



BBDNIIT

Babu Banarasi Das Northern India Institute of Technology



MECHDRISHTI

2024 - 25

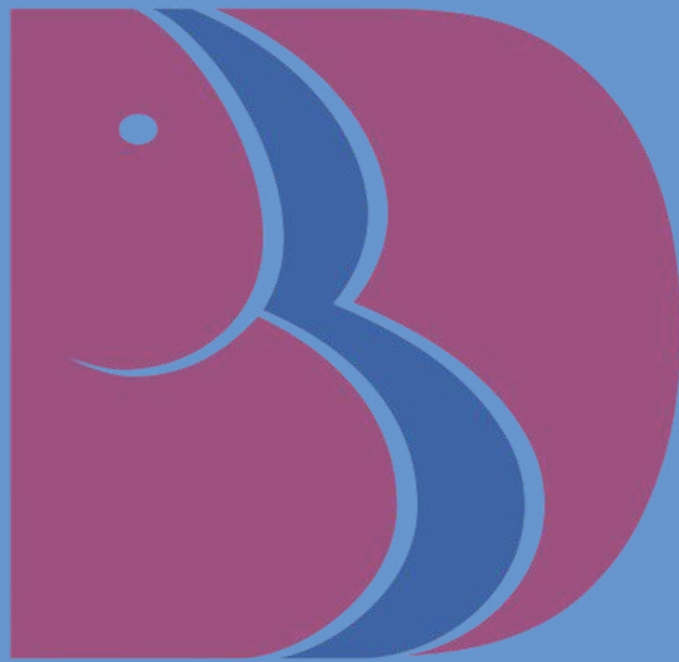
MECHANICAL ENGINEERING DEPARTMENT



Babu Banarasi Das Northern India Institute of Technology

Sector-II, Dr. Akhilesh Das Nagar, Ayodhya Road, Lucknow (U.P.) - 226028, India

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BBDNIIT

LORD GANESHA'S GRACE

The BBD Campus proudly houses a beautiful Ganesh temple, a spiritual haven that infuses the college with a profound sense of serenity and purpose. The temple's presence on campus is more than just a place of worship; it symbolizes a bridge between the academic and the divine, offering students a space to connect with their spirituality amid their educational journey.

Ganesh Ji, the revered remover of obstacles and the harbinger of wisdom and prosperity, holds a special place in Hindu tradition. His temple at BBD Campus stands as a testament to these values, providing students with a sanctuary where they can seek blessings, reflect, and find solace during their studies. The essence of the temple extends beyond its physical structure, permeating the entire campus with a spirit of peace and positivity.

For many students, college life is a time of immense growth, but it also comes with its share of challenges and uncertainties. The Ganesh temple offers a reassuring presence, reminding students that they are not alone in their journey. It encourages them to pause, pray, and draw strength from their faith, fostering a holistic approach to education that nurtures both the mind and the soul. The act of worshipping together also fosters a sense of community, as students from diverse backgrounds come together in shared reverence, strengthening their bonds and promoting a culture of mutual respect and support.

The choice of a Ganesh temple specifically holds deep significance. Lord Ganesh, revered as the deity of beginnings, is invoked at the start of new ventures to ensure success and remove obstacles. For students embarking on their academic journey, seeking Ganesh's blessings can be a source of immense comfort and confidence. His wisdom and benevolence inspire students to pursue their goals with determination and integrity, knowing they have divine support.

Moreover, the Ganesh Ji temple at BBD Campus serves as a reminder of the cultural and spiritual heritage that underpins our education system. It encourages students to value and preserve these traditions, recognizing that true education encompasses not just intellectual growth, but also moral and spiritual development.

BABU BANARASI DAS JI



Late Babu Banarasi Das Ji
(1912 – 1985)
Ex Chief Minister
Govt. of Uttar Pradesh

“To provide an open opportunity to the young generation for evolving their core competencies and to build their career as world class professionals with broad based foundation, in-depth knowledge & versatile personality to meet the challenges of Global Economy...” - Babu ji's Vision.

Babu Banarasi Das Ji, a born nationalist, in his early youth, joined hands with Mahatma Gandhi & Jawahar Lal Nehru in the movement to free India from the clutches of British rule.

During his long political career, he worked as a Minister, Speaker and Member of Parliament (both Lok Sabha and Rajya Sabha). He also held the position of the Chief Minister of Uttar Pradesh. His entire life was devoted to secure the dignity of individuals through selfless service to mankind. He was a humanitarian who enabled people to realize their goals. He never believed in surrendering to any forces. Even in the face of death, he would not give in. “Man doth not yield himself to angels, not even unto death, utterly, saved, by the weakness of his feeble will.” Babuji always led and inspired people through his own example, leaving behind a legacy for future generations. We are privileged to inherit that legacy and perpetuate his memory.

AKHILESH DAS GUPTA JI



LATE DR. AKHILESH DAS GUPTA
MBA, LLB, Ph.D.
Ex-Member of Parliament (Rajya Sabha)
Hon'ble Founder Chairman, BBD Group

"We not only make technocrats at BBD, we churn out citizens of the world, perfect in all respect in all respects, be it leadership, competence, confidence, communication, moral or knowledge..." - Akhilesh Das Gupta's Vision.

A distinguished political leader, philanthropist, educationist and social worker, Dr. Akhilesh Das is the pride of Lucknow city. He has established himself as a worthy son of his illustrious father Late Babu Banarasi Das Ji.

Public Life

He has obtained MBA, LLB & Ph.D.(Human Resource Management)degrees, Dr. Akhilesh Das decided to follow his father's footprints by choosing Social Service as his primary goal. In his distinguished public life spanning well over three decades, Dr. Das was first elected as the Mayor of Lucknow in year 1993 and became one of the youngest Mayors of the world. Subsequently, he was elected as a Member of Parliament (Rajya Sabha) in November 1996 and was re-elected for a second term in November 2002 till November 2008. Dr. Das has been elected again as a Member of Parliament (Rajya Sabha) for a third consecutive term in 2008 till 2014.

Dr. Das has been a member of many important parliamentary committees and National level apex advisory & statutory bodies including the AIMS. He has been a member of the Executive Committee of AICTE. He had been the Chairman Parliamentary Standing Committee for Industries. He also served with distinction as the Union Minister of State for Steel and made a place for himself as one of the foremost National leaders.

Contribution To Sports

Dr. Akhilesh Das is an enthusiastic sports person. He underwent an exhaustive training in England as a Junior Badminton player. Later, he represented and captained the U.P. State Badminton team for many years and won many National & International tournaments including the National Doubles Championship. His love for other sports is no less. He has been instrumental in organizing and facilitating many National level tournaments in various sports. Presently he is the president of the U.P. Olympic Association & Chairman of Badminton Association of India.

Contribution To The Cause Of Education

As a social thinker, Dr. Das realized the need of Quality Technical & Professional education for the overall growth and upliftment of the masses and development of the State of Uttar Pradesh. Accordingly, Babu Banarasi Das Educational Society (BBDES) was founded through which the torch for higher professional education was lit in Lucknow, the Capital of U.P. The first institution in the series, Babu Banarasi Das National Institute of Technology & Management (BBDNITM) was established in 1998.

Travels And Experiences

He has travelled extensively to U.K., U.S.A., Japan, France, Switzerland, Spain, Portugal, Sao Paulo etc. on several occasions. Dr. Das has attended several World Seminars and Conferences including UNO sponsored Conference of Mayors (Japan) in 1993 and UNCTAD XI Conference (Brazil) in 2004. As the Mayor of Lucknow, he attended the International Children's Game held in Canada in 1994 and led the Indian Badminton Team as its Chief-de-Mission at the Athens Olympics in August 2004. Dr. Das also led a team of academicians to various European countries to study their education systems in the year 2002.

AKHILESH DAS GUPTA JI

ALKA DAS GUPTA JJ



MRS. ALKA DAS
M.B.A., L.L.B.
Chairperson, BBD Group

A lady with spirit, determination and zeal, Mrs. Alka Das has been the driving force behind her husband Dr. Akhilesh Das. She is the daughter of Late Justice D. P. Gupta, who held high positions in the State of Rajasthan, as its Governor and Chief Justice. She was brought up on Gandhian ideals and philanthropic traditions.

Mrs. Das is a Management expert and a legal luminary who has a long involvement with issues of social justice and women empowerment in our country. She is a legal consultant to several reputed organizations and an active Social Worker. She is connected with many National Social & Educational Organizations. She is also a Life Member of the "Rajasthan High Court Bar Association". The establishment of Northern India Engineering College, Lucknow was an initiative taken by her to provide quality professional education to match the International Standards.

She has travelled extensively to countries like Denmark, Italy, Japan, France, Switzerland, UK and USA to study the pattern of education and facilities provided to the students there. As a Co-founder of Babu Banarasi Das Group of Educational Institutions, Mrs. Das has made a fertile attempt to nurture a generation of self-made and highly motivated students with an inbuilt commitment to do something constructive for the Country

VIRAJ SAGAR DAS JJ



Mr. Viraj Sagar Das
B.A LL.B (Hons.),
Advocate
President, BBD Group

“Education is the most powerful weapon which you can use to change the world”

– Nelson Mandela

Babu Banarasi Das University has its roots lying deep in quality education practices that equip each student with broad outlooks to prepare them for this futuristic world. We are committed to providing the education that fulfils the needs of today's world. Today, education is not limited to textbook courses and their practical implementation. Education has been through a major transformation where apart from the syllabus, it has become imperative to inculcate some extra skills in the students so that they could truly succeed in their lives. We encourage our students to perform well in their academics and also to take active participation in all the co-curricular activities to develop interpersonal skills, take up challenges, be self-dependent and most importantly, have a good time while learning.

To quote Dr. A.P.J.Abdul Kalam, “Learning gives creativity, creativity leads to thinking, thinking provides knowledge, and knowledge makes you great”.

DIRECTOR'S MESSAGE



Prof. (Dr.) V. K. Singh
Director (Engg.), BBDNIIT, Lucknow

Dear Readers,

"Education is the most powerful weapon which you can use to change the world."
– Nelson Mandela

It gives me immense pleasure to introduce our Computer Science and Engineering Departmental college magazine at Babu Banarasi Das Northern India Institute of Technology (BBDNIIT), Lucknow. Since its inception, BBDNIIT has been committed to providing quality technical education and developing competent technocrats who are socially sensitive and committed to excellence on a global scale.

For over 17 years, BBDNIIT has stood as a beacon of academic excellence and innovation in the field of engineering. Our esteemed faculty, state-of-the-art infrastructure, and rigorous academic processes are all geared towards nurturing talent and fostering an environment of growth and learning.

In this magazine, you will find a vibrant showcase of the creativity, dedication, and hard work of our students and faculty. It reflects the dynamic and inclusive community we have cultivated, where every student is encouraged to pursue their passions and excel both academically and personally. Our systematic teaching-learning process prepares students for the challenges ahead, equipping them with the knowledge, skills, and ethical values necessary to make significant contributions to society.

The global technology landscape is evolving rapidly, and to remain competitive, our students must be prepared to face new challenges head-on. BBDNIIT is dedicated to training students to meet these challenges with confidence and competence. We continue to strive for excellence in professional education, aiming for new heights and fostering a thinking, professional order.

I encourage all students to make the most of their time with our dedicated faculty and staff, to develop their proficiency, and to grow both personally and professionally. The doors of our faculty members are always open for guidance and support.

With best wishes for your continued success and growth.

HOD'S MESSAGE



Prof.(Dr.) N. K. Mishra
Head of department

Dear Readers,

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela

It is an honor to share my thoughts with you in this edition. The sustained growth and prominence of our college are reflections of our collective endeavor; every one of us has played an instrumental role in shaping the legacy of excellence we share today.

It is highly encouraging to observe the faculty's unwavering commitment to academic enrichment, as evidenced by their continuous organization of conferences, training programs, and workshops. Additionally, the strategic implementation of expert lectures across various departments plays a crucial role in maintaining our alignment with cutting-edge developments in science and technology.

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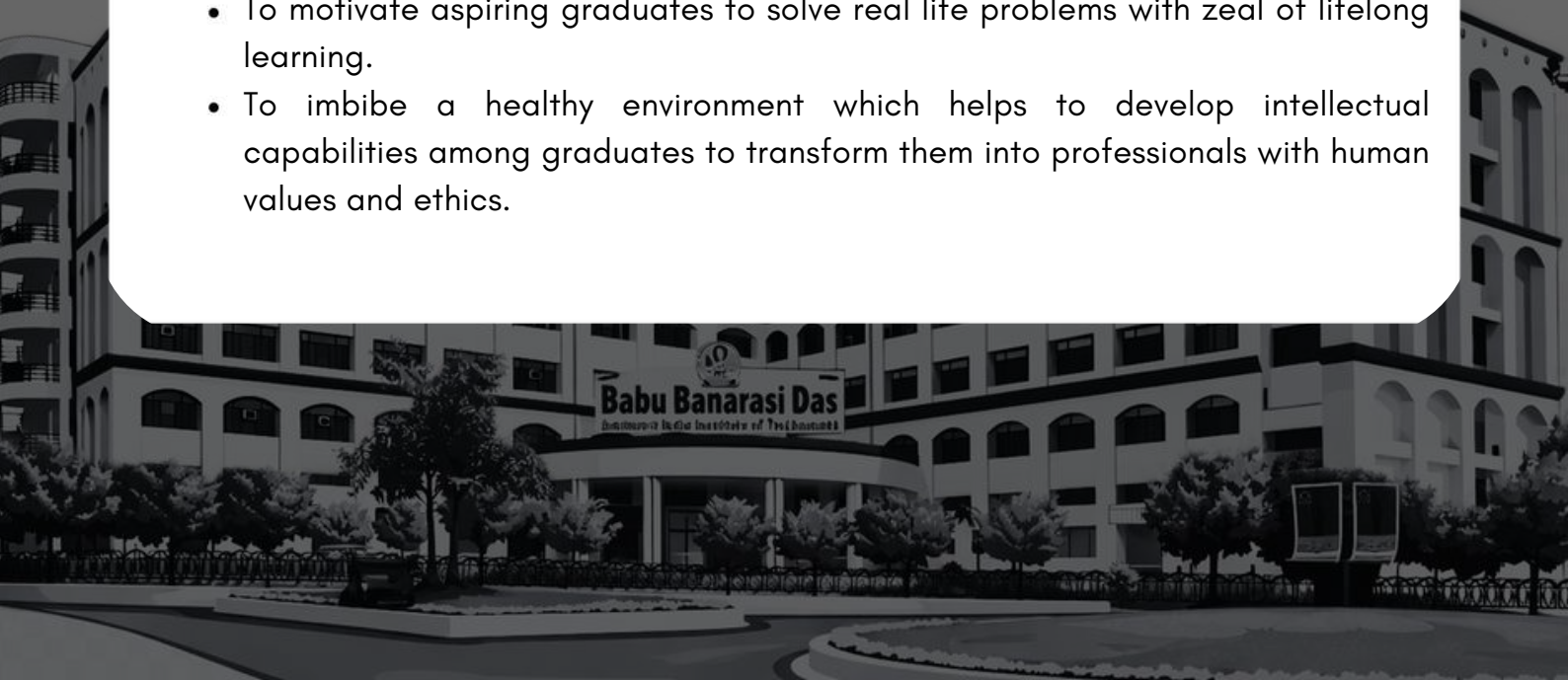
Institute Vision

To establish a multi-disciplinary environment with excellence in technical education and research for developing competent professionals who meet the challenges of industrial and societal development with human values and ethics.



Institute Mission

- To provide an excellent environment with supporting infrastructure to prepare globally competent professionals acceptable to industry and society.
- To inculcate a spirit of research, innovation and entrepreneurship by exposing multi-disciplinary approach.
- To motivate aspiring graduates to solve real life problems with zeal of lifelong learning.
- To imbibe a healthy environment which helps to develop intellectual capabilities among graduates to transform them into professionals with human values and ethics.





Department's Vision

To be a leading center in Mechanical Engineering by providing value-based quality education that nurtures competent, versatile, and entrepreneurial professionals capable of excelling at the global level.

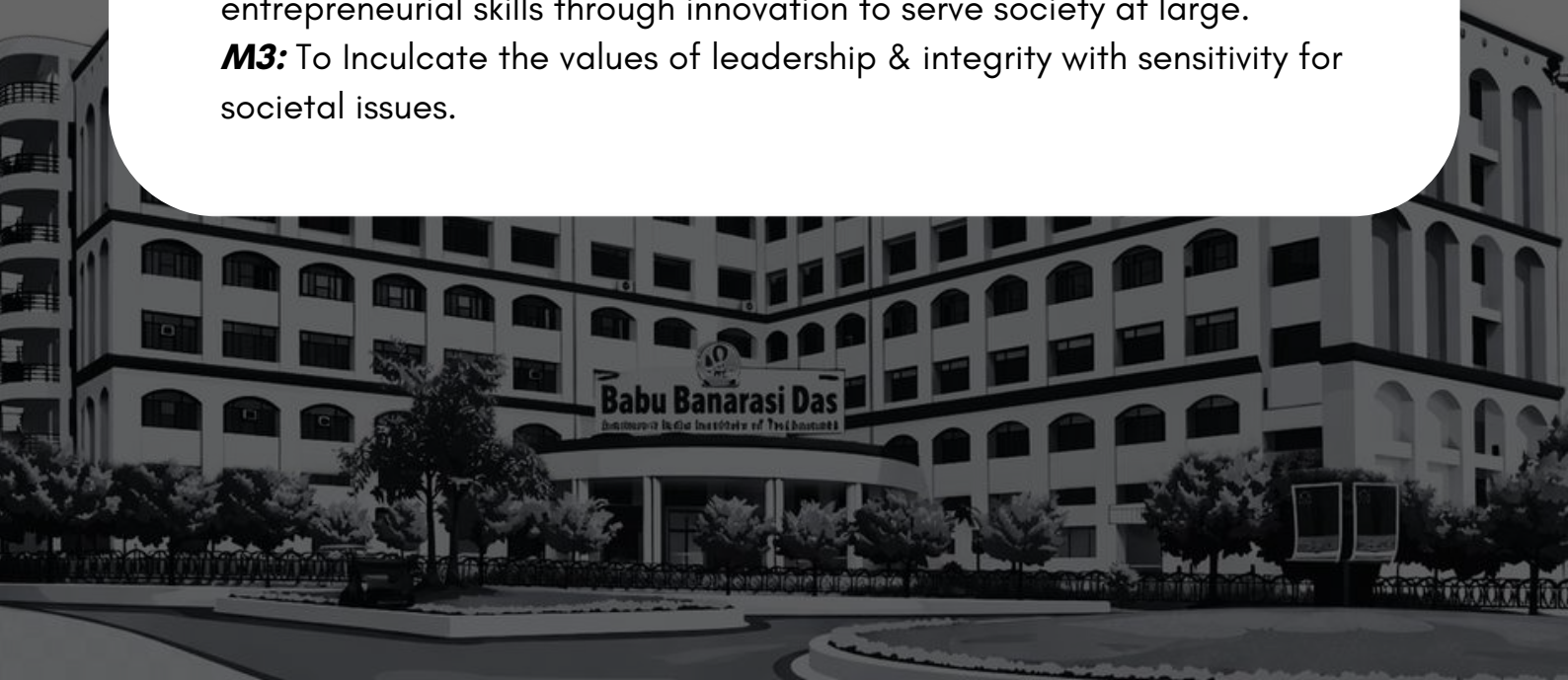


Department's Mission

M1: To deliver quality education using cutting edge infrastructure for producing competent professionals.

M2: To encourage students to pursue higher education and explore entrepreneurial skills through innovation to serve society at large.

M3: To Inculcate the values of leadership & integrity with sensitivity for societal issues.



PROGRAMME OUTCOMES

Program Outcomes (POs)

PO1: Engineering knowledge:

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

- Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

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

PO4: Conduct investigations of complex problems:

- Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PROGRAMME OUTCOMES

PO7: ENVIRONMENT AND SUSTAINABILITY:

- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: ETHICS:

- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: INDIVIDUAL AND TEAM WORK:

- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: COMMUNICATION:

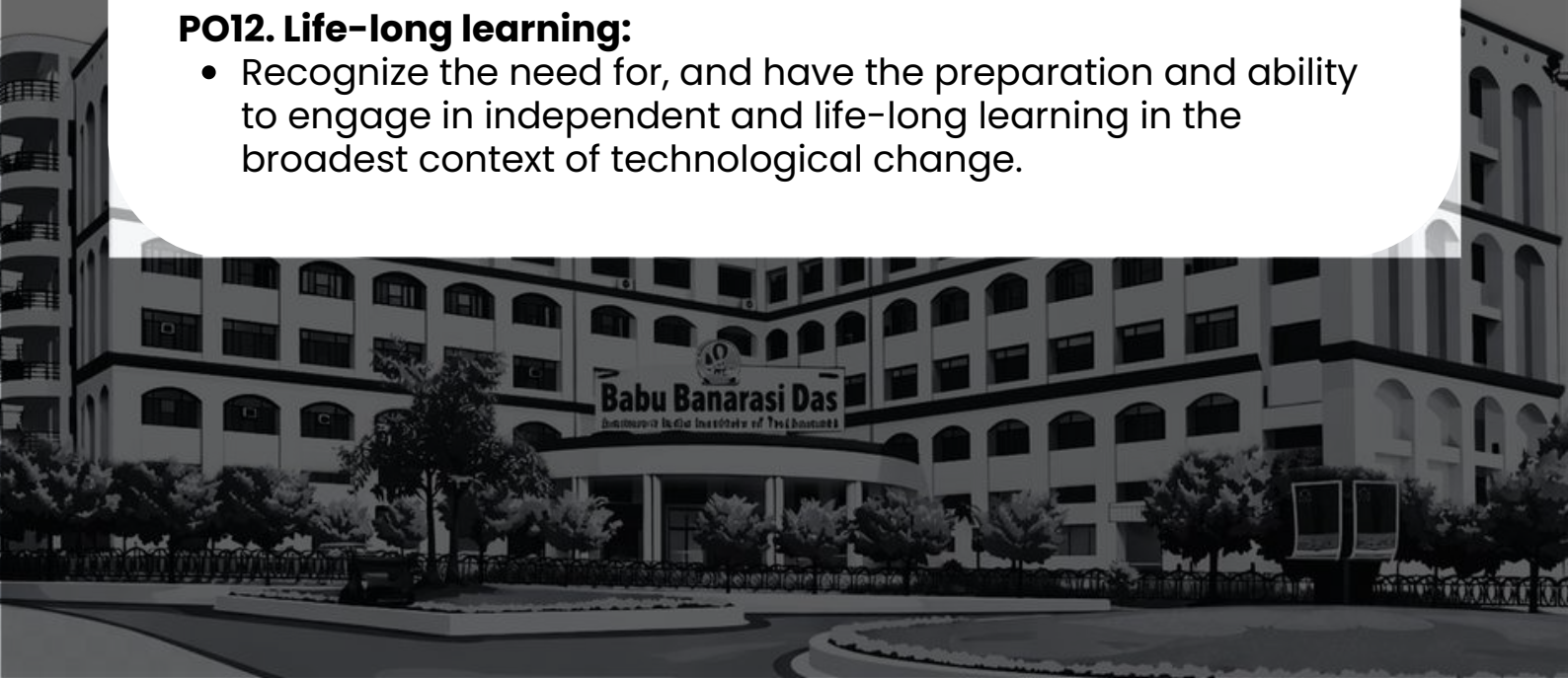
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: PROJECT MANAGEMENT AND FINANCE:

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

PO12. Life-long learning:

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



PROGRAMME EDUCATIONAL OBJECTIVES

Program Educational Objectives (PEOs)

PEO 1: Graduates will be able to apply domain knowledge for employment, advanced studies, entrepreneurial activities and for facing challenges in professional life.

PEO 2: Graduates will exhibit professionalism through effective communication skills, ethical values, and social responsibility.

PEO 3: Graduates will demonstrate team spirit and leadership qualities and engage in lifelong learning to contribute to nation- building.

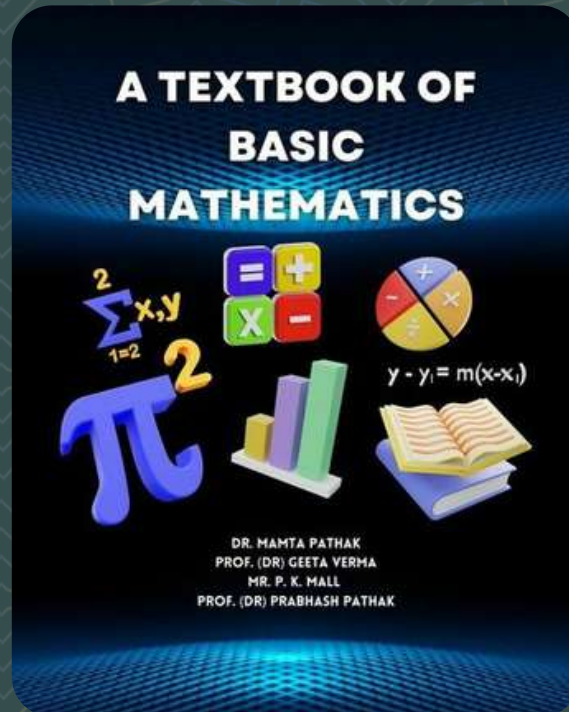
PROGRAMME SPECIFIC OUTCOME

Program Specific Outcomes (PSO)

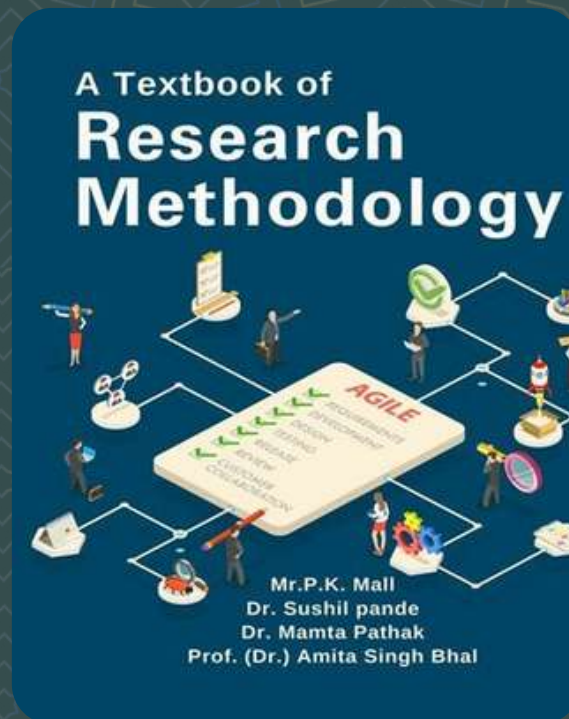
PSO-1: Graduates will be able to apply the fundamentals of thermal engineering, production engineering, and design engineering to provide solutions in the field of Mechanical Engineering and interdisciplinary areas.

PSO-2: Graduates will have the ability to develop advanced mechanical systems and processes using tools of Mechanical Engineering for practical applications.

Our Published Books



Author: Dr. P.K.Mall
ISBN: 9789359114521



Author: Dr. P.K.Mall
ISBN: 9789359119762
& 9359119768

Our Patent



ORIGINAL

कम सं/ Serial No. : 160837



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डिजाइन सं. / Design No. : 404638-001
तारीख / Date : 15/01/2024
पारस्परिकता तारीख / Reciprocity Date* :
देश / Country :

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो **AI BASED INTRUDER IDENTIFICATION** से संबंधित है, का पंजीकरण, श्रेणी 10-05 में 1.Prof. (Dr.) Amita Singh Bhal 2. Prof. (Dr.) Monica Mehrotra 3.Dr. Santosh Kumar Shukla 4.Dr. Anjali Awasthi 5.Dr. Mamta Pathak 6.Mr. P. K. Mall 7.Mrs. Saroj Singh के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class 10-05 in respect of the application of such design to **AI BASED INTRUDER IDENTIFICATION** in the name of 1.Prof. (Dr.) Amita Singh Bhal 2. Prof. (Dr.) Monica Mehrotra 3.Dr. Santosh Kumar Shukla 4.Dr. Anjali Awasthi 5.Dr. Mamta Pathak 6.Mr. P. K. Mall 7.Mrs. Saroj Singh.

डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्वीन प्रावधानों के अनुसरण में।
In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

जारी करने की तिथि : 21/03/2024
Date of Issue :



(Signature)
दस्ता की अति

सहाय्यक पेटेंट, डिजाइन और व्यापार चिह्न
Controller General of Patents, Designs and Trade Marks

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Departmental Events & Seminars

UPNEDA Visit



Mechanical Engineering Department of BBDNIIT conducts Industrial visit for their students.

Students with their respected faculties visited UPNEDA to see how they work..

RSB Transmission Visit



Mechanical Engineering Department of BBDNIIT gives opportunity to their students for RSB Transmission visit in 2024.

Internal Hackathon for SIH 2024



BBDNIIT conducted an internal hackathon to select top talent for the Smart India Hackathon (SIH) 2024. The event encouraged students to develop creative solutions for real-world problems under the MoE's Innovation Cell initiative.

INDUSTRIAL VISIT



AMUL Banaras Dairy, Lucknow on 03/05/2024 for Third year & fourth year students.

Industry 4.0 and Smart Manufacturing: Opportunities for Future Mechanical Engineers

The world of manufacturing is changing at an incredible pace. Machines are becoming smarter, factories are becoming more connected, and decision-making is increasingly driven by data rather than assumptions. This transformation, known as Industry 4.0, is reshaping the manufacturing sector and opening exciting opportunities for the next generation of mechanical engineers.

Industry 4.0 refers to the integration of advanced technologies such as the **Internet of Things (IoT)**, **Artificial Intelligence (AI)**, **robotics**, **cloud computing**, **digital twins**, and **big data analytics** into manufacturing processes. Unlike traditional factories, smart manufacturing systems can monitor their own performance, predict maintenance needs, reduce waste, and improve productivity with minimal human intervention. The result is a manufacturing environment that is faster, more efficient, and highly adaptable to changing market demands.

For mechanical engineers, this shift is not a challenge but an opportunity to redefine their role. While core engineering principles such as mechanics, thermodynamics, and manufacturing processes remain essential, today's engineers are also expected to understand automation, sensors, data analysis, and intelligent control systems. The mechanical engineer of the future will work at the intersection of hardware and software, designing systems that are not only mechanically efficient but also digitally connected.

One of the most exciting developments is predictive maintenance. Using sensors and AI-powered analytics, engineers can identify potential equipment failures before they occur. This minimizes downtime, reduces maintenance costs, and improves the reliability of industrial operations. Similarly, digital twins—virtual replicas of physical machines—allow engineers to simulate performance, test improvements, and optimize designs without interrupting actual production.

Another significant advancement is collaborative robotics, where robots work safely alongside humans instead of replacing them. These systems enhance productivity by handling repetitive or hazardous tasks while allowing engineers and operators to focus on innovation and problem-solving. Additive manufacturing, commonly known as 3D printing, is also revolutionizing product development by enabling rapid prototyping, customized production, and reduced material wastage.

However, succeeding in the era of **Industry 4.0** requires more than technical knowledge. Future mechanical engineers must develop skills in programming, data interpretation, communication, teamwork, and continuous learning. As technology evolves rapidly, adaptability will become one of the most valuable qualities in an engineer's career.

India is actively embracing smart manufacturing through initiatives such as Make in India and increasing investments in automation and digital infrastructure. As industries modernize, the demand for engineers who can combine mechanical expertise with digital technologies will continue to grow. This creates opportunities in sectors including automotive, aerospace, renewable energy, healthcare, and advanced manufacturing.

Industry 4.0 is not about replacing mechanical engineers—it is about empowering them with smarter tools and broader capabilities. Those who embrace innovation, remain curious, and continuously upgrade their skills will play a vital role in building the factories of tomorrow. For aspiring mechanical engineers, the future is no longer limited to designing machines; it is about creating intelligent systems that shape a more efficient, sustainable, and technologically advanced world.

*Author: Dr. Nagendra Kumar Mishra
Professor and Head of Dept.
Mechanical Engineering*

Hydrogen Energy and Fuel Cell Technology: The Future of Clean Energy

As the world searches for cleaner and more sustainable energy sources, hydrogen has emerged as one of the most promising solutions. With rising concerns over climate change, air pollution, and the depletion of fossil fuels, scientists and engineers are exploring technologies that can power the future without harming the environment. Among these innovations, hydrogen energy and fuel cell technology stand out as game changers that could redefine the way we produce and consume energy.

Hydrogen is the most abundant element in the universe, but it is rarely found in its pure form on Earth. It is usually extracted from water or natural gas through various processes. What makes hydrogen particularly attractive is that, when used as a fuel, it produces only water as a by-product. Unlike petrol, diesel, or coal, it does not release carbon dioxide during its use, making it an environmentally friendly energy carrier.

Fuel cells are devices that convert the chemical energy stored in hydrogen directly into electricity through an electrochemical reaction. Unlike conventional engines that burn fuel, fuel cells generate electricity without combustion, making them highly efficient and remarkably quiet. They are already being used in hydrogen-powered cars, buses, forklifts, backup power systems, and even spacecraft. Their ability to provide clean and reliable energy has made them a key technology in the global transition toward sustainable development.

One of the greatest advantages of hydrogen energy is its versatility. It can be used in transportation, power generation, and industrial applications. Hydrogen-powered vehicles offer longer driving ranges and faster refueling times compared to many battery-electric vehicles, making them particularly suitable for heavy-duty transport, railways, shipping, and aviation. In industries such as steel and fertilizer manufacturing, hydrogen has the potential to replace fossil fuels, significantly reducing greenhouse gas emissions.

However, the widespread adoption of hydrogen technology is not without challenges. Producing green hydrogen through renewable-powered electrolysis is still expensive, and storing and transporting hydrogen safely requires advanced infrastructure. Building hydrogen refueling stations and improving fuel cell durability also demand significant investment and technological innovation.

Nevertheless, governments and industries across the world are investing heavily in research and infrastructure, believing that these challenges can be overcome in the coming years.

For mechanical engineers, hydrogen technology presents exciting career opportunities. From designing fuel cell systems and hydrogen storage tanks to developing efficient thermal management systems and manufacturing processes, engineers have a vital role in shaping this emerging industry. Knowledge of renewable energy, materials science, thermodynamics, automation, and safety engineering will become increasingly valuable as hydrogen-based technologies expand across different sectors.

India has also recognized the importance of hydrogen in achieving energy security and reducing carbon emissions. The country's growing focus on green hydrogen production and clean energy initiatives is expected to create new opportunities for innovation, research, and employment. As industries move towards sustainable manufacturing and transportation, skilled engineers will be at the forefront of this transformation.

Hydrogen energy is not a distant dream—it is rapidly becoming a practical reality. Although there are challenges to address, continuous advancements in fuel cell technology and renewable energy are bringing us closer to a cleaner and more sustainable future. By embracing hydrogen as an alternative fuel, we are not only reducing our dependence on fossil fuels but also taking a significant step toward a greener planet for generations to come.

*Author: Ashwin Verma
4th year*

Renewable Energy Technologies and the Role of Mechanical Engineers

The twenty-first century has brought remarkable technological progress, but it has also reminded us of the urgent need to protect our planet. Climate change, rising global temperatures, and the rapid depletion of fossil fuels have made the search for cleaner and more sustainable energy sources more important than ever. Renewable energy is no longer just an alternative—it is becoming the foundation of a greener future. At the heart of this transformation are mechanical engineers, whose ideas and innovations are turning sustainable energy solutions into reality.

Renewable energy refers to energy generated from natural resources that are continuously replenished, such as sunlight, wind, water, biomass, and geothermal heat. Unlike conventional energy sources, these resources produce little or no greenhouse gas emissions during operation. Over the past decade, renewable energy technologies have advanced rapidly, becoming more efficient, affordable, and widely adopted across the globe.

Among the most widely used renewable technologies is solar energy. Modern photovoltaic panels convert sunlight into electricity with increasing efficiency, while solar thermal systems use the sun's heat for industrial processes and water heating. Wind energy has also emerged as a major contributor to clean power generation. Massive wind turbines installed on land and offshore convert the kinetic energy of moving air into electricity, providing power to millions of homes. Similarly, hydroelectric plants continue to generate reliable electricity using flowing water, while biomass and geothermal systems offer sustainable solutions for heating and power generation in suitable regions.

Although these technologies may appear simple from the outside, they rely heavily on mechanical engineering principles. Every wind turbine requires precisely designed blades, efficient gearboxes, durable bearings, and robust structural components to withstand varying weather conditions. Solar tracking systems use mechanical mechanisms to maximize sunlight absorption, while hydroelectric turbines require careful design to achieve maximum efficiency. Mechanical engineers also contribute to thermal management, vibration control, material selection, manufacturing processes, and maintenance planning, ensuring that renewable energy systems operate safely and efficiently for decades.

The role of mechanical engineers extends far beyond design. They are actively involved in research and development, where they work on improving energy conversion efficiency, reducing production costs, and increasing the lifespan of renewable energy equipment. Advanced manufacturing techniques, computational simulations, and smart monitoring systems have enabled engineers to optimize designs before physical prototypes are even built. Predictive maintenance using sensors and artificial intelligence further helps reduce equipment failures and operational costs.

Energy storage has become another critical area where mechanical engineers play an important role. Since renewable energy sources such as solar and wind depend on weather conditions, efficient storage systems are essential for ensuring a continuous power supply. Engineers contribute to the development of battery cooling systems, hydrogen storage technologies, compressed air energy storage, and thermal energy storage solutions that improve the reliability of renewable power grids.

India is witnessing a significant expansion in renewable energy through large-scale solar parks, wind farms, and green hydrogen initiatives. Government policies encouraging clean energy adoption are creating exciting opportunities for young engineers. As industries increasingly focus on sustainability, the demand for professionals with expertise in renewable technologies, automation, computer-aided design, and energy management continues to grow.

However, technical knowledge alone is not enough. Today's mechanical engineers must also develop problem-solving abilities, teamwork, communication skills, and a willingness to embrace lifelong learning. Renewable energy is a rapidly evolving field, and those who remain curious and adaptable will be best prepared to contribute meaningful solutions to global energy challenges.

The transition to renewable energy is not merely about replacing fossil fuels; it is about creating a cleaner, healthier, and more sustainable future for generations to come. Mechanical engineers are among the driving forces behind this transformation, combining innovation with practical engineering to build technologies that improve lives while protecting the environment. As the world moves toward a low-carbon economy, their contributions will become more valuable than ever. The future of renewable energy is bright, and for aspiring mechanical engineers, it offers not just promising careers but also the opportunity to make a lasting impact on the world.

Author: Shrikant Mishra
3rd year

DEPARTMENT TOPPERS

4th Year

A S H W I N V E R M A

3rd Year

S H R I K A N T M I S H R A

2nd Year

S U Y A S H O J H A

DEVELOPMENT AND MECHANICAL PROPERTIES EVALUATION OF ENVIRONMENTALLY SUSTAINABLE COMPOSITE MATERIAL USING VARIOUS REINFORCEMENTS WITH EPOXY

Research Paper

Authors: Ankit Asthana, R. Srinivas, Shailendra Singh Chauhan, Din Bandhu, Shashi Prakash Dwivedi, Kuldeep K. Saxena, Kirtanjot Kaurf, Ibrahim Alnaser.

Publishing Journal: ELSEVIER.

DOI: <https://doi.org/10.1016/j.cscm.2024.e03624>

Abbreviations: CFEC, Carbon Fiber-Epoxy composite; GFPMC, Glass-Fiber Polymer Matrix composite; KEC, Kevlar-Epoxy composite; KF, Kevlar Fiber.

ABSTRACT

In this study, the mechanical properties of advanced composites fabricated by the hand lay-up process were investigated. The mechanical properties evaluated in this study included tensile strength, flexural strength, and impact strength. Tensile tests were performed to measure the resistance of the composites to pulling forces, while flexural tests assessed their resistance to bending. Impact tests, on the other hand, determine the material's ability to absorb sudden forces or shocks. Results showed that all the composite materials exhibited high tensile strength, with the Carbon fiber epoxy composite displaying the highest value due to the exceptional strength of carbon fibers. In terms of flexural strength, the Glass-Fiber Polymer Matrix composite demonstrated the highest resistance to bending, while the Kevlar-Epoxy composite exhibited the highest impact strength, owing to the unique properties of Kevlar fibers, which offer excellent energy absorption capabilities. In the hardness test, the Kevlar composite to epoxy matrix showed hardness from HRB 105 to HRB 125 an increase of 19.04 %, while fiberglass increased hardness by 14.2 % and carbon fiber by 16.3 %. The Impact test shows that the Kevlar composite to epoxy matrix showed hardness from HRB 105 to HRB 125 an increase of 19.04 %, while fiberglass increased hardness by 14.2 % and carbon fiber by 16.3 %. Kevlar reinforcing composite produced the highest flexural strength, compared to neat epoxy by 91.7 %. Carbon fibre composites were 52.5 % higher, whereas glass fibre composites were 15.6 % higher. SEM imaging results from the cross-sections show that the best bonding between the base material and the fibers was observed for Kevlar reinforced with epoxy. All mechanical test showed that Kevlar (Aramid fiber) provides excellent mechanical properties when compared to carbon fibre and glass fibre.

DESIGN AND FABRICATION OF MOBILE FIRE SUPPRESSION UNIT [INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING AND MANAGEMENT (IJSREM)]

Research Paper

Authors: Deepak kumar, Su ryakant Yadav, Ankur Srivastava.

Publishing Journal: International Journal of Scientific Research in Engineering and Management (IJSREM).

DOI: <http://www.ijsrem.com>

ABSTRACT

Fire incidents remain a significant threat to human life, infrastructure, and the environment, often leading to fatalities, severe injuries, property loss, and long-term psychological trauma. Firefighters, while essential in combating such disasters, are frequently exposed to extreme danger, especially in hazardous environments such as industrial plants, nuclear facilities, and densely populated urban areas. To address these challenges, this project presents the development of a compact, remotely operated firefighting robot designed to operate in environments where human intervention is difficult or unsafe. The robot is equipped with a thermal sensor, smoke sensor, and a live-feed camera to provide real-

time situational data to operators. It features dual water delivery options: an onboard tank with a pumping system and an external hose connection for continuous water supply. A 360-degree rotating nozzle, controlled via remote interface, ensures targeted suppression of fire. The robot uses a chain drive mechanism powered by dual motors, enabling mobility across rough or confined terrain. Powered by a rechargeable battery, it can function in off-grid locations, and its internal electronics are enclosed to minimize heat-related failures. This solution enhances firefighter safety, improves fire response efficiency, and mitigates risks in scenarios where traditional firefighting approaches are limited.

SOLAR-POWERED VILLAGES: EMPOWERING RURAL COMMUNITIES WITH SOLAR ENERGY, AND OVERALL WELL-BEING

Research Paper

Authors: Garima Singh, Bharat Raj Singh.

Publishing Journal: Procedia Environmental Science, Engineering and Management.

DOI: <https://doi.org/10.21844/162021181073>

Keyword: Solar energy, rural development, education, healthcare, well-being, renewable energy, sustainability.

ABSTRACT

Solar energy presents a transformative and sustainable solution to the pressing challenges faced by rural communities, particularly in developing nations where access to reliable electricity remains limited. This paper delves into the potential of solar-powered villages to revolutionize rural development by empowering rural areas by improving critical needs such as education, healthcare, economic growth, and overall well-being. By analyzing the integration of decentralized solar energy systems in off-grid regions, the study underscores the vast socioeconomic and environmental benefits these solutions can offer.

Despite these advantages, the research identifies key challenges to scaling up solar energy adoption in rural areas. These include high initial costs, lack of awareness and technical expertise, and inadequate policy frameworks. To address these barriers, the findings advocate for a multi-faceted approach involving strong policy support, targeted subsidies, and public-private partnerships to reduce financial obstacles. Moreover, technological innovation is critical for enhancing the efficiency and affordability of solar systems, while community participation is essential to ensure local ownership, maintenance, and long-term sustainability of solar energy projects.

Thus, the study demonstrates that solar-powered villages have the potential to drive equitable development, improve quality of life, and foster sustainable growth in rural regions. By addressing challenges and leveraging opportunities, solar energy can empower rural communities to become resilient, self-reliant, and integral contributors to national development goals.

MEASURING THE EFFECTS OF LIQUID BULK VISCOSITY NUMERICALLY ON A SPHERICAL NITROGEN BUBBLE IN AQUEOUS H₂ SO₄

Research Paper

Authors:: P. K. Mall, H. K. Paliwal, Amit Medhavi, Ayman A. Aly.

Publishing Journal: International Journal of AIP Advances.

DOI: <https://doi.org/10.1063/5.0255985>

ABSTRACT

The current study extensively simulates multiple theories concerning the mechanism of bubble formation during the interaction between an aqueous H₂SO₄ solution and nitrogen gas. This interaction leads to pressure surges and high internal temperatures due to the violent collapse of the inertial bubble. This study examines the effects of liquid volume viscosity on the dynamics of a single cavitation bubble by applying the Gilmore model to the bubble interface under various boundary conditions, such as liquid volume, N₂, surface tension, temperature, pressure, etc. An aqueous solution of H₂SO₄ in liquid and nitrogen bubbles was used in this investigation. A comprehensive study of the effects of bubble frequency, asymptotic growth, and viscosity on bubble growth was carried out. To quantitatively investigate the influence of fluid shear viscosity on the dynamics of a single cavitation bubble, several numerical calculations were performed at various viscosities ranging from 0.002 to 0.014 Pa s, both with and without fluid shear viscosity. In addition, the study focuses on the maximum stress in the bubble rather than the highest temperature. Wherever possible, the experimental validations that serve as a guide for the theoretical predictions are also provided. The findings indicate that while the impact on a bubble boom may be negligible at lower viscosities, it cannot be completely ignored at relatively high viscosities. This analysis offers insight into how the thermodynamic method modifies the intensity of cavitation and advances our understanding of this complex thermal-hydrodynamic phenomenon.

From the Editors Pen.....

Respected Readers,

We proudly welcome you to the inception of Mechdrishti—the premier edition of the official magazine brought to you by the Department of Mechanical Engineering at BBDNIIT. This first issue goes far beyond a simple compilation of articles; it serves as a dynamic blueprint of our vibrant energy, shaped by the creativity, precision, and unstoppable determination inherent in our field.

The editorial team has meticulously crafted this publication, ensuring it perfectly echoes the mechanical pulse of our department. Spanning from the methodical brilliance found in our drafting labs to the loud hum of innovation across the workshop floors, Mechdrishti mirrors a collective committed to transforming untapped potential into concrete achievements. We pay tribute to the creators, designers, and fabricators who are constantly pushing the boundaries of contemporary engineering

Inside this volume, you will discover the documentation of our shared progress:

- **Scientific & Academic Advancements:** Documenting critical discoveries in thermodynamics, material sciences, and structural evaluations that continually deepen our theoretical foundations.
- **Applied Technical Prowess:** Spotlighting immersive training in Robotics, CAD/CAM, Automotive Design, and Advanced Manufacturing, effectively linking core mechanical principles with real-world industry standards.
- **Ingenuity & Fabrication:** Recognizing the tenacity of our competitive design teams, automotive builders, and the groundbreaking projects brought to life by our talented students.

Ultimately, Mechdrishti is a profound reflection of our unified goals and unbreakable resolve. As you navigate through these articles, we encourage you to immerse yourself in the concepts driving us ahead and to observe the gears of human intellect in motion.

With Unyielding Gratitude,

The Editorial Team

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Guided By: Prof. (Dr.) N.K. Mishra (HOD, ME)



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"To invent, you need a good imagination and a pile of junk."

Department of Mechanical Engineering



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