering, innovative CFD-based methodologies are now shaping the future of efficient thermal management. The research explores the interplay between geometry, material properties, and operating conditions, offering new insights into the development of optimized cooling solutions for critical mechanical components.

Introduction:
As the complexity and performance requirements of mechanical systems continue to increase, effective thermal management has become a cornerstone of design optimization. Whether in automotive engines, industrial machinery, or electronic devices, controlling heat dissipation is essential for enhancing efficiency, performance, and longevity. Computational Fluid Dynamics (CFD) has proven to be an invaluable tool in this area, enabling researchers and engineers to simulate and optimize thermal systems with unprecedented precision.

Research Objectives:
This article aims to present novel CFD-based approaches for optimizing thermal management solutions in mechanical applications. The key objectives include:

1. *Investigating the impact of various geometric configurations on heat transfer efficiency.*
2. *Understanding the role of fluid flow patterns in enhancing cooling performance.*
3. *Exploring the effects of material properties on thermal conductivity and heat dissipation.*
4. *Demonstrating how CFD can inform real-world design adjustments for improved thermal system performance.*

Methodology:
The research employs a combination of steady-state and transient CFD simulations to model complex thermal phenomena in mechanical systems. Various cooling techniques—such as heat sinks, passive cooling, and liquid cooling—are simulated under different operational scenarios. The model incorporates the effects of turbulence, heat conduction, convection, and radiation. A series of parametric studies is conducted to assess the sensitivity of thermal performance to changes in design variables, including material selection, fluid velocity, and surface roughness.

Results and Discussion:
The CFD simulations reveal significant improvements in thermal management efficiency when employing optimized geometries for heat sinks and cooling channels. The results also highlight the importance of fluid dynamics in preventing hot spots and improving overall heat distribution across critical components. Comparative analyses between various materials, such as metals and composites, demonstrate how material selection can significantly affect thermal performance. Moreover, the integration of advanced CFD algorithms with machine learning techniques shows promising potential for real-time optimization in real-world applications.

Conclusion:
CFD-based optimization is revolutionizing the design and performance of thermal management systems in high-performance mechanical applications. By providing deeper insights into fluid flow and heat transfer mechanisms, CFD is enabling engineers to push the boundaries of thermal efficiency. This research lays the groundwork for future innovations in cooling technologies, which will play a pivotal role in the continued advancement of mechanical systems in industries ranging from automotive to electronics.

Workshop

"Inauguration Two-day workshop on CNC Machining Technology" by Mr. Bhupendra Ukinkar, Extensive Expertise in CNC technology.

Workshop conducted on dated 18-10-2024 & 19-10-2024

Dr. Vijay Talodhikar presented a G-Memento to Mr. Bhupendra Ukinkar in recognition of his expertise.

Parents Teacher Meet

Parent-Teacher Meet conducted on dated 14-09-2024 to create awareness among parents and guardians about the college's academics, outcome-based education, and our institute's mission and vision.

Dr.Vijay Talodhikar interact with Students parents

Faculty Research Publications

Sr. No.	Name of faculty	Title of paper	Name of Journal
1	Prof.Dipali Bhoyar	Stress analysis in spur gear using ansys software	International Conference on Advances in Computing Control and Telecommunication Technologies 2025
2	Prof.Shrutika Nannaware	Design and fabrication of advanced layered movement of object collector robotic ARM	ICRIPE-2025 23rd-24th January 2025
3	Prof. Pramar Bakane	Design and fabrication of advanced lian urban turbine for efficient power generation.	ICRIPE-2025 23rd-24th January 2025
4	Prof.Anuj Muley	Design Optimization and Rigid Body Dynamics of a Robotic Arm Using Advanced Simulation Tools.	ICRIPE-2025 23rd-24th January 2025
5	Prof. Rahul Lekurwale	Design and fabrication of advanced Savonius axial wheel turbine structure for efficient multi station power generation	ICRIPE-2025 23rd-24th January 2025
6	Prof.Gaurav Nagdeve	Design and Development of welding fixture for the angle bracket for industrial uses.	ICRIPE-2025 23rd-24th January 2025
7	Prof.Ritesh Banpurkar	Analysis of Fusion of Filament of 3 D printing.	ICRIPE-2025 23rd-24th January 2025
8	Dr. Vijay Talodhikar	Comprehensive design and load analysis of free-standing i-beam jib cranes	ICRIPE-2025 23rd-24th January 2025
9	Prof.Praful Randive	Design & Analysis of Portable Injection Moulding Machine	ICRIPE-2025 23rd-24th January 2025
10	Prof.Ravindra Shende	Design and Analysis of Biomass Pyro-chulha.	ICRIPE-2025 23rd-24th January 2025
11	Prof. Vishwjeet Ambade	Modeling Simulation on mechanical properties of fiber reinforced composites	ICRIPE-2025 23rd-24th January 2025
12	Dr. Niteen Kakade	Optimizing Design through Modal Analysis of Carburetor Intake Manifold Dynamics	ICRIPE-2025 23rd-24th January 2025

Student Research Publications

Sr.No.	Name of All Project Group Members	Title of the Project	Name of Journal/Conference
1	Piyush khadgi, Yash jagtap, krushna raut, rushikesh wanjari	Design and fabrication of hydraulic spring stiffness testing machine	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
2	Dikshit Rahangdale Sachinkumar Tiwari Jyotish Mohatkar Vikky Kosme	Design and fabrication of manually operated turmeric peeling machine	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
3	Kartik Chahande Nikhil NInawe Aditya Deotare Atharva Inzalkar	Design And Fabrication of wheelchair with Bluetooth And Voice Control	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
4	Ganesh Nikhade, Aman Thavkar, Anuj Patle, Yelish Gajbhiye	Design and Fabrication of pneumatic Water Pumping System	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
5	Kailas Balaji Wadje, Sameer Kapale, Achal Dhabarde, Pallavi Bagde	Development of phase change material based solar energy power system	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
6	Devendra Mohankar Prayag Jangle Omprakash Maskare Ankit Choriya	Design & Fabrication Of An Automatic Pneumatic Paper Cutting Machine	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
7	Abhishek kukwase, Arya Koparkar, Aman Sharma, Akash Meshram	Design And Fabrication Of Safety Lift Mechanism	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
8	Chetan chaware Hanmant Narmod Himanshu Gothe Dhanpal barve	Design and fabrication of electric car using PVC pipes	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
9	Jaikumar Naidu Mohit kanekar Kamalkishore tembhare Mayur nakshine Mayur raut	Multi-purpose trolley cum wheelchair by using four bar mechanism	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET
10	Suraj Barapatre, Vijay Gaddamwar, Prantesh Kahurke, Rohit Warche, Rohit Kadu	Design and fabrication of automatic spring rolling machine	Paper published in 10th International Conference IC-IKSAT-2K24 at TGPCET

Certificates:-

Placements

Academic Toppers

DEPARTMENT TOPPERS

ACADEMIC YEAR (2024-25)

IV -SEM AUTONOMOUS TOPPERS

Rank	Name of Student	Marks	Percentage%
I	Vaibhav Yuvraj Choudhari	649	**10.00**
II	Ramesh Chandra Sahoo	632	**9.74**
III	Shruti Namdeo Bawane	630	**9.91**

VI -SEM AUTONOMOUS TOPPERS

Rank	Name of Student	Marks	Percentage%
I	Pratik Narendra Taiwade	549	**8.57 %**
II	Yash Vinod Butke	547	**8.76 %**
III	Aniket Dilip Singh	497	**8.14 %**

VIII -SEM RTMNU TOPPERS

Rank	Name of Student	Marks	Percentage %
I	Jyotish Ramesh Mohitkar	494	**76.00 %**
II	Piyush Pramod Khadgi	493	**75.84 %**
III	Ankit Dayaram Chauriya	490	**75.38 %**

Achievements

Faculty Achievement

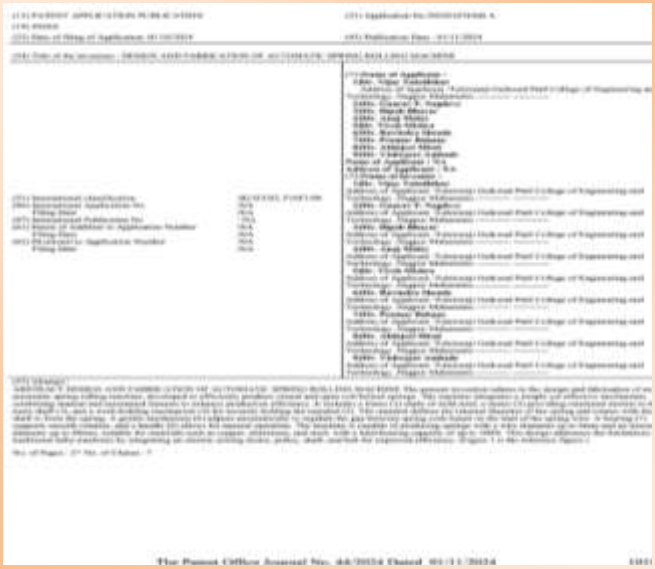
Name of Faculty	*Course Name*	*Percentage*	*Achievement*
Prof. Anuj Muley	*Automation in Manufacturing*	*61 %*	*Elite Certification*

Students Achievement

Sr. No	Name of Event	Date of Event	Name of Participant	Category of Event
1	Ideathon-2024	26/09/2024	Prashik Dange	Technical
2	Ideathon-2024	26/09/2024	Sahil Ghodmare	Technical
3	Ideathon-2024	26/09/2024	Sarthak Khobragade	Technical
4	Ideathon-2024	26/09/2024	Pratik Taiwade	Technical
5	Ideathon-2024	26/09/2024	Aniket Singh	Technical
6	Ideathon-2024	26/09/2024	Tanay Singh	Technical
7	Ideathon-2024	26/09/2024	Pradip Gaikwad	Technical
8	Ideathon-2024	26/09/2024	Chetan lonkar	Technical
9	Ideathon-2024	26/09/2024	Atulesh Patil	Technical
10	Ideathon-2024	26/09/2024	Rutvik Dhage	Technical

Inter Departmental Project competition

Name of Student	*ProjectTitle*	*Achievement*
Anmol Bisen	*Bottle Tree Guard*	*Ist Prize*
Rinkesh Pardhi		
Yash Dhode		



Dr. Vijay Talodhikar, Mr.Gaurav Nagdeve, Mr.Dipali Bhoyar, Mr.Anuj Muley, Dr.Vivek Mishra, Mr.Ravindra Shende, Mr.Pramar Bakane, Prof.Abhijit Misal, Mr.Vishwjeet Ambade

Faculty of ME Patent files "Design and Fabrication of Automatic Spring Rolling Machine"

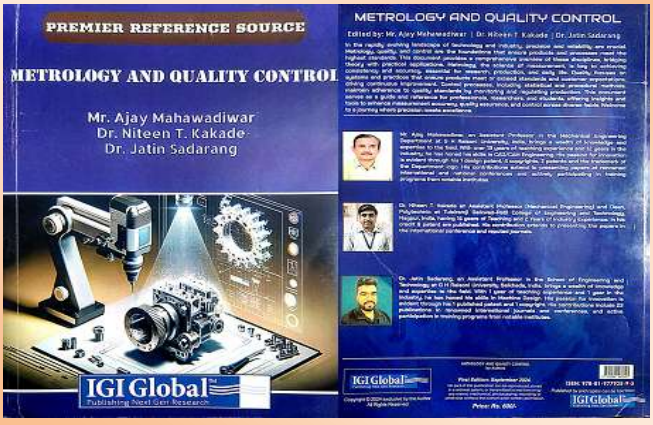
The Patent Office, Government Of India
Certificate of Registration of Design

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class 12-12 in respect of the application of such design to *MULTI-PURPOSE BED -CUM-WHEELCHAIR* in the name of 1.Dr. Niteen Kakde 2. Mr. Ritesh Banpurkar 3.Mr. Vivek Patil 4.Mr. Rahul Anil Lekurwade 5.Mr. Yogesh Ramteke 6.Mr. Praful Randive 7.Dr. Vinay Kumar 8.Ms. Shrutika Nitnaware

In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

Dr.Nitin Kakde, Mr.Ritesh Banpurkar, Mr.Vivek Patil, Mr.Rahul Lekurwade, Mr.Yogesh Ramteke, Mr.Praful Randive, Dr.Vinay Kumar, Ms.Shrutika Nitnaware,

Faculty of ME Patent files "Multi Purpose Bed-Cum-Wheelchair"



Dr. Nitin Kakde, Successfully publishing books "Metrology and Quality Control" ISBN: 978-81-977925-9-5


Elite
NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)
This certificate is awarded to
ANUJ ASHOKRAO MULEY
for successfully completing the course
Automation in Manufacturing
with a consolidated score of 61 %

Online Assignments	23.75/25	Proctored Exam	37.5/75

Total number of candidates certified in this course: 1559
Jul-Oct 2024
(12 week course)
Prof. T.V. Bharat
Indian Institute of Technology Guwahati
swayam


MALAVIYA MISSION TEACHER TRAINING PROGRAMME
NEP 2020 ORIENTATION AND SENSITIZATION PROGRAMME
CERTIFICATE OF PARTICIPATION
This is to certify that Mr. Anuj Ashokrao Muley, Assistant Professor from Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur has completed the NEP 2020 Orientation & Sensitization Programme under the Malaviya Mission Teacher Training Programme (MM-TTP) of the University Grants Commission (UGC) jointly Organized by UGC-Malaviya Mission Teacher Training Centre, Sant Gadge Baba Amravati University, Amravati, and Tulsiramji Gaikwad-Patil College of Engineering and Technology, Nagpur (Maharashtra) from 25th November, 2024 to 04th December, 2024 and obtained grade 'A+'.
Dr. Pragati Patil
Coordinator & Vice Principal
Tulsiramji Gaikwad-Patil College of Engineering and Technology
Prof. Mohammad Atique
Director, UGC-MMTTC, SGBAU


MALAVIYA MISSION TEACHER TRAINING PROGRAMME
NEP 2020 ORIENTATION AND SENSITIZATION PROGRAMME
CERTIFICATE OF PARTICIPATION
Dr. Pragati Patil
Prof. Mohammad Atique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Prof. Mohammad Atique


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