

## ABOUT THE CONFERENCE

*This international conference aims to provide a platform to share the knowledge in recent emerging trends in mechanical engineering and its allied areas among the scholars, academicians, scientists and industry personnel. The theme of this conference is to focus on the advancements in mechanical engineering and its applications, mainly interdisciplinary areas of mechanical engineering.*



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International Conference on Advanced Mechanical Engineering and Applications

# International Conference on Advanced Mechanical Engineering and Applications

*Conference Proceedings*

(ICAMEA-2024)

(APRIL 15-16, 2024)

Department of Mechanical Engineering  
Andhra Loyola Institute of Engineering & Technology  
Vijayawada, Krishna, Andhra Pradesh, India.



Edited by  
**Dr. G. G. Srinivasu**  
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# **1<sup>st</sup> International Conference on Advanced Mechanical Engineering and Applications**

**(ICAMEA-2024) (APRIL 15-16, 2024)**

*Conference Proceedings*

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**Dr. G. G. Srinivasu & Dr. T. Subba Reddy**

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# International Conference on Advanced Mechanical Engineering and Applications

- Dr. G. G. Srinivasu & Dr. T. Subba Reddy

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## **About the conference**

This international conference aims to provide a platform to share the knowledge in recent emerging trends in mechanical engineering and its allied areas among the scholars, academicians, scientists and industry personnel. The theme of this conference is to focus on the advancements in mechanical engineering and its applications, mainly interdisciplinary areas of mechanical engineering.

### **Objective of the Conference**

- ✚ To encourage research and development activities in mechanical engineering and its associated fields.
- ✚ To promote scientific information exchange among the academicians, researchers, developers, engineers, students, and practitioners working around the world

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**Rev. Fr. Dr. B. Joji Reddy S.J**

**Secretary & Director, ALIET**

It gives me immense pleasure to know that Department of Mechanical Engineering, Andhra Loyola Institute of Engineering & Technology, Vijayawada, India is organizing International Conference on Advanced Mechanical Engineering and Applications (ICAMEA-2024)

I am sure that this conference will provide a forum to national and international students, academicians, researchers and industrialists to interact and involve in Research and Innovation. Such academic events benefit the students, teachers and researchers immensely and widen the horizons of their knowledge and work experience in the field of Advanced Mechanical Engineering and Applications. I sincerely appreciate the humble efforts of the Institute in providing a platform for students, academicians, researchers and industrialists to share their ideas and research outcome through the forum of this Conference.

I give my best wishes to all delegates and organizing committee to make this event a grand success.



**Fr. D. Bala Swamy SJ**

**Asst. Director, ALIET**

Innovation has been the backbone for the economic development ever since mankind started to live on this earth. Bill Gates observed “Never before in History has Innovation offered promise of so much to so many in so short a time”.

It gives me immense pleasure to know that Department of Mechanical Engineering, Andhra Loyola Institute of Engineering and Applications Technology, Vijayawada, India has chosen “Advanced Mechanical Engineering and applications” as the theme for conducting an International conference ICAMEA-2024. I am sure the conference will provide adequate opportunity for all the participants to share their knowledge and deliberate on various current issues connected with the subject.

I wish all success to this conference.



**Dr. O. Mahesh**

**Principal**

It is a matter of great pleasure for me to know that Department of Mechanical Engineering, Andhra Loyola Institute of Engineering and Applications Technology, Vijayawada, India has chosen “Advanced Mechanical Engineering and applications”

Education is always a sign of development and learning. It should be research-oriented helping society to create something new. Thinking in an innovative and new way is significant to cope with technological changes. It is also relevant for exploring and searching various aspects of education through & Advanced Mechanical Engineering and applications.

The response of contributors and likeminded educational fraternity showing their keen interest in this conference is highly motivating. Presentation of such research papers is extremely beneficial for research scholars and stimulating factor for us to organize such conferences frequently in future. I sincerely offer my earnest gratitude to those who have contributed through their research papers at the conference. I am sure that the conference would achieve its objective by providing a suitable platform for learning and experiencing the latest advancement in the field of industry. The cohesive efforts of a dedicated and committed team become necessary for organizing such conferences. We are fortunate enough for having such a hardworking team with us.

I wish for the grand success of the conference.



**Dr. M. GEETA RANI,**

**HOD**

With great pride and honor, I take this opportunity to welcome you all to 1st International Conference on Advanced Mechanical Engineering and applications ICAMEA-2024 on 15-16 April 2024 organized by the Department of Mechanical Engineering, Andhra Loyola Institute of Engineering and Applications Technology, Vijayawada, India. ICAME-2024 shares insight on various significant topics with upcoming trends & technologies in the field of Advanced Mechanical Engineering. The conference seeks to provide a forum with broad blend of high-quality academic papers to promote communication, learning and exchange of ideas amongst researchers, scientists, and engineers in the field of mechanical engineering. As the convener of ICAMEA-2024, I firmly believe that the conference will serve as a nodal conjunction between the Researchers, Academicians, Learners & the Industry.

The Conference will witness deliberations, discussions and sharing of innovative thoughts & ideas that will bolster the efforts to take up new challenges and initiatives in the field of mechanical engineering & its allied areas. It's a matter of immense pleasure that Academia from various IITs, NITs, Central, State and Foreign Universities, Industry Stalwarts and Scientists from various reputed organizations will enlighten us with their knowledge and experience in the Conference. Being the HoD-ME Department, I take this opportunity to extend my heartiest thanks to the management of ALIET for their valuable support and also, convey my heartiest congratulations to the Organizing Committee to undertake an arduous task in the most impeccable manner to accomplish the same. On behalf of the entire team, I welcome you all for ICAMEA-2024 and hope your stay turns intellectually stimulating and professionally enriching. With long lasting memories and a strong legacy to emulate, I personally as well as on behalf of Mechanical Engineering Department wish ICAMEA-2024 a grand success.

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## **Development and testing of 3D printed ASTM standard PLA-Alumina composite polymer**

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### **Abstract:**

One of the most commonly used thermoplastics in industry is polylactic acid (PLA). The goal of this project is to use fused deposition modelling to create PLA-alumina composite polymers for applications requiring strong, lightweight materials. The variation of PLA-alumina consists of layers and filaments are used to print the product according to ASTM standards. Aluminium oxide is used together for each layer to make the polymer composite. The percentage of alumina for each sample was set to 0, 10, and 15. Tensile testing of polymer composite samples was performed using ASTM D638, Rockwell hardness test D785, D 256 IZOD impact test and D3763 multiaxial impact test. The results showed that the addition of alumina significantly improved properties such as tensile strength, hardness and toughness.

**Keywords:** Polylactic Acid, Alumina, ASTM standards, polymers, tensile testing.

# Experimental Investigation on Effect of Pulse Current Welding Parameters on Microstructure Evolution and Mechanical Properties of Austenitic Stainless steel components by GTAW based additive manufacturing

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## Abstract:

Wire Arc Additive manufacturing (WAAM) became an emerging technology for fabricating large scale metallic components due to its cost effective, high deposition rates and near net shape. Gas Tungsten Arc Welding (GTAW) an arc welding process using a non-consumable electrode and separate wire feeder for deposition. GTAW based WAAM process combined with depositing continuous wire and melted via heat source. In the present work, GTAW based WAAM was used to manufacture a single walled component with ER 316L filler wire. The fabricated component has studied through microstructure, micro-hardness and tensile properties of the built structure. The microstructure results revealed that the columnar dendrites were formed in the middle and bottom regions and equiaxed dendrites in the top region. Micro-hardness results showed that the uniform distribution of hardness value from bottom to top region of the built structure deposits walls and the average value of 240 HV was obtained. The tensile studies showed that the higher tensile properties of UTS: 470MPa, YS: 340 MPa, EL: 42% & RA: 44.3% respectively. The use of pulsed current technique improves the microstructure and mechanical properties due to grain refinement in the fusion zone. Fracture surface exhibits that large number of dimples with homogeneous distribution and implies the superior toughness of the fabricated parts. The study shows a better GTAW based WAAM technique for industrial component manufacturing based on 316L stainless steel microstructure and mechanical integrity test. This study paves the way to produce the thin walled structure with improved microstructure and mechanical properties.

**Keywords:** WAAM, GTAW, Stainless steel, Microstructure & Mechanical Properties.



# Investigations on Hardness and Wear Behavior of Al-4032/Al<sub>2</sub>O<sub>3</sub>/SiC/CNT Hybrid Composites

S.Krugon<sup>1\*</sup>, D.Vijay Praveen<sup>1</sup>, P.Umamaheswar rao<sup>2</sup>, Y.Narendra Babu<sup>2</sup>, B.Iftekhara Hussain

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## Abstract

The advancement of the manufacturing sector has spurred the evolution of materials in recent decades. Traditional alloys fall short of meeting the diverse mechanical property requirements such as strength, stiffness, hardness, and toughness demanded by the sector. To address these needs, composite materials have emerged as indispensable, offering the desired properties. Additionally, to enhance production rates, the manufacturing sector has shifted focus towards development of high strength composite materials. With this perspective, the current paper aimed to develop Al-4032 hybrid composites by incorporating different proportions of Aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), silicon carbide (SiC), Carbon Nano Tubes (CNT) reinforcements using a stir casting route. Microstructural, Hardness and wear characterizations are performed on the developed composites. Microstructural studies revealed the uniform dispersion of the reinforcement in the base alloy. Further, the effects of the combinations of the reinforcements on hardness and wear behaviour are explored.

**Keywords:** CNT, Hardness, Tensile strength, hybrid metal matrix composites.

# Maximizing Efficiency: Fine-Tuning Copper Beryllium Alloy Manufacturing via Wire Arc Additive Methods with Orthogonal Array Optimization

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## Abstract:

Wire Arc Additive Manufacturing (WAAM) is an emerging technology known for its unique capabilities in crafting intricate metal components. This study investigates the utilization of WAAM technology in the production and detailed examination of copper beryllium products—a high-performance alloy highly prized across multiple industries. The primary objective is to assess the feasibility of employing WAAM for copper beryllium fabrication while scrutinizing the resulting material properties and mechanical behavior. Stringent safety precautions are implemented, considering the potential hazards associated with beryllium alloys. This study significantly contributes to the expanding body of knowledge concerning WAAM technology and its potential applicability to copper beryllium alloys. Focused on processing CuBe alloy through WAAM, this research employs an orthogonal array methodology to optimize the mechanical properties of the resultant components. The outcomes of this study enhance our broader comprehension of WAAM's capacity to manufacture high-performance alloys, thus fostering the development of innovative solutions across diverse industrial sectors.

**Keywords:** WAAM; Additive Manufacturing; Copper-Beryllium; Mechanical properties, orthogonal array, High performance alloys, Potential hazards.

# Multi response optimization of process parameters during friction stir welding of AA1100-AA6082 using TOPSIS approach

Tiparani Sai Sudheer<sup>1</sup>, Bongu Nagendra<sup>2</sup>, Bobbili Dinesh Kumar<sup>3</sup>, Kancharla Joshiya Raju<sup>4</sup>, P.Umamaheswarrao<sup>1\*</sup>

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## Abstract

Aluminum AA1100 is the most widely used grade of Aluminium due to its excellent corrosion resistance, high ductility and reflective finish. The AA6xxx series alloys have applications in structural strength and automobiles applications. FSW of Aluminium alloys have the potential to hold good mechanical and metallurgical properties. In this study, multi objective optimization for Friction stir welding (FSW) of dissimilar AA1100-AA6082 has been presented to provide optimum tensile strength, hardness and % of elongation. The input parameters considered for the analysis are tool rotational speed, feed and tilt angle. Experiments are designed based on Taguchi<sub>L9</sub> orthogonal array. The effect of FSW using these welding parameters was studied by measuring the tensile strength, hardness and % of elongation of the welded joints. The parametric influence on responses was discussed through main effects plot and interaction plot. Further, multi objective optimization was performed with technique for order of preference by similarity to ideal solution (TOPSIS). Results demonstrated that feed was observed to be the most significant factor affecting the responses followed by tool rotational speed and tilt angle. The obtained optimum combinations of parameters are i.e. tool rotational speed-710 rpm, feed - 50 mm/rev, and tilt angle-1°.

**Keywords:** Tensile strength, hardness, FSW, orthogonal array, multi response optimization.

## Non-Destructive Testing on Weld Joint

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This work presents a review of the three most efficient non-destructive testing methods. These methods are radiography, magnetic particle test and penetrate test. These particular techniques were chosen because they are able to cover most of the industrial needs for welding joint inspection. The aim of this work is to present the physical background of operation for the given methods, discuss their benefits, limitations, and typical areas of application, and compare them with each other. In the first part of this work, all three methods and their variations are described in detail with schemes and figure with represent their working principles. It appears that although all the given methods can detect all types of flaws in welding joints, they have their specific limitations.

For magnetic particle testing is able to detect defects surface and subsurface flaws in ferromagnetic materials. Penetrant test is finding the open surface defects. The main flaw of radiography is the resolution: it is not usable for very fine defects. The second part of the work is for comparing the testing methods and for drawing the conclusions. The methods are compared according to the possible material, defect types and their position, as well as the possible areas of application. This part gives the background for choosing a proper welding joint testing method for certain applications in the welding industry.

**Key words:** Non destructive testing, Low carbon steel, Welding defects, Radiography, Magnetic particle test, penetrate test.

# Analyzing the Performance and Emission Characteristics of Diesel Engine by using Mango Seed Oil

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Affiliated JNTUK, Mylavaram, A. P

## Abstract:

This study investigates the extraction of mango seed oil using a combination of biodiesel and 1-propanol as solvents. The extraction process involved a hybrid approach combining mechanical pressing with solvent extraction techniques to enhance oil yield and efficiency. Biodiesel, derived from renewable sources, and 1-propanol were selected for their eco-friendly characteristics and compatibility with the extraction process. The extracted mango seed oil was thoroughly analyzed to evaluate its physicochemical properties, including fatty acid composition, antioxidant content, color, odor, and viscosity. Results demonstrate that combining biodiesel and 1-propanol resulted in an efficient extraction process, yielding mango seed oil with desirable characteristics for various industrial applications.

## Smart Control Grass Cutter

Jaiprasad M, Shashidhara J S, Yogesh Kumar R M

Amruta Institute of Engineering Management Sciences, Abbanakuppe, Karnataka 562109

### Abstract

The intention of this project is to design a renewable energy source based on around a piece of exercise equipment. The energy expended in a typical workout at the gym is usually wasted in the mechanics of the equipment. This project harnessed the mechanical energy of the machine and convert edit to electrical energy using a generator-based system. The exercise equipment, attached to the shaft of the generator. Thus, produced electrical energy is used in powering a piece of equipment such as lamp or a computer while exercising. This report will introduce the project and present all applicable information regarding the design, development, and the final product. This project will help one develop engineering skills while learning about a clean way of generating electricity. The modern challenge faced with the global energy situation is the growing energy demand and the strong dependence on unsustainable fossil fuels. Another concurrent issue is the adverse health and socio-economic implications of adult obesity. This gym power generation machine Mini-project, which uses metabolized human energy to generate electrical power, could potentially address both these challenges.

## Fabrication of Vehicle Tracker Integrated with Team center

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### Abstract:

Vehicle Tracking System is developed using a web-based and an IoT platform, which act as a tracking device. This system is developed for all vehicle users to provide easy tracking of their vehicle location. GPS module is responsible for getting the location in the form of latitude and longitude from the satellite. The location will then send to the SIM 808 microcontroller and processed before being redirected to the GSM module. In the meantime, the GSM module is responsible for sending the location to the users via Short Message Service (SMS) or data transfer to the web-server. This tracking device is installed inside the vehicle where it is not visible to anyone. We are planning for the combination of present technology with the requirement of information transmission; we planned for the creative approach of “Vehicle Tracking System using GPS and GSM”. To overcome the drawbacks of the previous methods of paper based and we introduce a project to track a vehicle using GPS and GSM. This Vehicle Tracking System can also be used for Accident Detection Alert System, Soldier Tracking System and many more, by just making few changes in hardware and software and widely in tracking Cabs/Taxis, stolen vehicles, school/colleges buses etc and the whole process can be effectively organized with the help of Team center software.

**Keywords:** Team center, GPS module, GSM module, SMS.

## Speech Guided Landmine Detector Robot

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### Abstract

This project focuses on designing and implementing an AI-based voice controlled robot. The robot is equipped with speech recognition technology, which enables it to understand and respond to voice commands given by the user. The project involves the use of various AI technologies such as Natural Language Processing, Machine Learning, and Computer Vision, which allow the robot to interpret and respond to user commands accurately. The robot's performance is evaluated based on its ability to recognize and respond to different voice commands in real-time. The project aims to demonstrate the potential of AI-based voice controlled robots and their potential to revolutionize the way we interact with machines.



## Thermal Cycling Effects on Titanium-6Al-4V Alloy: A Thermo Gravimetric Analysis

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### Abstract:

Thermo Gravimetric Analysis (TGA) is a powerful method used to study how materials behave when exposed to different temperatures and environments. This research focuses on using TGA to understand how thermal cycling affects a well-known titanium alloy Titanium-6Al-4V. This alloy is crucial in many industries like aerospace and medicine, where it's subjected to repeated heating and cooling. By carefully controlling temperature changes, we can see how the alloy's weight changes over time. This helps us learn about its tendency to lose mass, undergo phase changes, and react with its surroundings. We run experiments where we cycle the temperature up and down while measuring how much the alloy weighs at each stage. Then, we analyze this data to find out how fast it oxidizes, how stable it is when heated, and if it undergoes any structural changes. Understanding these factors not only deepens our knowledge of the alloy's behavior but also helps us improve its performance in challenging conditions. This research provides valuable insights for making the alloy more reliable in real-world applications.

**Keywords:** Thermo Gravimetric Analysis, Titanium-6Al-4V, Thermal Cycling, Oxidation Kinetics.

## The Design and Simulation of Height-Adjustable Desk Using Solid Works

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### Abstract

Comfort and conducive workspace is always very dear to any aspirant of various field. May it be working professionals, researchers, students or anyone who is serious about their work, this give rise to the requirement of better ergonomic conditions, specially, when its domain enter the educational institutions, where students spend their long hours doing studies and experiments. The height adjustable desk comes as an aid to this problem, with its capability to solve this emerging problem. It help one to attain more comfort and better concentration while doing the tedious jobs. This flexibility seems more attractive and meeting wider range of user requirements and needs on a personal level. Though, the desk with adjustable height have been developed in order to meet the different necessities, there seems to have been little attempt to meet the students requirement to this issue. It is reality that almost all the educational institutions have failed to have the height adjustable desk, especially when it comes to the laboratories, except for few elite institutions. Hence, this project aims at designing and simulation of Height Adjustable Desk using Solid works. The software used in the field of Design and Engineering drawing. Further, it also attempts to bring awareness towards it future scope with less complicated design with affordable budget, and opens up ways for more development.

**Keywords:** Ergonomic, educational institutions, height adjustable desk, Solid works.

## Design of solar roof top charging station for EV

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### Abstract:

The project aims to design and implement a solar rooftop wireless charging station for electric vehicles (EVs). The system utilizes solar panels installed on the rooftop to harness solar energy, which is then converted into electrical energy using a solar inverter. The electrical energy is stored in a battery bank to ensure continuous power supply, even during periods of low sunlight. The wireless charging technology eliminates the need for physical cables, providing convenience and ease of use for EV owners. The station is equipped with a wireless charging pad that automatically aligns with the EV's receiver, ensuring efficient charging. The core components of this system include solar panels, an Arduino microcontroller, wireless charging modules, keypad , RFID reader , LCD , and a power management system. Solar panels are used to capture sunlight and convert it into electrical energy, which is stored in batteries for use during low-light conditions or at night. The Arduino microcontroller serves as the brain of the system, managing the energy flow, monitoring battery status, and controlling the wireless charging process. The wireless charging modules use resonant inductive coupling technology to transfer power efficiently to compatible devices, eliminating the need for physical connectors. Users can place their devices on the charging station, and the Arduino system will automatically detect and initiate the charging process, making it hassle-free and user-friendly. The power management system ensures the efficient use of stored energy, optimizing the charging station's performance

**Key words:** solar energy, electrical energy, stored energy.

# Performance and Combustion Analysis of Single Cylinder Diesel Engine Fuelled With Nano-particle Dispersed Biodiesel Blend

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## Abstract

The world is presently confronted with the twin crises of fossil fuel depletion and environmental degradation. Search for an alternative fuel, which promises a harmonious correlation with sustainable development, energy conservation, efficiency and environmental preservation, has become highly pronounced in the present scenario. Vegetable oil's physical and chemical properties are close enough to mineral diesel and may be used as alternative to diesel, but long-term use of vegetable oils or their blends pose various operational and durability problems in the engine and need to be modified (biodiesel). Transesterification is found to be an effective technique for the vegetable oil formulation as a fuel. The present work deals with the development to the end use of biodiesel in transportation diesel engine. Vegetable oil is modified into biodiesel using chemical process of transesterification (alkali-catalyzed). Process parameters for transesterification of vegetable oil are optimized. Characterization of the ground nut biodiesel thus produced is carried out and most of the important properties of biodiesel are found close to mineral diesel. Detailed engine tests (performance and combustion investigations) with developed fuel on a single cylinder diesel engine have shown improved performance of bio-diesel.

**Key-words:** CI Engine, Bio-Diesel, Transesterification, Nano particles.

## **Fabrication of metal matrix hybrid composites and mechanical properties of Al2024 alloy based with B<sub>4</sub>C and Al<sub>2</sub>O<sub>3</sub>**

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### **Abstract**

Composite materials are now a major field of research and development activity. Composites are rapidly becoming important and useful structural materials, and probably the next major area for polymer applications is in the field of composite materials. Aluminum matrix composites (AMCs) become choice for automobile and aerospace industries due to its tunable mechanical properties such as very high strength to weight ratio, superior wear resistance, greater stiffness, better fatigue resistance, controlled coefficient of thermal expansion and good stability at temperatures. Stir casting is an appropriate method for composite fabrication and widely used industrial fabrication of AMCs due to flexibility, cost-effectiveness and best suitable for mass production. In the present work an attempt was made to understand the mechanical behavior of composite, Aluminum 2024 alloy, reinforced with Boron Carbide and Aluminum Oxide. Composites are casted using stir casting method. Castings are prepared with a percentile range from 1% ,2%, 3% and 4%. An investigation is made on studying the mechanical behavior of the pure base metal (2024) when compared with different weight percent of reinforcements. The composite with 4% Al<sub>2</sub>O<sub>3</sub> gave us the best results in the property tests conducted among all other compositions.

**Key Words:** AL2024 alloy, B<sub>4</sub>C, Al<sub>2</sub>O<sub>3</sub>, Hybrid Composites.

## Optimization of Process Parameters of Al2024 Alloy-Based Hybrid Composites With B4C And Al2O3

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### Abstract

Surface roughness and material removal rate are critical factors in machining processes. Surface roughness affects the appearance, texture, and tactile feel of the component, while the material removal rate impacts both the surface finish and the economic aspects of machining. This study investigates the impact of spindle speed, feed rate, and depth of cut on MRR and surface roughness during the turning of Al2024 alloy, boron carbide, and aluminum oxide on a CNC Lathe machine using carbide-coated tools. Utilizing Taguchi's design of experiments (DOE) with an orthogonal L18 array, experiments were conducted followed by an Analysis of Variance (ANOVA) for optimization. Results highlighted the significance of cutting parameters on MRR and surface roughness, with depth of cut and feed rate emerging as primary factors. Furthermore, optimization focused on specimens with a composition of 4% Al2O3 and 0.5% B4C, exhibiting superior mechanical properties. The study underscores the critical role of process parameter optimization in CNC turning operations, with implications for enhancing efficiency and quality in metal part manufacturing. ANOVA results revealed that depth of cut and feed are the most predominant factors for material removal rate and surface roughness respectively.

**Keywords:** Surface roughness, material removal rate, CNC turning, Taguchi DOE, ANOVA, optimization.

## Process Improvement in a Pharmaceutical Industry By Using Lean Six Sigma Methodology

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### Abstract

Lean Six Sigma is an integrated approach between lean thinking and the six Sigma methods. Lean it is a method to remove non-value adding activities in the production process to improve the performance of a process .It focuses on speed, flow and cost of a process. Six Sigma it is a method seeks to identify and reduce defects in the production process. It focuses on quality consistency and how to fulfill customer requirements. Combined, lean and six sigma will be beneficial for organizations in determining the most suitable method for identifying and solving problems. So the outcome of a process can fulfill customer satisfaction by adding value to the product and also the profits Can be increased. To determine the number of non-value adding activities in the processes we going for the Value adding and non value adding analysis we call itas Va Nva analysis to find out number of value adding activities and number of non-value adding activities Involved in the process and also taking the count of time lead time and value adding time and non value adding time in the entire processes.

This study proposes a lean six Sigma methodology as an approach to reduce waste in the production process in a pharmaceutical industry. After determining the number of Wastes and improvements in the entire processes in the Industry, we are identifying the nva activities and by the Dmaic approach we are determining the problem where majority of nva are occurringfrom which department Is determined. As a result, this Approach can be Helpful for the companyto reduce waste and increase the value added activities and decrease the non value adding activities. Suggestions related to Dmaic tools and lean tool box and their implementations are also elaborated so that the related company can evaluate its current processes and strive for Better improvement and increase its cycle efficiency and increase the value- adding time to the product.

**Keywords:** Six Sigma, Lean Six Sigma, Non value adding activities, value adding activities, DMAIC Approach, Lean tool Box.

## Numerical Investigation of Solar Dryer To Optimize The Geometrical Parameters

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### Abstract

Inadequate preservation techniques and poor storage provisions lead to deterioration in the quality of agricultural products. Advanced processing techniques have been used to reduce postharvest losses of agricultural goods. Drying is a processing technique used for food product preservation. Drying by solar energy is an ancient food preservation technique. Main purpose of solar drying is to reduce moisture content from agricultural products to store it for a longer period of time. When the solar radiation falls on the collector its surface gets heated up, so the air which passes over the surface of the dryer gets heated due to natural convection therefore the hot air removes the moisture content from the items in the drying chamber. In this project, the investigation of the performance analysis of different kinds of geometrical models of solar dryers was carried out using Ansys software. In this project, the geometrical parameters of different solar dryer models were analyzed and the best solar dryer model with optimized dimensions was selected. The performance parameters of the optimized solar dryer were estimated under different working conditions. By comparing the results obtained by analyzing the solar dryer models with four different collector angles of 20°, 27°, 30°, & 40°C, the highest absorber plate temperature of 97.4°C and the maximum drying chamber temperature of 76.3°C was achieved by solar dryer model with collector angle of 30°. Hence the collector angle of 30° was selected as optimum angle. From the analysis of solar dryer model with different inlet gaps of 0.08m, 0.1 m, & 1.25 m, the model with inlet gap of 0.08 m has achieved the highest drying chamber temperature of 104.2°C. The results of performance analysis of optimized model under different heat flux values of 650 W/m<sup>2</sup>, 950 W/m<sup>2</sup>, 1100 W/m<sup>2</sup>, 1250 W/m<sup>2</sup> showed that the highest chamber temperature of 88.8°C was observed at the heat flux value of 1250 W/m<sup>2</sup>.

**Keywords:** Radiation Fall, Moisture, Collector, Optimum Angle, Drying Chamber,



## Automatic Railway Gate Control System

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### Abstract

India is a country that has the world's largest railway connectivity. Almost every common person prefers the railway to travel because of its affordable cost. But even though the railway plays a vital role in the life of all Indians, safety is not that much provided. Accidents at the level crossing, and on rail tracks, are increasing every day. The main reason behind it is the careless operation of human workers, lack of resources, and lack of technology. The main purpose of designing the model of this system is to provide automatic control railway gates at level crossings replacing human interference. It focuses on two things mainly. The first one is the reduction of the closing time of gates and the second one is it provides the highest safety to travelers at a level crossing. The proposed system uses infrared proximity sensors to detect the arrival and departure of trains at the level crossing. This system consisting of automation over railway gate control can be used where chances of accidents are extremely high & highest reliability is required.

## Design and Fabrication of Drilling Machine using Gearless Transmission System

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### Abstract

Today's world requires speed on each and every field. Hence rapidness and quick working is the most important. Now days for achieving rapidness, various machines and equipment's are manufactured by man. Engineer is constantly conformed to the challenges of bringing ideas and design in to reality. New machine and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. The project "Gearless Transmission" being compact and portable equipment, which is skillful and is having something, practices in the transmitting power at right angle without any gears being manufactured. This project provides the knowledge, experience, skill and new ideas of the manufacturing. It is a working project and having guarantee of the success. This project is the equipment useful to improve the quality of the gear being manufactured and can be made in less time, hence we have selected this project El-bow mechanism is an ingenious link mechanism of slider and kinematic chain principle.

## Footstep Power Generation using Piezo Electric Effect

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### Abstract

In our energy-hungry world, finding renewable sources is a key. This study looks at turning human movement into power using piezoelectric sensors. The idea is to collect and store energy from walking, especially in busy places. It explains how piezoelectric sensors can turn pressure into electricity effectively. This technology could be a big help in making sustainable energy, by using our movement more wisely. The study talks about how the sensors are set up, how the energy is stored, and why this is good for the environment.

**Key words:** piezoelectric buzzer.

**Surface Engineering of WE43 Mg Alloy by Friction Stir Process and Roller Burnishing**

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**Abstract**

This study investigates the surface modification of the WE43 magnesium alloy through friction stir processing (FSP) and roller burnishing techniques. FSP offers a promising method to refine the microstructure and improve mechanical properties by inducing plastic deformation in the surface layer. Roller burnishing, on the other hand, aims to further enhance surface finish and improve wear resistance through cold working and smoothing of the surface. Through detailed analysis and characterization, this study provides the development of high-performance components in aerospace, automotive, and biomedical sectors.

## **Global System for Mobile Communications (Gsm) Smart Fire Alarm and Extinguishing System**

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### **Abstract**

This project describes a GSM based Automatic fire detection and water sprinkler system that can monitor an industry, building, and home. It plays an important role in maintaining and monitoring the safety of all kinds of environments and everything that is damaged by fire. However, the many existing fire detecting (fire extinguisher) systems are not modernized or automatic and also with high cost. Subsequently, it is not affordable for the low income users. The main objective of this project is to make a fire control system with low cost. The project has three main systems the first is the detection system, the second is the monitoring system and the third is the appliance or controlling system. The detection system operates as the fire detector. The detector will sense smoke caused by a fire accident and switch on the water sprinkler to prevent major damage. This detection system has components like flame detector, smoke detector, heat detector etc. This discussion is about the design and implementation of a fire detecting and controlling system using the microcontroller which operates the entire system. The detectors are placed in parallel at different levels. Any signal from each detector at any level is monitored using a monitoring system. The appliance system has components like buzzer, siren, for alarming, LCD for displaying temperature or display text and motor pump to stop the fire. The system which is proposed in this paper uses modern technology to detect fire accidents and also to inform the respective authorities with minimum delay. Three types of sensors: fire, smoke and heat sensors are used to detect the fire accidents. The signals from these sensors will activate the microcontroller which in turn activates the message transfer system, alarm system, water sprinkler system and the motor to automatically open the emergency door of the bogie in which the accident took place. The proposed system is designed by using GSM technology and PIC16F877A microcontroller along with sensors. The entire system is controlled by a microcontroller.

**Dynamic Wireless Solar Charging System for Electric Vehicles**

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**Abstract**

The transition to electric vehicles (EVs) from conventional vehicles will reducing greenhouse gas emissions and mitigates climatic disorders. To support this transition, the development of efficient and accessible charging infrastructure is paramount. In this paper, we propose a Dynamic Wireless Solar Charging System for Electric Vehicles by integrating renewable energy sources to power vehicles sustainably. The system utilizes Arduino-based control mechanisms to manage power flow and ensure optimal charging performance. By harnessing solar energy, this solution not only reduces burden on grid electricity but also promotes eco-friendly transportation. The integration of Arduino technology enhances flexibility and scalability, making it adaptable to various problems and user needs. A proto type Dynamic Wireless Solar Charging System was developed and verified charging with an electric vehicle. The results were quite satisfactory.

**Key Words:** Arduino, Solar Panel, Electric vehicle (EV).

## Working of Button Operated Electromagnetic Gear Shifting For Two-Wheeler

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### Abstract

This study presents the development of an indigenous automatic gear shifting system for motorcycles, aiming to enhance rider convenience and control. While conventional motorcycles rely on manual gear shifting, this system introduces an additional electromechanical component to enable automatic gear changes. By retaining the option for manual shifting, the system offers flexibility and compatibility with any two-wheeler ranging from 50cc to 200cc. Key components include electromagnetic coils coupled to the gear lever, which are activated by buttons to facilitate gear shifts. This low-cost solution promises to revolutionize motorcycle transmission technology, providing riders with a seamless and adaptable riding experience.

**Key words:** - Gear Shift, Two Wheeler, Electromagnetic Coil, Gear lever, Button, etc.

## Design and Development Multi-Purpose Agricultural Equipment

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### Abstract

India is highest populated country. Due to the rapid growth in the population and rapid industrialization there is a high demand for the food items. To fulfill this demand, modernization of the agriculture is inescapable. Farmers are very poor due to which they are unable to purchase tractors and other costly equipment hence they use traditional methods of farming. Essentially, a lot of farmers in India also use oxen, horses and buffaloes for farming. So we are thinking that the efforts of man and animal can be replaced by advanced mechanization which will be adapted to small farmers in economy and effort point of view. The modernization of equipment enables better distribution and the reduction of the inputs and raw materials and reduces the wastages in inputs. The conservation of inputs reduces the unit cost of production hence the farmers. Multipurpose agricultural equipment represents a significant advancement in farming technology, offering versatility, efficiency, and cost-effectiveness to farmers worldwide. This review explores the evolution, features, benefits, and impact of multipurpose agricultural equipment in modern agriculture. The evolution of multipurpose agricultural equipment traces back to the mid-20th century, coinciding with the mechanization and modernization of agriculture. Initially designed to perform a limited range of tasks, such as plowing, planting, and harvesting, multipurpose equipment has evolved to incorporate a wide range of functions, including soil preparation, seeding, fertilizing, spraying, and harvesting, among others. Key features of multipurpose agricultural equipment include modular design, interchangeable implements, adjustable settings, and compatibility with various farming practices and crops. This versatility allows farmers to streamline operations, reduce equipment costs, optimize resource use, and adapt to changing agronomic conditions and market demands.



## Water Pumping System using Wind Power

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### Abstract

Since time immemorial, the main source of energy has been coal, oil, natural gas, nuclear energy, wood and coal. However, all these sources are limited and are the main cause of pollution and this has led to development and more focus on sustainable energy supply with minimum pollution effects. Hence research and analysis has shown that wind energy, solar energy and biomass are the most prominent solutions to the above problems because they are eco-friendly and readily available in nature. Wind energy can be generated using windmills that provide mechanical energy that is used directly on machinery e.g. water pump and grinder; or wind turbines that provide electrical energy. The main objective of our project was to design a windmill and therefore our scope will be limited to a windmill for water pumping water. Windmills are classified into two main types based on the axis about which they rotate. Horizontal axis has the main rotor shaft running horizontally and if the rotor must be oriented in the direction of the wind, a wind vane is coupled with a servomotor. Vertical axis has the main rotor shaft running vertically. The rotor assembly can have two or more blades depending on the desired solidity. In our design, we used a horizontal axis windmill with 5 blades. Each blade has a radius of 0.5m giving a total surface area of 0.2585 meter square and this gives a solidity of 0.4, the minimum theoretical optimum value for windmills. The torque output of the windmill is 50.2 Nm and this is sufficient to sustain the desired flow rate of  $(0.05736 \times 10^{-3})$  meter cube per second with a maximum head of 5m, and also overcome other barriers to motion such as friction.

**Key words:** wind mill, gear box, connecting rod, reciprocating pump.

## Solar Grass Cutter Operated with Android Mobile

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### Abstract

The Solar Grass Cutter is a mechanical device used for cutting grass with the help of solar energy instead of electricity. First of all its body is made with the help of hollow square bar, then a castor wheel is placed below the body of square bar. Then an inclined fiber plate is kept on a body, then on the inclined fiber plate a solar panel is kept. Which transmits solar energy & then solar energy is converted into electrical energy & electrical energy is converted into mechanical energy. This electrical energy is transmitted to an electric motor. On the shaft of the electric motor a blade is connected having a cutting edge which cuts the grass.

The basic project idea is to develop a grass-cutting robot controlled with the help of an Android application. Here the Bluetooth module is used to connect Raspberry Pi with the phone and in which the reading of the ultrasonic sensor is stored on an IOT platform i.e. ThingSpeak. Previously the grass cutter machines were operated by fuel which is costly. Here the solar panel is utilized to charge the battery so that it doesn't have to be charged externally. The sun-based energy source is more straightforward to utilize, more profitable contrasted with other energy sources and it is not difficult to work. Using solar panels, we can use sunlight to generate electricity free of cost. The solar panel is used to charge the battery for grass cutting purposes. The movement of the machine is totally controlled by using the Android app. The controlling device of the system is Raspberry Pi. Bluetooth module and DC motors are interfaced to the Raspberry Pi. The data received from the Android phone application by the Bluetooth module is given as an input to the Raspberry Pi and the controller acts accordingly on the DC motor of the solar grass cutter. And here at the input, we have connected an ultrasonic sensor for obstacle detection. Whenever the obstacle is detected the Raspberry Pi sends the command to stop the machine in its place and the reading of the ultrasonic sensor is stored on the cloud.

**Keywords:** Solar Panel, Microcontroller (ARDUINO), Bluetooth Module HC-05, Battery, Motor, Fiber Sheet, Wire, Normal Wheel.

## Smart Silent Aqua Sir Purifier and Humidifier

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### Abstract

Air humidifiers are becoming more common in every household. The purpose of the air humidifier is to increase the humidity of the surroundings. The air humidifier will produce water mist and spread it into the air to make the humidity level of surrounding increase. As the water mist spreads out in the air, the air will become clearer and fresher as it will make the harmful substances in the air such as dust and bacteria stay in the floor. In medical purposes, the patient who has breathing problems such as asthma will be better with clean air. Even more, the right level of humidity level of the surrounding will help the skin and face become less dry and reduceskin problems. Humidity is blamed for harmful things of all kinds. I this study it aims at creating an automatic controller for humidifier and dehumidifier. It helps to regulate and monitor the level of humidity to minimize the room humidity and to make the user comfortable. The study uses a humidity sensor to measure the room's humidity and provides the device with two choicesto automatically humidify or dehumidify the air. This helps minimize Odors that can surround Mold and mildew to rid your house of the “musty” or “rotting” smell, it also decreases dust and the risk of forming Molds on your clothing, furniture, and other linens, and eventually reduces inflammation of your skin and respiratory system, making it easier to breathe and feel comfortable at home. The controller used in this study is Arduino Uno. An input supply to the Arduino Uno is then connected to its pin by a humidity sensor, and the LCD will display the humidity value.

**Keywords:** Air Purifier, Filter, Humidifier.

## ICAMEA24-30

### Advanced Mechanical Engineering Applications in Thermal Power Plants

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#### **Abstract**

Innovations such as advanced materials, computational fluid dynamics (CFD) simulations, and intelligent control systems have revolutionized plant design, operation, and maintenance. Advanced turbine designs, including combined cycle systems and supercritical steam cycles, optimize energy conversion processes, resulting in higher thermal efficiencies and reduced emissions. Furthermore, innovative heat exchanger designs and advanced cooling technologies improve heat transfer efficiency and mitigate environmental impacts. Robust structural analysis techniques ensure the integrity and safety of critical components under extreme operating conditions. Overall, the integration of advanced mechanical engineering principles in thermal power plants not only enhances performance and reliability but also facilitates the transition towards greener and more sustainable energy production.

**Keywords:** Turbine Designs, Heat Exchanger, Structural Analysis, Overall Impact.

## 360 Degrees Fire Protection System

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### Abstract

Large factories, warehouses, and industrial production facilities always run the risk of fires breaking out. Lack of appropriate firefighting measures could result in disastrous consequences and along with financial losses and might even lead to massive loss of human life. Usual fire protection systems installed in buildings have the following disadvantage. They spray small amounts of water from each sprinkler which may not be enough to put out the fire. The sprinklers are not targeted and spray an entire floor or building ruining computers, furniture and paperwork. While this sprayer gun can spray water in desired quantity only at fire outbreak point to stop fire without ruining complete office furniture and electronics. This demo version is made to be remote controlled from few meters but future version will operate remotely from fire dept. Fire monitors and sprayers are an aim able and controllable high-capacity water jet used to deal with large fires. Unlike Fire extinguishers, Fire Monitors are permanently installed and cannot be removed. While traditional fire monitors systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control. Thereby allowing the user to operate it from a safe distance.

**Key words:** Fire protection in 360 degrees.

**Design and Building of Solar Powered Thermoelectric Refrigerator**

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**Abstract**

Now a day, we have many problems such as continuous and increasing demand for refrigeration in various fields, numerous energy crisis and environment degradation owing to the increasing CO<sub>2</sub> emission and ozone layer depletion has become the main examine to both developed and developing nations. Our project takes advantage of the solar energy for its functioning. Solar refrigeration utilising thermoelectric module (Peltier Module) is likely to be one of the most cost effective, clean and environment friendly technology. This paper does not require any type of refrigerant and mechanical equipment like compressor, prime mover, etc for its functioning. The primary aim of this project is to offer refrigeration to the distant regions where electricity supply is not feasible.

Thermoelectric cooling is a strong candidate to replace the traditional refrigeration cycles because of its low maintenance and long life, which can reach up to 200,000 working hours; it transforms electrical energy to produce a cooling effect directly without the need of the traditional refrigeration cycle components.

**Keywords:** Solar Refrigeration, Refrigerant, Thermoelectric Module, Mechanical Equipment



### **About the Department of Mechanical Engineering**

The Department of Mechanical Engineering has come into existence in the year 2010 with an intake of 60 and it was extended to 120 from 2013 to 2021. The Department at present has 16 dedicated staff members (Teaching 13, Non Teaching 3) and five faculty members with Ph.D., Four faculty members are pursuing Ph.D.'s, and the rest of faculty members are with PG Qualifications. The mechanical engineering program has been certified by the ISO and NBA. Our faculty and staff team are highly experienced and themselves have earned reputation for their work as educators, researchers, and administrators in the discipline. With their help, our students can build a career in industries such as automobile, power plants, aerospace, petroleum, and others. We are dedicated to enabling our students such that they contribute to Society and Industry.