

PRAGATI YANTRA

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Issue- I

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2022-2023



CSE

Capital School of Engineering, Khordha
Department of Mechanical Engineering



FROM EDITORIAL ...

Dear Readers,

Welcome to the 2022-2023 edition of *Pragati Yantra* (Volume-2, Issue-1). As we step into another year of progress and innovation, the field of mechanical engineering continues to be a driving force behind technological transformation. Engineers today is not only solving complex challenges but also shaping a future that is smarter, more efficient, and sustainable.

This edition highlights the breakthroughs that define our era, focusing on emerging technologies, sustainable practices, and the evolving role of mechanical engineers in a rapidly changing world. With industries adapting to digitalization, automation, and the growing demand for environmentally responsible solutions, engineers must be at the forefront of these advancements.

Another major focus is sustainability in mechanical engineering. As climate concerns and resource limitations become more pressing, engineers are pioneering green technologies that reduce environmental impact. From renewable energy innovations to energy-efficient materials and processes, this edition showcases how sustainable engineering is not just a necessity but a driving force for the future.

We also take a deep dive into advancements in material science, highlighting cutting-edge developments such as smart materials, nanotechnology, and high-performance composites that are transforming industries ranging from aerospace to biomedical engineering.

Additionally, we feature young engineers and researchers who are making remarkable contributions in their respective fields, proving that innovation knows no boundaries. Their work demonstrates the limitless potential of mechanical engineering in solving real-world problems.

As you explore this issue, we hope it ignites curiosity, inspires fresh ideas, and motivates you to push the boundaries of what is possible. Together, let us continue to innovate, adapt, and lead the way toward a brighter, more sustainable future.

Here's to another year of engineering excellence and innovation!

Editorial Board Committee

Mechanical Engineering Department

Fostering Innovation, Collaboration, and Knowledge Sharing

Editorial Board Structure

Published by:

Mechanical Engineering Department

Capital School of Engineering, Khordha, Odisha

Conceptualized by:

Mr. Rakesh Kumar Sahoo

HOD, Mechanical Engg. Dept.

Saroj Kumar Parida

Mechanical Engg. Dept.

Chief Editor

Debananda Behera

Mechanical Engg. Dept.

Editor





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2ND YEAR, Editor

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From the HOD'S Pen

Dear Readers,

Greetings from Department of Mechanical Engineering

I am pleased to know that our students are successful in bringing their Second issue of magazine Pragati Yantra for this academic year 2022-2023. Pragati Yantra, the departmental magazine has the prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down innovative ideas. This magazine is intended to bring out the hidden literary talents in the students and teachers to inculcate strong technical skills among them. As a half yearly magazine of CSE, it helps the students to interact and share their ideas with the industry leaders and their peers studying in the college. I congratulate and thank all the students and faculty coordinator who have made untiring efforts to bring out this magazine.

I thank everyone for their valuable contributions to the magazine and hope to receive similar enthusiasm through your precious insight in the coming issues of Pragati Yantra.

Thanks & Regards,
Mr. R. K. Sahu
H. O. D, Mechanical
CSE, Khordha



From the Editor's Pen

Greetings from Department of Mechanical Engineering

Dear Readers,

It brings me immense pleasure to bring the second issue of Pragati Yantra to you. Pragati Yantra has only just begun to explore the potential of the new digital media. I look forward to some awesome output from our students in the coming years. And I wait with bated breath for Best of this year's to have a laugh, turn a thought, and to try and form a mental picture of what we really are like.

Campus magazine is important not just for capturing the currents and moods of the time, but also because they are an archive we can visit later to view ourselves from the distance that the years will bring. I am glad Pragati Yantra is putting together literary pieces and reviews of the major contributions of CSE.

Pragati Yantra is by the students, of the students and for the students to bring out their creative skills.

I can just thank and congratulate everyone involved in making this effort a grand success by contributing their articles to spread knowledge and to all of those who have put their heart in to this.

Thanks & Regards,
Saroj Kumar Parida,
Dept. of Mechanical Engineering,
PRAGATI YANTRA

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... pour façonner l'image des marques, Lindbergh partage la vision d'une femme forte, à la silhouette conquérante et la féminité minimaliste, avec des créatrices comme Jil Sander, l'Américaine Donna Karan et l'Italienne Miuccia Prada. Franca Sozzani, rédactrice en chef du *Vogue* Italie, qui travaille avec Lindbergh depuis l'époque de son magazine *Lei* en 1980, déclare que « Peter est un photographe qui marquera l'histoire de la photographie car il n'est pas prisonnier des tendances, il a sa propre identité : n'est pas un photographe de mode. Il se sert de mode pour parler aux femmes et pour parler des femmes, ce qui est très différent. »

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PRODUCTION OF PYROLYTIC OIL FROM WASTE PLASTICS AS AN ALTERNATIVE TRANSPORTATION FUEL

by Sangram Mahapatra

Recent Challenges for disposal of plastic wastes and environmental pollution due to aggregation of such wastes, pyrolysis process is carried out as a substitute productive and presumptive process, rather than combustion, which is primarily marked as destructive one. Pyrolysis can be proved as a suitable method for non-biodegradable wastes recycling, which seems to be very relevant for complex materials, such as plastics. This method could not only effectively actuate waste plastics with less pollution, but also effective in producing oil, which can diminish energy crisis. According to our research pyrolysis of plastic occurs at a temperature around 2500C under atmospheric pressure and ends at a temperature of about 4500C. Environmental concern and availability of petroleum fuels have caused interests in the search for alternate fuels for internal combustion engines. Conversion of waste to energy is one of the recent trends in minimizing not only the waste disposal but also could be used as an alternate fuel for CI Engines. As an alternative, non-biodegradable, and renewable fuel, waste plastic oil is receiving increasing attention. In the present paper waste plastic pyrolysis oil, waste plastic pyrolysis oil and its blend with diesel has been introduced as an alternative fuel. In this research various operating parameters have been prepared for better understanding of operating conditions and constraints for waste plastic pyrolysis oil.

This research has provided concise summary of plastic pyrolysis and a discussion of the main affecting parameters to optimize liquid oil yield. Based on the studies on literatures, pyrolysis process was chosen by most researchers because of its potential to convert the most energy from plastic waste to valuable liquid oil, gaseous and char. Therefore, it is the best alternative for plastic waste conversion and economical in terms of operation. The sustainability of the process is unquestionable since the amount of plastic wastes available in every country is reaching millions of tons. With the pyrolysis method, the waste management becomes more efficient, less capacity of landfill needed, less pollution and cost effective.

ORGANIC FIRMING USING VEMICOMPOSTING: AN ALTERNATE METHOD FOR WASTE TO WEALTH

by Amit Jain Biswal

Vermicomposting is a green technology that converts organic wastes into plant available nutrient rich organic fertilizer. It has also found to reduce heavy metal concentration in contaminated feeding materials. Vermicompost (VC), when used as fertilizer, not only bears positive impact on soil quality, plant growth and yield but also enhances nutritional value of crops produced. Use of VC on soil improves its physiochemical (aggregation, stability, pH, EC, bulk density, water holding capacity (WHC), organic matter (OM), micro-and macro-nutrients.) and biological properties (microbial population, enzymes

Vermicomposting is a type of composting in which certain species of earthworms are used to enhance the process of organic waste conversion and produce a better end-product. Vermicomposting is a mesophilic process utilizing microorganisms and earthworms. Earthworms feeds the organic waste materials and passes it through their digestive system and gives out in a granular form (cocoons) which is known as vermicomposting.

Like regular compost, vermicomposting also benefits the environment by reducing the need for chemical fertilizers and decreasing the amount of waste going to landfills/dumpsites. Vermicomposting is primarily earthworm excrement, called castings, which can improve biological, chemical, and physical properties of the soil. The chemical secretions in the earthworm's digestive tract help break down soil and organic matter, so the castings contain more nutrients that are immediately available to plants.

CRYOGENIC GRINDING

by Deepak Kumar Hota

Cryogenic grinding, also known as freezer milling, freezer grinding, and cryomilling, is the act of cooling or chilling a material and then reducing it into a small particle size. For example, thermoplastics are difficult to grind to small particle sizes at ambient temperatures because they soften, adhere in lumpy masses and clog screens. When chilled by dry ice, liquid carbon dioxide or liquid nitrogen, the thermoplastics can be finely ground to powders suitable for electrostatic spraying and other powder processes. Cryogenic grinding of plant and animal tissue is a technique used by microbiologists. Samples that require extraction of nucleic acids must be kept at -80°C or lower during the entire extraction process. For samples that are soft or flexible at room temperature, cryogenic grinding may be the only viable technique for processing samples. A number of recent studies report on the processing and behaviour of nanostructure materials via cry milling.

Freezer milling is a type of cryogenic milling that uses a solenoid to mill samples. The solenoid moves the grinding media back and forth inside the vial, grinding the sample down to analytical fineness. The idea behind using a solenoid is that the only "moving part" in the system is the grinding media inside the vial. The reason for this is that at liquid nitrogen temperatures (-196°C) any moving part will come under huge stress leading to potentially poor reliability. Cryogenic milling using a solenoid has been used for over 50 years and has been proved to be a very reliable method of processing temperature sensitive samples in the laboratory.

Cryomilling is a variation of mechanical milling, in which metallic powders or other samples (e.g. temperature sensitive samples and samples with volatile components) are milled in a cryogen (usually liquid nitrogen or liquid argon) slurry or at a cryogenics temperature under processing parameters, so a nanostructured microstructure is attained. Cry milling takes advantage of both the cryogenic temperatures and conventional mechanical milling. The extremely low milling temperature suppresses recovery and recrystallization and leads to finer grain structures and more rapid grain refinement. The embrittlement of the sample makes even elastic and soft samples grindable. Tolerances less than $5\text{ }\mu\text{m}$ can be achieved. The ground material can be analysed by a laboratory analyser.

Nanotechnology in Mechanical Engineering

by Rashmi Ranjan Panda

Nanotechnology, the manipulation of matter at the atomic and molecular levels, has revolutionized various fields, including mechanical engineering. This innovative technology deals with structures and materials on a nanometer scale, unlocking unprecedented opportunities for advanced applications. As students and aspiring engineers, understanding the impact of nanotechnology in our domain is crucial for embracing the future of engineering.

One of the most exciting applications of nanotechnology in mechanical engineering is the development of nanomaterials. Materials such as carbon nanotubes, graphene, and nanocomposites have remarkable mechanical properties, including high strength, lightweight characteristics, and excellent thermal and electrical conductivity. These materials are being integrated into components to enhance performance and durability, particularly in aerospace, automotive, and robotics industries.

Furthermore, nanotechnology plays a significant role in enhancing lubrication systems. Nano-lubricants, containing nanoparticles, reduce friction and wear between moving parts in machines. This innovation not only increases the efficiency and lifespan of mechanical components but also contributes to energy conservation and cost reduction in manufacturing processes.

In the area of coatings and surface treatments, nanotechnology has brought about significant advancements. Nano-coatings provide superior protection against corrosion, wear, and heat, making them invaluable for mechanical components exposed to harsh environments. Applications range from protective coatings for turbine blades to wear-resistant surfaces in automotive engines.

Another remarkable contribution of nanotechnology is in the field of sensors and diagnostics. Nano-sensors can detect minute changes in pressure, temperature, and strain, providing real-time data for monitoring and optimizing mechanical systems. These sensors are being increasingly used in smart manufacturing and predictive maintenance strategies.

Moreover, energy efficiency and sustainability are critical concerns in mechanical engineering. Nanotechnology contributes to the development of more efficient energy storage systems, such as advanced batteries and supercapacitors.

Additionally, it plays a role in creating nanostructured materials for thermoelectric devices, which convert waste heat into usable energy.

The potential for innovation does not stop there. Nanorobots, still in experimental phases, hold the promise of revolutionizing fields like maintenance and repair in mechanical systems. Imagine tiny robots capable of repairing cracks in pipelines or performing precise assembly tasks in confined spaces.

As students, embracing the study and research of nanotechnology will undoubtedly open doors to exciting opportunities. The fusion of nanotechnology and mechanical engineering promises a future where machines and materials are not only stronger and smarter but also more sustainable and efficient.

In conclusion, nanotechnology is reshaping the landscape of mechanical engineering. By harnessing the power of the nanoscale, we can solve complex engineering challenges and pave the way for a more innovative and sustainable future.

STUDENT ARTICLES

Pour façonner l'image des marques, Lindbergh partage la vision d'une femme forte, à la silhouette conquérante et la féminité minimaliste, avec des créatrices comme Jil Sander, l'Américaine Donna Karan et l'Italienne Muccia Prada. Franca Sozzani, rédactrice en chef du *Vogue* Italie, qui travaille avec Lindbergh depuis l'époque de son magazine *Lei* en 1980, déclare que « Peter est un photographe qui marquera l'histoire de la photographie car il n'est pas prisonnier des tendances, il a sa propre identité : n'est pas un photographe de mode. Il se sert de mode pour parler aux femmes et pour parler des femmes, ce qui est très différent. »

Armani, qui a aussi collaboré avec Lindbergh sur des commandes, explique : « Il y a tout un dire et de rassembler des expériences et des femmes, par exemple. Leur corps et leurs

Voici près de cinq décennies que Lindbergh collabore avec de grands noms de la mode, dont Jean Paul Gaultier et John Galliano depuis leurs premières collections jusqu'à aujourd'hui, mais aussi avec la Japonaise Rei Kawakubo et sa marque Comme des Garçons (page 24, image 21). En 1981, fraîchement débarquée de Tokyo avec Yohji Yamamoto, elle présente à Paris une première collection au parti pris radical. Si, pour beaucoup, ses créations avant-gardistes font alors l'effet d'un choc, elles constituent une contre-proposition à une décennie 1980 exubérante et dorée en alliant tradition japonaise et savoir-faire français. L'esthétique minimaliste du photographe, les images granuleuses aux ambiances cinématographiques qu'il a concoctées pour divers magazines, ont attiré l'attention de Kawakubo et fait naître entre eux une collaboration artistique. Ces robes post-apocalyptiques, déstructurées, conçues comme des pièces d'architecture en relation avec de critiques, certains journalistes traditionnels les jugent anti-mode et importables. Kawakubo donne à Lindbergh toute liberté pour construire la marque d'avant-garde qui arrive en Europe. Quand, en 1988, la photographie capture Linda Evangelista, Kirsten Owen et Michaela Bercu devant une énorme roue d'engrenage enveloppée de vapeur (page 216/217), il exprime tout un passé visuel et émotionnel qui est fort dans le temps.

Lindbergh est inspiré par les dans des lieux parfois spartan, murs et aux sols écailleux, avec une simple table, des chaises de bois, des ventilateurs et du matériel oubliés la fameuse bache en guise de lumière pour créer l'atmosphère « lindberghienne ». On dirait pour le cinéma.

Marvels in Mechanical Engineering

by Sayed Mushahiduz Zama, 3rd Semester

Mechanical Engineering is one of the oldest and most versatile branches of engineering. Over the years, it has played a pivotal role in shaping the world as we know it today. From the smallest gadgets to the largest industrial machines, mechanical engineering marvels are present everywhere, pushing the boundaries of innovation and technological advancement.

One of the most awe-inspiring achievements in this field is the development of robotics and automation. Robots, which once existed only in science fiction, are now transforming industries, from manufacturing and healthcare to space exploration. These machines are designed with precision and ingenuity, capable of performing tasks that are repetitive, hazardous, or require extreme accuracy. They have become essential components in modern production lines, increasing efficiency and reducing human error.

Another remarkable area is the advancement in energy-efficient systems and renewable energy technologies. Mechanical engineers have been at the forefront of designing innovative wind turbines, solar tracking systems, and advanced power generation systems that harness clean and sustainable energy sources. These efforts are crucial in combating climate change and promoting a greener, more sustainable future.

The field of transportation has also witnessed groundbreaking innovations, thanks to mechanical engineering. High-speed trains, electric vehicles (EVs), and even hyperloop technologies are reshaping the way people travel. EVs, in particular, are becoming increasingly popular as they offer an environmentally friendly alternative to traditional internal combustion engine vehicles.

In conclusion, mechanical engineering continues to be a driving force behind technological progress. The marvels created by mechanical engineers have transformed industries, improved lives, and paved the way for a more sustainable and interconnected world. As students, we should be inspired by these achievements and strive to contribute to this ever-evolving field with creativity and innovation.

Introduction to Surface Engineering

by Suryakanta Maharana, 3rd Semester

Surface engineering is a fascinating field that plays a crucial role in enhancing the performance, durability, and appearance of materials used in countless applications. From automotive parts to medical implants and electronic devices, surface engineering impacts almost every aspect of modern life. By focusing on modifying the outermost layer of materials, this discipline ensures components can withstand harsh environments, resist wear and tear, and maintain their functionality for extended periods.

At its core, surface engineering involves the study and application of techniques designed to alter the surface properties of materials without changing their bulk characteristics. This can include improving hardness, corrosion resistance, friction reduction, and even aesthetic appeal. Common processes used in surface engineering are coating, heat treatment, surface modification, and advanced deposition techniques.

One popular method is **coating**, where a thin layer of protective material is applied to the surface. Coatings can be metallic, ceramic, or polymer-based, each offering specific advantages depending on the application. For example, a thin ceramic coating on turbine blades can protect them from high temperatures and oxidation.

Another significant process is **heat treatment**, where the material is subjected to controlled heating and cooling cycles. This alters the microstructure of the surface, improving properties such as hardness and toughness. Techniques like carburizing and nitriding are common in heat treatment for surface hardening.

Surface modification techniques, such as laser texturing or ion implantation, are used to directly change the surface characteristics without adding any external material. These methods are often employed in high-tech industries where precision and performance are critical.

Cutting Edge Technologies in Mechanical Engineering

by Mrutyunjaya Pradhan, 3rd Semester

Mechanical engineering, often referred to as the backbone of modern industry, is undergoing a remarkable transformation with the emergence of cutting-edge technologies. These advancements are not only redefining traditional practices but also paving the way for innovative solutions to complex engineering problems. Here's a look at some of the most exciting technologies revolutionizing the field.

1. Additive Manufacturing (3D Printing) One of the most groundbreaking advancements in mechanical engineering is additive manufacturing, commonly known as 3D printing. This technology allows engineers to create complex components layer by layer, reducing waste and enabling faster prototyping. Industries such as aerospace, automotive, and healthcare are leveraging 3D printing to produce lightweight yet durable components, customize products, and reduce production timelines.

2. Robotics and Automation Robotics and automation are transforming manufacturing processes by enhancing efficiency, precision, and safety. Robots are now capable of performing intricate tasks that were once exclusively handled by humans. Collaborative robots, or cobots, are designed to work alongside human operators, improving productivity and reducing the risk of workplace injuries.

3. Internet of Things (IoT) and Smart Manufacturing The integration of IoT in mechanical engineering has led to the development of smart manufacturing systems. IoT-enabled machines can communicate with each other, monitor performance in real-time, and predict maintenance needs. This results in reduced downtime, optimized energy consumption, and improved overall efficiency.

4. Advanced Materials The discovery and application of advanced materials are reshaping mechanical design and manufacturing. Materials such as carbon fiber composites, shape memory alloys, and high-temperature ceramics offer superior properties like lightweight strength and resistance to extreme conditions. These materials are finding applications in industries ranging from automotive to aerospace.

5. Sustainable and Green Technologies As the world moves towards sustainability, mechanical engineers are at the forefront of developing eco-friendly technologies. From energy-efficient manufacturing processes to the design of renewable energy systems, engineers are playing a crucial role in reducing the carbon footprint of industrial operations.

6. Artificial Intelligence and Machine Learning AI and machine learning are enabling smarter decision-making in mechanical engineering. These technologies are used for predictive maintenance, design optimization, and quality control, helping companies save costs and improve product performance.

Conclusion The landscape of mechanical engineering is evolving rapidly with these cutting-edge technologies. Students and professionals alike must stay updated with these advancements to remain competitive in the field. As the line between mechanical and digital engineering continues to blur, the future holds endless possibilities for those willing to innovate and adapt. The journey ahead promises to be exciting, challenging, and immensely rewarding.



Applications of Mechatronics in Modern Industry

By Udaya Sabar, 5th Semester

In today's rapidly advancing technological landscape, mechatronics has emerged as a transformative discipline that integrates mechanical engineering, electronics, computer science, and control systems. This interdisciplinary approach has led to groundbreaking innovations and is playing a crucial role in shaping modern industries. From automation in manufacturing to advancements in healthcare, the applications of mechatronics are vast and impactful.

1. Manufacturing Automation: One of the most prominent applications of mechatronics is in automated manufacturing systems. Robots equipped with sensors and intelligent control systems are revolutionizing production lines. These robotic systems can perform repetitive tasks with precision and consistency, significantly enhancing productivity and product quality.

Mechatronics-based automation also allows for real-time monitoring and adaptive control, making factories smarter and more efficient.

2. Automotive Industry: The automotive sector has greatly benefited from mechatronics. Advanced features such as anti-lock braking systems (ABS), electronic stability control (ESC), and adaptive cruise control (ACC) are made possible through mechatronic systems. Electric and autonomous vehicles rely heavily on the seamless integration of mechanical components, sensors, and intelligent control units, demonstrating the critical role of mechatronics.

3. Healthcare and Medical Devices: In the healthcare sector, mechatronics has enabled the development of sophisticated medical devices and systems. Robotic surgical tools, prosthetics, and automated diagnostic equipment are examples of mechatronics in action. These innovations have not only improved the accuracy of medical procedures but also enhanced the quality of life for patients.

4. Aerospace and Defense: The aerospace and defense industries require highly reliable and precise systems. Mechatronic solutions are employed in the development of unmanned aerial vehicles (UAVs), flight control systems, and advanced navigation equipment. These systems enhance the safety, efficiency, and performance of modern aircraft and defense technologies.

5. Consumer Electronics: Everyday gadgets, from smartphones to smart home devices, are products of mechatronic engineering. Features like motion detection, touch-sensitive screens, and automated home systems are powered by the integration of sensors, actuators, and control software. Mechatronics has made modern life more convenient and connected.

6. Renewable Energy Systems: The push for sustainable energy solutions has also seen the adoption of mechatronics. Wind turbines, solar tracking systems, and energy-efficient smart grids rely on mechatronic components for optimal performance and energy management.

In conclusion, mechatronics is driving innovation across multiple sectors, creating smarter, more efficient, and more sustainable solutions. As technology continues to evolve, the role of mechatronics will only become more significant, making it a vital field for aspiring engineers and technologists to explore.

Magnetic Fuel Energizer

by Krushna Chandra Das, 5th semester

As the world faces rising energy demands and environmental concerns, innovative technologies are emerging to enhance fuel efficiency and reduce emissions. One such fascinating invention is the **Magnetic Fuel Energizer**, a simple yet effective device that promises significant benefits for automobiles and other fuel-dependent machines.

The Magnetic Fuel Energizer works by utilizing strong magnetic fields to align the hydrocarbon molecules in the fuel. Under normal conditions, these molecules are randomly arranged, which can lead to inefficient combustion. When fuel passes through a magnetic field created by the energizer, the hydrocarbon chains become more organized, resulting in better atomization during combustion. This leads to a more complete and efficient burning process, reducing unburnt fuel residues and harmful emissions.

Several studies have shown that the use of magnetic fuel energizers can improve fuel efficiency by up to **10%** and reduce pollutants such as carbon monoxide and nitrogen oxides. The device is easy to install and requires no modification to the engine, making it a popular choice for both car enthusiasts and environmentally conscious drivers.

Beyond environmental benefits, the economic savings from better fuel efficiency cannot be overlooked. In today's era of fluctuating fuel prices, even a small increase in mileage can significantly impact the overall operating cost of a vehicle.

However, it's important to note that the effectiveness of Magnetic Fuel Energizers can vary depending on the type of vehicle and fuel quality. While some skeptics argue about its consistency, many users swear by its positive impact.

As young engineers and innovators, it's crucial for us to explore such technologies and contribute to sustainable solutions for the future. Who knows? One of us might even invent the next big breakthrough in fuel optimization.

Hyperloop

by Biswachandan Bhoi, 5th semester

The concept of Hyperloop, a high-speed transportation system, has taken the world by storm since it was proposed by Elon Musk in 2013. This futuristic transportation technology promises to revolutionize the way we travel by drastically reducing travel times between cities. The Hyperloop aims to transport passengers in pods that travel through low-pressure tubes at speeds of over 700 mph, harnessing magnetic levitation or air propulsion systems to reduce friction and increase speed.

Hyperloop's main advantage is its energy efficiency. Unlike traditional trains or airplanes, the system's low friction environment allows for minimal energy consumption. The concept also envisions using renewable energy sources, such as solar power, to further enhance sustainability. This would make Hyperloop an environmentally friendly alternative to current transportation methods.

Furthermore, Hyperloop's speed and reduced travel time could lead to a significant boost in global economic activity by improving the accessibility of distant regions. This could bring about a shift in urban planning, potentially leading to the development of new cities and industries.

While the concept has captured the imagination of many, there are still significant challenges to overcome. Technical hurdles, including the development of safe, reliable vacuum tubes and the potential for structural issues due to the varying terrains, need to be addressed. Despite this, Hyperloop remains an exciting and ambitious step toward the future of transportation.

Emerging Trends in Mechanical Engineering

by Ganesh Hembram, 3rd semester

Mechanical engineering is an ever-evolving field, and as technology advances, new trends are constantly emerging. Some of the most prominent trends in mechanical engineering today include the integration of automation and robotics, 3D printing, artificial intelligence (AI), and renewable energy technologies.

Automation and robotics are transforming manufacturing processes, increasing efficiency, and reducing human error. Industries are increasingly adopting robotic systems for tasks such as assembly, welding, and material handling. These systems can operate 24/7, improving productivity and reducing costs.

3D printing, or additive manufacturing, is another breakthrough technology. It allows engineers to create complex geometries that were previously impossible to produce using traditional manufacturing methods. This technology has applications across various industries, including aerospace, automotive, and healthcare.

The rise of AI in mechanical engineering is another game-changer. AI algorithms are used to optimize designs, improve predictive maintenance, and automate quality control processes. Machine learning can analyze large sets of data to predict failure patterns in machinery, enabling engineers to proactively address issues before they cause significant problems.

Finally, the focus on renewable energy is gaining momentum. Mechanical engineers are at the forefront of developing more efficient solar panels, wind turbines, and other green technologies. These innovations are helping to reduce our dependence on fossil fuels and combat climate change.

These trends are shaping the future of mechanical engineering, creating exciting opportunities for engineers to innovate and solve global challenges.

Industrial Applications of Plasma Cutting

by Muna Pattasani, 3rd semester

Plasma cutting is a process that uses a high-velocity jet of ionized gas (plasma) to cut through electrically conductive materials like metal. It's a widely used technique in the manufacturing and fabrication industries due to its efficiency, precision, and versatility.

One of the primary industrial applications of plasma cutting is in the fabrication of metal parts. This technology is used in a wide range of industries, including automotive, aerospace, and construction, to cut materials such as steel, aluminum, and copper. Plasma cutting is particularly effective in situations where intricate and complex cuts are required, as it produces a clean and smooth edge with minimal distortion.

Another important application of plasma cutting is in the repair and maintenance of equipment. By using plasma torches, industries can quickly and efficiently remove worn-out or damaged parts, facilitating faster repairs and minimizing downtime. Plasma cutting is also used in the production of pipes and tubes, where it helps create accurate cuts and weld joints.

Moreover, plasma cutting is often combined with CNC (Computer Numerical Control) technology, allowing for automated cutting processes. This combination increases the speed and accuracy of the cutting process, reducing human error and enhancing productivity. It also enables companies to produce custom parts with high precision.

In conclusion, plasma cutting is a critical technology for industries that rely on the precise and efficient cutting of metals. Its ability to handle a variety of materials and its compatibility with automation make it an indispensable tool in modern manufacturing.

Surface Treatment Technologies for Enhanced Material Performance

by Gaurab Charan Sahu, 5th semester

Surface treatment technologies play a crucial role in improving the performance, durability, and aesthetics of materials. In mechanical engineering, these treatments are applied to materials such as metals, ceramics, and polymers to enhance their resistance to corrosion, wear, and fatigue.

One of the most common surface treatments is coating, where a thin layer of material is applied to the surface of a workpiece to improve its properties. Types of coatings include galvanizing (for corrosion resistance), anodizing (for enhanced hardness and appearance), and thermal spraying (for wear resistance). Each coating type is selected based on the specific needs of the application.

Another important surface treatment is heat treatment, which involves heating and cooling materials in a controlled manner to alter their microstructure. This process is used to improve the hardness, toughness, and wear resistance of metals, making them suitable for use in high-stress applications such as gears, shafts, and bearings.

Surface polishing and grinding are also commonly used to improve the surface finish of materials. Polishing reduces surface roughness, while grinding is used to shape and smooth surfaces with high precision. Both techniques are critical in applications where dimensional accuracy and surface smoothness are essential.

Laser surface treatment is an emerging technology that uses a high-powered laser beam to alter the surface properties of materials. This technique can improve hardness, reduce friction, and increase wear resistance, making it ideal for high-performance engineering applications.

By enhancing the surface properties of materials, surface treatment technologies enable engineers to design components that perform better, last longer, and are more resistant to failure, making them crucial in modern mechanical engineering.

Diesel Engines: Working Principles and Applications

by Ganesh Behera, 1st semester

Diesel engines are internal combustion engines that use diesel fuel to generate power. They are known for their efficiency, durability, and ability to produce more torque at lower speeds compared to gasoline engines. Diesel engines work on the principle of compression ignition, where air is compressed to a high pressure, causing the temperature to rise and igniting the injected fuel.

The working cycle of a diesel engine consists of four stages: intake, compression, power, and exhaust. During the intake phase, air is drawn into the cylinder. In the compression phase, the air is compressed, raising its temperature. The fuel is injected into the high-temperature air during the power phase, where it ignites and produces a force that moves the piston. Finally, the exhaust phase expels the combustion gases.

Diesel engines are used in a wide range of applications, including in automobiles, trucks, ships, and power generation plants. Their high torque and fuel efficiency make them ideal for heavy-duty applications where power is needed over extended periods of time. Additionally, diesel engines are often used in industrial machinery, construction equipment, and agricultural vehicles.

While diesel engines have many advantages, they also have drawbacks, particularly in terms of environmental impact. Diesel engines emit higher levels of nitrogen oxides (NOx) and particulate matter compared to gasoline engines, contributing to air pollution. However, advancements in emission control technologies, such as selective catalytic reduction (SCR) and diesel particulate filters (DPF), are helping to mitigate these issues.

Despite the environmental challenges, diesel engines remain an integral part of the global transportation and industrial sectors due to their reliability, power, and efficiency.

Natural Frequencies of Cantilever Beam

by Dipu Muduli, 5th semester

The natural frequency of a cantilever beam is a critical parameter in structural engineering, as it determines the vibration behavior of the beam when subjected to dynamic forces. A cantilever beam is a beam that is fixed at one end and free at the other, and its natural frequencies depend on factors such as material properties, geometry, and boundary conditions.

When a cantilever beam is subjected to a force, it vibrates at specific frequencies known as its natural frequencies. These frequencies are determined by the beam's length, cross-sectional area, Young's modulus, and moment of inertia. The first natural frequency corresponds to the fundamental vibration mode, and higher natural frequencies correspond to higher modes of vibration.

Understanding the natural frequencies of a cantilever beam is essential in preventing resonance, a phenomenon that occurs when the frequency of external forces matches the natural frequency of the beam, leading to excessive vibrations. Resonance can cause structural failure or damage, making it crucial to design structures that avoid resonance by ensuring that external frequencies do not coincide with the natural frequencies of the beams.

Engineers use mathematical models and experimental methods to calculate the natural frequencies of cantilever beams. Modal analysis is a common technique used to determine these frequencies and study the vibration modes of the beam. In practice, finite element analysis (FEA) is also employed to simulate the behavior of cantilever beams under dynamic loading conditions.

In conclusion, understanding the natural frequencies of cantilever beams is essential for ensuring the structural integrity of mechanical systems. Proper design and analysis help mitigate the risk of resonance, ensuring that structures perform safely and efficiently under dynamic loading conditions.

MECHANICAL POEM

ଏଞ୍ଜିନ୍ ର ଗାନ

(Engine ra Gaan)

ଗୁଡୁଗୁଡୁ ଧ୍ବନିରେ ଚାଲେ ଏଞ୍ଜିନ୍,
ଶକ୍ତିର ଧାରା ଭରି ଏହି ନୂତନ।
ଲୋହାର ଗଢ଼ଣା, ଗତିର ଜନ୍ମ,
ଘୂର୍ଣ୍ଣନ ଗତିରେ ଚଳେ ଅକ୍ଷୟ।

ଯେଉଁଠି ଆଉଛି ଏଞ୍ଜିନର ଅବିରତ ଚେତନା,
ଶ୍ରମିକ ହାତରେ ଏହାର ପ୍ରାଣ ଓ ଜୀବନ।
ଇଂଧନ ଦେଲେ ଏଇଁ ଜଳି ଉଠେ,
ପ୍ରଗତିର ଚକ ଏହି ଏଞ୍ଜିନ୍ ଉଠେ।

ଏକ ସ୍ମୃତିରେ ରହିଲା ଏଞ୍ଜିନ୍ ଦିନ,
ମେକାନିକ୍ ହୃଦୟରେ ଏହା ଅପରିହାର୍ଯ୍ୟ ଜୀବନ।
ଯେଉଁଠି ଚାଲେ ଏଞ୍ଜିନର ଅବିରତ ଗାନ,
ସେଉଁଠି ଜନ୍ମ ନେଉଛି ନୂଆ ନବୀନ ସ୍ବପ୍ନ!

Gaurab Charan Sahu

ଏଞ୍ଜିନ୍ ର ମହିମା

(Engine ra Mahima)

ଏଞ୍ଜିନ୍ ଚାଲେ ଧମ୍‌ଧମ୍ ବଜେ,
ଯିଏ ଜଗତକୁ ନୂଆ ଆଶା ଦେଖେ।
ଉନ୍ମୁଳ ଭବିଷ୍ୟତ ଏଠି ଲୁକାଇ,
ଏହି ଯନ୍ତ୍ର ଚାଲେ ଲକ୍ଷ୍ୟ ହିଁ ଲାଲ।

ଇଂଧନ ଜଳେ ଜାଗେ ଶକ୍ତି,
ଏଞ୍ଜିନ୍ ହେଉଛି କାମର ଭକ୍ତି।
ଘୂର୍ଣ୍ଣନ ଗତିରେ ହେଉ ଅସୀମ,
ସ୍ବପ୍ନ ଗଢ଼ିଥାଏ ଏହି ମହିମା।

Shubham Mishra

The Heart of Innovation

Gears that turn, wheels that spin,
Mechanical minds where dreams
begin.

Strength in steel, precision in art,
Engineering wonders set apart.

Bridges rise and engines roar,
Machines that build, forever more.
From tiny bolts to mighty beams,
We craft the world, we fuel the dreams.

Pradyumna Behera

The Power of Mechanics

Bolts and gears, metal so strong,
Machines in motion, rolling along.

Bridges stand and engines run,
Built with skill, second to none.

Design and force, balance so true,
Innovation sparks something new.
With every turn, with every glide,
Mechanical minds move far and wide!

Sashanka Samantaray

THE LITTLE MECHANICAL MAN

The little mechanical man
has finally run down
He sits slumped in the
chair head hanging feet
splayed broken and dented

The little mechanical man is no more
For so many years he just keep leaping up and
going but no more

For so long he retained the bounce back
from every pointless throw at the wall punch
every dark road with no end

Every lie that some hand at the end of the
road to grasp

But toys break eventually if you don't take good
care didn't momma tell you that

Now look

Poor little mechanical man
is broken

Won't wind up and run any
more in can't get up and run
anymore

So you can quit playing with me
god and put me with the rest of

The broken toys
waiting to go to the trash

GREAT QUOTES

Bikash Jena

"I destroy my enemies when I make them my friends."

— Abraham Lincoln

"If you want to live a happy life, tie it to a goal, not to people or objects."

— Albert Einstein

Instead of wondering when your next vacation is, maybe you should set up a life you don't need to escape from."

— Seth Godin

You must be the change you wish to see in the world."

— Mahatma Gandhi

2022-2023



DEPARTMENT OF
MECHANICAL ENGINEERING

CAPITAL SCHOOL
OF
ENGINEERING, KHORDHA