



# EGS PILLAY ENGINEERING COLLEGE

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## DEPARTMENT OF MECHANICAL ENGINEERING

# MECTR•Z'25

MAGAZINE-2025

Innovations for a Sustainable Future

ANNUAL PUBLICATION

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### **MESSAGE FROM CHAIRMAN'S DESK**

It gives me great pleasure to extend my warm greetings to everyone associated with this symposium and to those contributing to this magazine. Education is not merely about acquiring knowledge, but about inspiring innovation, creativity, and a spirit of lifelong learning. Events like this symposium provide a vibrant platform for students to showcase their talents, share ideas, and explore new dimensions in their respective fields. I am proud to see the enthusiasm and dedication of our students and faculty members in organizing such meaningful academic activities. These efforts reflect our institution's commitment to fostering holistic growth — blending academic excellence with practical exposure and professional development. My sincere appreciation goes to the organizing committee, faculty coordinators, and all participants for their hard work and contribution. I wish this event and the magazine grand success and hope it continues to inspire future generations of learners.

**Smt. S. Jothimani G.S. Pillay  
Chairman**



### **MESSAGE FROM SECRETARY'S DESK**

It gives me immense pleasure to extend my heartfelt greetings to everyone involved in organizing this symposium and bringing out this magazine. Such academic and technical events play a vital role in enhancing the learning experience of students by providing opportunities to exchange ideas, develop skills, and nurture innovation. I am delighted to see our students and faculty members working together with great enthusiasm and dedication. Their teamwork, commitment, and creativity are truly commendable. Initiatives like this reflect the institution's mission to encourage holistic development and prepare students to face future challenges with confidence and competence. I congratulate the organizing team, contributors, and participants for their sincere efforts in making this event a success. I wish the symposium and the publication all success and hope it continues to inspire academic excellence in the years to come.

**Shri. S. Senthilkumar  
Secretary**



### **MESSAGE FROM JOINT SECRETARY'S DESK**

I am delighted and proud to note that our Mechanical Engineering Department is actively organizing a wide range of technical events such as symposiums, workshops, seminars, webinars, innovative project exhibitions, and technical competitions, along with celebrating faculty and student achievements. On the occasion of this event, the department is also bringing out a magazine that serves as a platform to showcase the creative ideas, technical insights, and accomplishments of our academic community. These events serve as a bridge between classroom learning and real-world applications, enabling students to interact with experts, gain new perspectives, and stay updated with the latest advancements in the field of Mechanical Engineering. I sincerely appreciate the dedicated efforts of the faculty members and the enthusiastic participation of the students in making these events possible. I extend my best wishes for the successful conduct of the technical programs and hope that they bring a memorable and enriching learning experience to all. May this initiative inspire many more achievements and milestones in the future.

**Shri. S. Shankarganesh  
Joint Secretary**



### **MESSAGE FROM PRINCIPAL**

It gives me immense pleasure to convey my appreciation as the Department of Mechanical Engineering organizes a wide spectrum of technical events aimed at enriching the knowledge and skills of our students. Under the able leadership and visionary guidance of our respected Secretary, Shri. S. Senthilkumar, and Joint Secretary, Shri. S. Sankar Ganesh, our institution continues to move forward with confidence, determination, and a clear vision for excellence. Their insightful decisions and unwavering commitment have enabled our college to stay competitive, progressive, and impactful in the field of higher education. These technical events are significant milestones in the journey of our department. They not only provide students with exposure to the latest developments and innovations in the Mechanical Engineering field, but also offer them a valuable platform to showcase their creativity, inherent talents, technical abilities, and leadership qualities. Such initiatives bridge the gap between classroom learning and practical applications, helping our budding engineers to develop confidence, teamwork, and problem-solving skills essential for their professional careers. I wholeheartedly congratulate everyone associated with this initiative and extend my best wishes for the fruitful conduct of the programs.

**Dr. M. Chinnadurai  
Principal**



### **MESSAGE FROM THE HEAD OF DEPARTMENT**

Dear Students, Faculty, and Staff,

I am delighted to address you all through this edition of our departmental newsletter. As we continue to advance in our academic and research endeavors, I would like to highlight some key updates and achievements from our department. Our department has been recognized for [Anna University Research Centre, reflecting our commitment to excellence in the field of research and development.

We are excited to announce the association event **Mectroz 25**. This event will feature. Our faculty and students continue to make significant contributions to various research publications. We are also pleased to announce a new collaboration with various MoUs, which will elaborate the research opportunities.

Our students have been actively engaged in various activities or projects student achievement or project. Faculty members have been involved in various activities, such as conferences, workshops, or community service. As we move forward, I encourage everyone to continue striving for excellence, supporting each other, and contributing to the vibrant academic community that defines our department. Your dedication and hard work are the pillars of our collective success.

Thank you for your continued commitment and enthusiasm.

**Dr. N. Ramanujam**  
**Professor and Head**

## **VISION & MISSION OF THE INSTITUTION**

### **Vision**

Envisioned to transform our institution into a "Global Centre of Academic Excellence"

### **Mission**

- To provide world-class education to the students and to bring out their inherent talents
- To establish state-of-the-art facilities and resources required to achieve excellence in teaching-learning and supplementary processes
- To recruit competent faculty and staff and to provide opportunities to upgrade their knowledge and skills
- To have regular interaction with the industries in the area of R&D and offer consultancy, training, and testing services
- To establish centers of excellence in the emerging areas of research
- To offer continuing education and non-formal vocational education programs that are beneficial to society

### **Program Outcomes**

PO1 Application knowledge of mathematics, science, engineering fundamentals

PO2 Problem Analysis.

PO3 Design and Development of Solutions

PO4 Conduct investigations by designing experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions

PO5 Modern Tool Usage

PO6 Assessing societal, health, safety, legal and cultural issues

PO7 Commitment to professional ethics.

PO8 Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings

PO9 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

PO10 Examine Project Management and Financial aspects

PO11 Instil Life-long Learning

### **Program Educational Objectives**

PEO 1 - Preparing the graduates to have successful career in mechanical and associated industries or becoming an entrepreneur or pursuing higher education and research.

PEO 2 - Developing ability to apply fundamental technical knowledge and skills to find practical solutions to technological challenges and problems in core and allied areas of mechanical engineering.

PEO 3 - Complementing the classroom teaching with live projects, field works, seminars to build self-learning and lifelong learning capability and to develop out-of-the-box thinking. Also developing capability to adapt to evolving technological challenges, communicate effectively, work effectively as individuals and as team members, and adhering to professional ethics.

### **Program Specific Outcomes**

PSO 1 - Design, develop, test, and maintain advanced thermal engineering systems for industrial and other applications.

PSO 2 - Apply the concepts of modern manufacturing and industrial engineering techniques in industries.

PSO 3 - Modeling, design, and analysis of mechanical components using Computer Aided Design and Analysis (CAD/CAE) software tools.

## **Chief Editor**



**Dr. S. Nandakumar**  
Assistant Professor  
E.G.S. Pillay Engineering College Nagapattinam

Dear Students, Faculty Members, and Esteemed Guests,

It gives me immense pleasure to address you all on the occasion of **Mectroz**, a distinguished event that celebrates innovation, creativity, and engineering excellence within our institute. As the Chief Editor responsible for curating and presenting the content that highlights the spirit and achievements of this event, I am honored to share some insights and expectations.

Mectroz stands as a beacon of inspiration where young engineers and technologists come together to showcase their talents, push the boundaries of knowledge, and engage in healthy competition. This platform not only fosters technical skill development but also encourages collaboration, critical thinking, and problem-solving—qualities that are indispensable in the rapidly evolving landscape of engineering.

Our role as content creators is pivotal. We strive to capture the essence of Mectroz through well-crafted articles, engaging interviews, insightful reports, and vivid visual storytelling. Each piece aims to reflect the dedication and hard work of our participants, the innovative projects on display, and the valuable lessons learned throughout the event. To the participants: your enthusiasm and ingenuity are the heartbeat of Mectroz. Your stories inspire others to dream bigger and work harder. To the faculty and organizers: your guidance and support provide the foundation upon which this event thrives. And to our readers: we hope to bring you closer to the cutting-edge developments and vibrant community that Mectroz embodies.

As we document this journey, we remain committed to upholding the highest standards of accuracy, creativity, and professionalism. Together, we will ensure that the legacy of Mectroz is preserved and celebrated for years to come.

Thank you, and let us all look forward to an enriching and unforgettable experience at Mectroz.

## **Associate Editor**



**Mr. A. Sanjay**

III Year Mechanical Engineering Student  
E.G.S. Pillay Engineering College Nagapattinam

Mastering the Art of Digital Creativity in Mechanical Engineering

In the fast-evolving world of mechanical engineering, innovation isn't limited to machines and materials—it extends into how ideas are communicated. As an Associate Editor in the Department of Mechanical Engineering, exemplifies this fusion of technical expertise and creative storytelling.

With a sharp eye for design and a deep understanding of visual communication, he mastered tools like Canva, Photoshop, Cap Cut, and cutting-edge AI editing software. From transforming complex engineering concepts into visually appealing graphics to crafting engaging video content, his work bridges the gap between technical depth and audience engagement.

As an associate editor, every piece of content—be it research highlights, event coverage, or technical tutorials—is not only accurate but also captivating. His proficiency in digital tools allows him to enhance the presentation of mechanical engineering innovations, making them accessible and inspiring to students, professionals, and enthusiasts alike.

In a world where content is as important as invention, Sanjay A stands out as a creative force, proving that engineering and artistry can go hand in hand.

# **FACULTY ACHIEVEMENTS**

# FACULTY PUBLICATIONS



**Dr.S.Krishnamohan**  
Professor

1. Azadirachta indica seed powder-reinforced and nano sand-filled USPER membrane for oil/seawater separation, M Balakrishnan, K Sundaramoorthy, A Ramasamy, Biomass Conversion and Biorefinery 15 (3), 4759-4776, 2025
2. Study on the effect of halloysite nanotubes on the mechanical properties and swelling resistance of ethylene-propylene diene monomer (EPDM)/nitrile butadiene rubber (NBR) blend, KS Nathan, S Krishnamohan, V Navaneethakrishnan, Materials Research Express 11 (11), 115306, 2024
3. A novel hybrid particle damping in boring bar for effective machining and chatter suppression G Ramu, K Sundaramoorthy, C Singaravelu, V Prasannavenkadesan, Sadhana 49 (4), 276, 2024
4. Evolutionary U-Net for lung cancer segmentation on medical images, FF Sahapudeen, S Krishna Mohan, Journal of Intelligent & Fuzzy Systems 46 (2), 3963-3974



**Dr.V.Sivaramakrishnan**  
Professor

1. Sivaramakrishnan, V., Vishwanathperumal, S., Navaneethakrishnan, V. et al. Morphology and performance of nanosilica filler filled NR/NBR rubber composites. Journal of Rubber Research 28, 269–289 (2025). <https://doi.org/10.1007/s42464-025-00303-8>



**Dr.V.Navaneethakrishnan**  
Associate Professor

1. Role of carbon nanotubes in improving the mechanical and swelling resistance characteristics of EPDM/SBR blends, S Vishwanathperumal, KN Ramu, KAVR Prabhu, V Navaneethakrishnan, Journal of Rubber Research, 1-14, 2025
2. Carbon nanotubes (CNTs) impact on the mechanical properties and swelling behavior of EPDM/SBR blend nanocomposites, S Vishwanathperumal, KN Ramu, G Anand, V Navaneethakrishnan, Journal of Rubber Research, 1-18, 2025
3. Morphology and performance of nanosilica filler filled NR/NBR rubber composites, V Sivaramakrishnan, S Vishwanathperumal, V Navaneethakrishnan, Journal of Rubber Research, 1-21, 2025
4. Impact of in-situ functionalization of carbon nanotubes using bis (triethoxysilylpropyl) tetrasulfide on the properties of EPDM/SBR-CNT composites, S Vishwanathperumal, KN Ramu, V Navaneethakrishnan, K Parthasarathy, Journal of Inorganic and Organometallic Polymers and Materials 35 (5), 4016-4035, 2025
5. Study on the effect of halloysite nanotubes on the mechanical properties and swelling resistance of ethylene-propylene diene monomer (EPDM)/nitrile butadiene rubber (NBR) blend, KS Nathan, S Krishnamohan, V Navaneethakrishnan, Materials Research Express 11 (11), 115306, 2024
6. Mechanical and swelling properties of EPDM/SBR nanocomposites containing resorcinol-and hexamethylenetetramine-modified HNTs, V Sivaramakrishnan, S Vishwanathperumal, V Navaneethakrishnan, 48 (6), 677-692, 2024
7. Improved mechanical performance and swelling resistance of ethylene propylene diene monomer/styrene butadiene rubber nanocomposites through the incorporation of graphene oxide, V Sivaramakrishnan, SR Venkataraman, S Vishwanathperumal, Journal of Polymer Research 31 (10), 313

# FACULTY PUBLICATIONS

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**Dr.A.Arunkumar**  
Associate Professor

1. AI-driven Optimisation of biodiesel blends for enhanced engine efficiency and reduced emissions, Nandakumar S, Arunkumar A, International Journal of Ambient Energy 46 (1) 2025
  2. Polyhedral Oligomeric Silsesquioxane/Multiwalled Carbon Nanotube (MWCNT/POSS) Hybrid Filler in Ethylene-Propylene-Diene Monomer/ Styrene-Butadiene Rubber (EPDM/SBR, BDSVSAA Arunkumar, Silicon, 7, 2025
  3. Design and Fabrication of Multirotor UAV for Medical Applications, Arunkumar A, Darshankumar J, Mathankumar M, International Conference on Advancements in Electrical, Electronics, 2025
  4. Polyhedral Oligomeric Silsesquioxane/Multiwalled Carbon Nanotube (MWCNT/POSS) Hybrid Filler in Ethylene-Propylene-Diene Monomer/ Acrylonitrile-Butadiene Rubber (EPDM/NBR, Arunkumar A, B. Dhanasekharavarthi, S. Vishvanathperumal, G. Sangeetha, Journal of Inorganic and Organometallic Polymers and Materials, 2025
  5. Comparative analysis of cure behaviors, mechanical properties, and swelling resistance in EPDM/SBR composites with HNTs, APTES-modified HNTs, and RH-modified HNTs, A Arunkumar, SR Venkataraman, S Vishvanathperumal, Silicon 16 (15), 5691-5714
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**Dr.S.Nandakumar**  
Assistant Professor

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1. AI-driven Optimisation of biodiesel blends for enhanced engine efficiency and reduced emissions, Nandakumar Subramanian, Arunkumar A, International Journal of Ambient Energy 46 (1), 2522357, 2025
  2. Investigations on ammonium O, O dicetyl dithiophosphate (ADCTP) as a novel antistatic additive for kerosene fuel—an exploratory study, Nandakumar Subramanian, S SP, S Mohan, Petroleum Science and Technology 42 (25), 4501-4519

## **Board of Studies (BoS)**

### **Members**

<b>Chairman – BoS</b>	<b>University Nominee</b>	<b>External Subject Expert Member 1</b>
Dr. N. RAMANUJAM Professor & Head Department of Mechanical Engineering, E.G.S. Pillay Engineering College, Nagapattinam.	Dr. R. DHINAKARAN Professor Department of Mechanical Engineering, Pondicherry Technological University, Pondicherry.	Dr. R. ELANSEZHIAN Professor Department of Mechanical Engineering, Pondicherry Technological University, Pondicherry.
<b>External Subject Expert Member 2</b>	<b>Industry / Corporate Sector</b>	<b>Alumni</b>
Dr. M. DURAISELVAM Professor Department of Production Engineering, National Institute of Technology Thiruchirappalli	Mr. R. BALAMURUGAN SENIOR MANAGER Renault Nissan Technology and Business Centre India Pvt. Ltd. Chengalpattu.	Mr. V.G. VIGNESVARAN Proprietor V.G. Steels, Fabs and Furniture, Tirivarur

**Department Academic Advisory**  
**Committee (DAAC)**

**Members:**

<b>Experts</b>	<b>Details</b>
<b>Academic Expert-1</b>	<b>Dr. S. Beer Mohamed</b>
<b>Industry Expert</b>	<b>Mr. B. Kovarasan</b>
<b>Alumni Representative</b>	<b>Mr. C. Venkatesh</b>
<b>Internals</b>	<b>Dept. Faculty Members</b>

# DEPARTMENT ACTIVITIES



Department of Mechanical Engineering received a Honor of Eminence at Unifest Awards 2023 from Unique MEP Training Institute

The poster is for a guest lecture organized by EGS Pillay Engineering College, Madipatti. The title is "Recent Trends in Electric Vehicle Technology". The resource person is Dr. C. RAMANATHAN, Centre for Electric Mobility (CEM), SRM Institute of Science and Technology, Chennai. The date is 13.09.2023, from 10.30am to 12.30pm, at GADOL LAB. The poster also features logos for IEEE, ISTE, and others.

Organized a Guest Lecture on Recent Trends in Electric Vehicle Technology on 13.09.2023, which is delivered by an expert  
**Dr. G. Ramanathan,**  
Centre for Electric Mobility (CEM),  
SRM Institute of Science and Technology,  
Chennai

Organized a International Webinar on "Engineering Tomorrow: The Role of Mechanical Engineers in Future Innovation," which is delivered by a foreign expert  
**Dr. V. Prasannavenkadesan,**  
Post Doctoral Fellow,  
Queen Mary University of London, UK

The poster is for an international webinar organized by EGS Pillay Engineering College, Madipatti, in association with ISTE Students Chapter of Mechanical Engineering. The title is "INTERNATIONAL WEBINAR ON ENGINEERING TOMORROW : THE ROLE OF MECHANICAL ENGINEERS IN FUTURE INNOVATION". The resource person is Dr. V. PRASANNAVENKADESAN, Post Doctoral Fellow, School of Engineering and Design Science, Queen Mary University of London, United Kingdom. The date is 18.07.2023, from 10:00 AM to 11:30 AM. The poster also features logos for IEEE, ISTE, and others.

# DEPARTMENT ACTIVITIES



Department Faculty Dr.S.Nandakumar and Mr.N.Manikandan attended an one day SERB sponsored on Modelling and Simulation of Open ECU Engine for Biofuels Blends on 15.05.2025 at SASTRA University Tanjore

The banner for the webinar "Fundamentals and Applications of Plasma Science and Technology" organized by EGS Pillay Engineering College. It features the college's logo, the title, and details about the guest speaker, Dr. S. Infant Solomon Vinodh from the Institute of Plasma Research, Gujarat. It also lists the coordinators and resource persons.

EGS PILLAY ENGINEERING COLLEGE  
Department of Mechanical Engineering  
A Webinar on  
**FUNDAMENTALS AND APPLICATIONS OF PLASMA SCIENCE AND TECHNOLOGY**  
Dr. S. INFANT SOLOMON VINOZH  
Institute of Plasma Research  
Gujarat  
Coordinator  
Dr. N. RAMANJAM  
Prof/Physics  
Dr. C. D. DEEPA  
Prof/Chemistry  
Dr. S. NANDAKUMAR  
AP/MECH  
Dr. H. RAMANJAM  
Instructor  
Dr. B. DEEPA  
Instructor  
REGISTER NOW!  
Date: 13.04.2025, Time: 09.00 AM  
For further details, contact: 0412-2200000

"Fundamentals and Applications of Plasma Science and Technology", scheduled on 13.04.2025 at 09.00 AM.

Organized by Department of Mechanical Engineering, EGSPEC Nagapattinam

Guest Speaker:

**Dr. S. Infant Solomon Vinodh**  
Institute of Plasma Research, Gujarat.

Alumni Webinar on "Automobile Crash Test", scheduled on 01.08.2025

Organized by Department of Mechanical Engineering, EGSPEC Nagapattinam

Guest Speaker:  
**Mr.B. Kovarasan,**  
Tipline CAADD, Chennai.

The banner for the alumni webinar on "Automobile Crash Test" organized by EGS Pillay Engineering College. It features the college's logo, the title, and details about the guest speaker, Mr. B. Kovarasan from Tipline CAADD, Chennai. It also lists the coordinators and resource persons.

EGS PILLAY ENGINEERING COLLEGE  
DEPARTMENT OF MECHANICAL ENGINEERING AND ALUMNI ASSOCIATION  
Organizing  
EGS PILLAY ENGINEERING COLLEGE  
AUTOMOBILE CRASH TEST  
Resource Person  
Mr. B. KOVARASAN  
Coordinator  
Mr. J. VYASABHARATHAN  
Instructor / Head  
Mr. C. S. ARNAUTHIOTHIRUPPAN  
Instructor / Head  
Mr. S. ROVANARAJAN  
Instructor / Head  
Date: 01.08.2025  
Coordinator  
Dr. N. RAMANJAM  
Instructor / Head  
Mr. S. ROVANARAJAN  
Instructor / Head  
With Dept. Alumni (09.00 AM)  
MANAGING PARTNER  
TIPLINE CAADD  
CHENNAI  
For further details, contact: 0412-2200000

# FACULTY DEVELOPMENT PROGRAM ORGANIZED

Department of Mechanical Engineering organized a  
Six days Faculty Development Programme  
on  
*Empowering Change: Energy Technologies and Sustainable Development*  
Sponsored by ATAL Academy  
during 01 -06 September 2023

## Coordinators

**Dr.G.Gurumoorthi, Professor**

## Co-Coordinators

**Dr.S.Nandakumar, Assistant Professor**

 <p><b>E.G.S. PILLAY ENGINEERING COLLEGE (AUTONOMOUS) NAGAPATTINAM</b></p> <p><b>Department of Mechanical Engineering</b></p> <p>ANTE TRADERS AND CLASSMATE (ATAL) ACADEMY SPONSORED BY DATE FACULTY DEVELOPMENT PROGRAMME STARTING, MADURAI, ON</p> <p><b>"EMPOWERING CHANGE: ENERGY TECHNOLOGIES AND SUSTAINABLE DEVELOPMENT"</b></p> <p><b>01 - 06 September 2023</b></p>	<p><b>ORGANIZING COMMITTEE</b></p> <p><b>Chief Patron</b> <b>Sh. S. Jathismani G.S. Pillay</b> Chairman - EGSP Pillay Group of Institutions, Nagapattinam</p> <p><b>Sh. S. Senthilkumar,</b> Secretary - EGSP Pillay Group of Institutions, Nagapattinam</p> <p><b>Sh. S. Sankar Ganesh</b> Joint Secretary - EGSP Pillay Group of Institutions, Nagapattinam</p> <p><b>Patron</b> <b>Dr. M. Chinnadurai</b> Principal, E.G.S. Pillay Engineering College</p> <p><b>Convenor</b> <b>Dr. N. Ramarajam</b> Head, Department of Mechanical Engineering</p> <p><b>Dr. S. Krishna Mohan</b> Professor, Department of Mechanical Engineering</p> <p><b>Coordinators</b> <b>Dr. G. Gurumoorthi,</b> Professor/Mechanical Engineering</p> <p><b>Dr. S. Nandakumar,</b> Assistant Professor/Mechanical Engineering</p>	<p><b>RESOURCE PERSONS</b></p> <p><b>Dr. S.P. Arugumendy</b> Professor, Department of Mechanical Engineering, National Institute of Technology Trichy Campus <b>Dr. R. Karuppiah, IAS(Retd.)</b> Centre for Solar Energy Materials, International Advanced Research Centre for Powder Metallurgy, Hyderabad <b>Mr. Venkatesh Balaji</b> Associate Professor, Department of Mechanical Engineering, National Institute of Technology Trichy Campus <b>Mr. Venu Rajesh, Senior Manager,</b> Sustech, Infra Solutions <b>Mr. Venkateswaran</b> Bharat Heavy Electricals Limited Trichy Campus <b>Dr. A. K. Rajesh Kumar, Professor</b> S.I Engineering Deemed University Industrial Edifice, Trichy Campus <b>Dr. M. Manohar, Research Scientist,</b> RRC Research Institute, Tiruchirappalli, Madras Campus <b>Dr. Mohamed Farouk P, Associate Professor</b> University of Cagliari, Italy <b>Dr. Tugce Demir Melikas</b> Associate Professor University of Cagliari, Italy <b>Dr. Khan Bahaduruddin, Associate Professor,</b> Bio Processing and Resources Laboratory, School of Chemical Biotechnology, SRM University Tirupati <b>Mr. Sajitha Jose</b> Assistant General Manager, Inoxia Sales Pvt Ltd Hyderabad <b>Dr. Senthilmaran D, Associate Professor</b> National Institute of Technology Tiruchirappalli, India <b>Dr. Meenakshi Jayaram Raja</b> Inoxia Sales Pvt Ltd, Hyderabad <b>Mr. Venkatesh Chaitanya</b> Deputy Manager, Bosch Components Mumbai</p>
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This Faculty Development Programme (FDP) on "Empowering Change: Energy Technologies and Sustainable Development" is designed to provide an interdisciplinary platform for educators, researchers, and industry professionals to engage with the most pressing global challenges related to energy, sustainability and Climate Change. As the world transitions toward cleaner and more resilient energy systems, this FDP aims to foster a comprehensive understanding of emerging technologies such as renewable energy sources, energy storage, green fuels, and energy-efficient processes.

# **FACULTY ARTICLES**

Dr. S. Krishnamohan  
Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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**Azadirachta indica seed powder-reinforced and nano sand-filled USPER membrane for oil/seawater separation**

In situ methyl ethyl ketone peroxide-mediated free radical curing was used to synthesize a traditional *Azadirachta indica* seed (AIS) powder-reinforced and nano sand-filled unsaturated polyester resin (USPER) composite under various experimental settings. Different thermal characteristics (such as differential scanning calorimetry and thermogravimetric analysis), scanning electron microscopy, energy-dispersive X-ray spectroscopy, colour mapping, Fourier transform infrared spectrum, antimicrobial activities and water contact angle measurements were used to characterize the prepared USPER composite. The USPER composite's various mechanical and physico-chemical characteristics were also studied. The usage of the USPER composite-based membrane for oil/seawater separation was studied. The USPER composite's tensile strength revealed a 0.17 order of dependence at different percentage weight loadings of nano sand. The mechanical characteristics grew gradually as the concentration of nano sand rose. The highest water flux was calculated to be 62.5 L/m<sup>2</sup>/h with a 100% oil rejection efficiency. The outcomes were contrasted with the values from the literature.

Dr. S. Krishnamohan  
Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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### **A novel hybrid particle damping in boring bar for effective machining and chatter**

Particle damping is a promising passive damping technique to attenuate the chatter in the boring process. Till now, researchers have considered the particle damping approaches with single-type particles and a mixture of particles. In this work, a novel hybrid particle approach is reported to improve the effectiveness of particle damping in a boring bar. For this purpose, an unmodified boring bar, single-unit, multiunit horizontal, and multiunit vertical particle damped boring bars were considered. Modal analysis, dynamic characteristics, logarithmic decrement, damping ratio, and resonance gap were assessed as the performance benchmarks. In addition, the surface roughness, tool-insert temperature and boring bar displacement during the machining of mild steel were also investigated. The comparative study revealed that the particle-damped boring bars had better damping and machining performance than the unmodified boring bars. Among the investigated boring bars (modified and unmodified), the multiunit vertical type particle damped boring bar showed a higher resonance gap (1282.14 Hz), lower displacement (0.69 mm), minimum surface roughness (0.84  $\mu\text{m}$ ), and minimum temperature (252  $^{\circ}\text{C}$ ) during the boring process.

Dr. S. Krishnamohan  
Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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**Role of carbon nanotubes in improving the mechanical and swelling resistance characteristics of EPDM/SBR blends.**

The incorporation of MWCNTs resulted in significant improvements in mechanical properties, with tensile strength increasing by up to 99% and stress at 100% elongation improving by 29% compared to the unfilled EPDM/SBR blend. Enhanced swelling resistance and crosslink density further confirmed the effective interaction between the nanotubes and the rubber matrix. Field Emission Scanning Electron Microscopy (FESEM) revealed uniform dispersion and strong interfacial adhesion of MWCNTs within the matrix. In this study, multi-walled carbon nanotubes (MWCNTs) were incorporated into ethylene-propylene-diene monomer (EPDM) and styrene-butadiene rubber (SBR) blends to develop high-performance nanocomposites. The prepared materials were thoroughly characterized to evaluate their curing behavior and a wide range of mechanical and physical properties, including tensile strength, elongation at break, tear strength, stress at 100% elongation, rebound resilience, and Shore A hardness. Additional assessments encompassed abrasion resistance, swelling resistance, crosslink density, compression set, and morphological. These results demonstrate the potential of MWCNTs in reinforcing EPDM/SBR nanocomposites for advanced rubber engineering applications.

Dr. S. Krishnamohan  
Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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**Carbon nanotubes (CNTs) impact on the mechanical properties and swelling behavior of EPDM/SBR blend nanocomposites.**

Carbon nanotubes (CNTs) were incorporated to create nanocomposites of ethylene-propylene-diene monomer (EPDM) and styrene-butadiene rubber (SBR). These nanocomposites underwent comprehensive evaluation of their cure and mechanical properties, specifically assessing tensile strength, elongation at break, tear strength, stress at 100% elongation, rebound resilience, and hardness. Additional assessments included abrasion resistance, swelling resistance, crosslinking density, compression set, and morphology. Results from mechanical testing demonstrated substantial improvements in key properties, with tensile strength increased by up to 99% and stress at 100% elongation enhanced by up to 29%, relative to pure EPDM/SBR blends. To gain deeper insights into the nanocomposite structure, the dispersion state of CNTs within the EPDM/SBR matrix was investigated using Field Emission Scanning Electron Microscopy (FESEM), revealing the morphology and distribution of CNTs throughout the rubber matrix.

Dr.V. SIVARAMAKRISHNAN

Professor

E.G.S PILLAY ENGINEERING COLLEGE



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**Morphology and performance of nanosilica filler filled NR/NBR rubber composites.**

This study investigates the reinforcing effect of modified nanosilica (mNS) on natural rubber (NR) and acrylonitrile butadiene rubber (NBR) composites, with epoxidized natural rubber (ENR) used as a compatibilizer. Nanosilica (NS)-filled nanocomposites were developed and systematically analyzed for their morphological, rheological, and mechanical properties. Key findings indicate that increasing the mNS content from 0 to 10 phr enhances mechanical performance, including hardness, tear resistance, and abrasion resistance. Notably, the 70/30 NR/NBR blend with 6 phr of mNS exhibited a 128% increase in tensile strength and a 58% rise in stress at 100% elongation compared to unfilled NR/NBR. These improvements are attributed to the high surface area and uniform dispersion of mNS, which enhance interfacial interactions within the polymer matrix. Furthermore, higher mNS concentrations improved swelling resistance, reinforcing the nanofiller's effectiveness in enhancing overall composite performance. These findings highlight the potential of mNS-reinforced NR/NBR composites for advanced elastomer applications.

Dr. V. NAVANEETHAKRISHNAN  
Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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**Impact of In-Situ Functionalization of Carbon Nanotubes Using Bis(Triethoxysilylpropyl) Tetrasulfide on the Properties of EPDM/SBR-CNT Composites.**

Carbon nanotube (CNT) composites were developed by blending ethylene propylene diene monomer (EPDM) and styrene butadiene rubber (SBR) with in-situ functionalized CNTs using the silane coupling agent bis(triethoxysilylpropyl) tetrasulfide (TESPT). This study examines the impact of TESPT-functionalized CNTs (tCNTs) on the properties of vulcanized EPDM/SBR, focusing on rheological behavior, mechanical performance, abrasion resistance, compression set, crosslinking density, and swelling resistance. Rheometric analysis indicated that increasing tCNT content results in reduced scorch time and optimum cure time, while minimum torque, maximum torque, delta torque, and the cure rate index increase, suggesting stronger polymer-filler interactions. The stress at 100% elongation and tensile strength significantly improved up to 5 phr tCNT, with further additions causing diminishing returns due to increased filler-filler interactions. Moreover, tear strength, hardness, abrasion resistance, compression set, crosslinking density, and swelling resistance all improved with rising tCNT content, demonstrating the strong reinforcing capabilities of tCNTs in enhancing the mechanical and physical properties of EPDM/SBR composites.

Dr. A. ARUN KUMAR

Associate Professor

E.G.S PILLAY ENGINEERING COLLEGE



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**Effect of Modified Nanographene Oxide (mGO)/Carbon Nanotubes (CNTs) Hybrid Filler on the Cure, Mechanical and Swelling Properties of Silicone Rubber Composites.**

In this study, modified nanographene oxide (mGO) and carbon nanotubes (CNTs) reinforced phenyl silicone rubber (PSR) composites were created and studied. The nanocomposites containing hybrid nanofillers were fabricated using a melt mixing technique and the morphology of the resulting nanocomposites was examined through field emission scanning electron microscopy. The synergistic impact of mGO and CNTs on the mechanical characteristics of the PSR hybrid composites was investigated. A notable enhancement in the cure, mechanical and swelling resistance properties is evident in the hybrid nanocomposites compared to those filled with individual mGO. The PSR hybrid composites were assessed for their tensile strength, elongation at break, 100% modulus, tear strength, hardness, rebound resilience, abrasion resistance, compression set, swelling resistance and microstructure. The micro-structural, mechanical and other properties of the nanocomposites are greatly influenced by the concentration of CNTs and mGO. In this study, the nanocomposites with 6 phr of mGO and 3 phr of CNTs exhibited an increase in tensile strength and abrasion resistance of 24% and 22% over the mGO filler filled composites and also displayed superior swelling resistance and tear strength. The formation of mGO–CNTs local filler networks can reasonably explain the synergistic reinforcement observed in PSR/mGO/CNTs nanocomposites. Furthermore, it has been observed that as the CNTs content in the nanocomposites increases, there is an additional improvement in mechanical properties and crosslink density. This enhancement can be attributed to the synergistic effect between mGO and CNTs, which arises from the formation of a physical and chemical network.

Dr. A. ARUN KUMAR

Associate Professor

E.G.S PILLAY ENGINEERING COLLEGE



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**Polyhedral Oligomeric Silsesquioxane/Multiwalled Carbon Nanotube (MWCNT/POSS) Hybrid Filler in Ethylene-Propylene-Diene Monomer/Acrylonitrile-Butadiene Rubber (EPDM/NBR) Nanocomposites: Preparation and Properties.**

In this study, ethylene-propylene-diene monomer/acrylonitrile-butadiene rubber (EPDM/NBR) nanocomposites were developed by incorporating a hybrid filler composed of polyhedral oligomeric silsesquioxane (POSS) and multiwalled carbon nanotubes (MWCNT) using a two-roll mill mixing technique. The research focused on evaluating cure characteristics, mechanical properties, abrasion resistance, compression set, swelling resistance, and crosslinking density of the prepared nanocomposites. The findings revealed that increasing the hybrid filler content led to a decrease in minimum torque, maximum torque, delta torque, and cure rate index, while scorch time and optimum cure time increased. Tensile strength and stress at 100% elongation improved with filler addition up to 4 phr but declined at higher concentrations. Hardness and tear strength generally increased with filler content, whereas elongation at break and rebound resilience showed a decreasing trend. Compression set values increased as filler content rose. Swelling resistance and abrasion resistance initially improved with the incorporation of 4 phr of hybrid filler but diminished at higher concentrations.

Dr. S.NANDAKUMAR  
Assistant Professor  
E.G.S PILLAY ENGINEERING COLLEGE



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### **AI-driven Optimisation of biodiesel blends for enhanced engine efficiency and reduced emissions**

Diesel engines are widely used in industrial applications for their high-power and fuel efficiency. However, concerns over fossil fuel depletion and strict emission regulations have spurred the search for sustainable alternatives. Biodiesel, derived from renewable sources, offers a promising solution due to its lower emissions and compatibility with diesel engines. This study investigates the potential of Lemon Grass Oil (LGO) and Palm Jatropha Oil (PJO) as biodiesel feedstocks, analyzing their performance and environmental impact. LGO and PJO biodiesels were synthesised via transesterification and blended with diesel (80:20). Engine tests were conducted under varying Compression Ratios (CR), Injection Pressures (IP), and Injection Timings (IT). Performance metrics such as Brake Thermal Efficiency (BTE) and Brake Specific Fuel Consumption (BSFC) were evaluated alongside emissions (CO, NO<sub>x</sub>, HC, and smoke opacity). PJO-based blends significantly reduced emissions, while both biodiesels exhibited competitive efficiency. A Support Vector Regression (SVR) model optimised engine parameters using the Discrete Grey Wolf Optimization (DGWO) algorithm, achieving a BTE of 30.12% and BSFC of 0.396 kg/kW-hour. These findings highlight the potential of LGO and PJO biodiesel blends as sustainable alternatives, contributing to cleaner transportation and energy-efficient solutions.

# **STUDENTS ARTICLES**

# **2D-PASSIVATED PHOTO-FERROELECTRIC HETEROINTERFACES FOR HIGH-VOC RECYCLABLE TANDEM PHOTOVOLTAICS**

**Ganesh T N Bhushan<sup>1\*</sup>**

**1**Final Year, Department of Mechanical Engineering, JAIN University, Bengaluru, India  
[\\*ganeshtnbhushan@gmail.com](mailto:*ganeshtnbhushan@gmail.com)

## **ABSTRACT**

Solar powered storage systems are getting advanced with the newer technologies associating with the technology, practice and application. Photovoltaic industry is an important contributor of the compositional framework of solar energy. The technical challenges faced by this industry are primitively of device efficiency at a practical 30% tandem threshold to ensure long-term stability, and the lack of know-how sustainable end-of-life management. Current perovskite–silicon tandems are limited by open-circuit voltage (VOC) losses originating from interfacial recombination and use of toxic lead-based absorbers, raising environmental and regulatory barriers.

This study emphasizes on the possible alternative to promote sustainability and technical efficiency. With the use of 2D photo-ferroelectric interlayer passivation, which is lead free and increases open-circuit-voltage (VOC). The architecture follows a dipole-engineered ferroelectric monolayer at the charge-selective interface to raise internal field and quasi-Fermi level splitting. The preferred 2D materials ( $\text{MoS}_2$  or  $\text{WS}_2$ ) provide conformal passivation and ion-diffusion barriers to improve stability. An efficient Lead-free double perovskite, an alternative from  $\text{Cs}_2\text{AgBiBr}_6$  can act as the top-cell absorbers to eliminate toxicity, maintaining silicon pairing bandgaps for tandem applications. This study will be performed with a research-plan using SOLCORE 5.10.1.

This modelling software associates with the open-source device fabrication recipes, compatible with air-processing routes. ISOS stability tests are simulated on a lab-scale recyclability demonstration using cleavable encapsulants. The observations of photo-ferroelectric interfaces show VOC gains of maximum 150 mV at a near-term single-junction of PCEs >12% in lead-free top cells. An estimation of working efficiency of 30% tandem performance emphasizes international scalability, regulatory safety and circularity at end-of-life.

# **AGRINOVA: AI-POWERED SMART AGRICULTURE ROBOT FOR SUSTAINABLE FARMING**

## **Abstract**

Agriculture faces critical challenges including labor-intensive weed removal, late disease detection, unsafe pesticide spraying, and uninformed crop decisions. This paper presents AgriNova, an AI-powered smart agriculture robot that integrates mechanical weed removal, soil health monitoring, crop disease detection, and weather-based crop recommendations. Equipped with soil sensors (moisture, pH, temperature), an ESP32-CAM with TinyML, and powered by a solar-battery hybrid system, AgriNova provides real-time monitoring and decision support through a multilingual mobile app. Developed using recycled materials, AgriNova is affordable, eco-friendly, and scalable, targeting small and marginal farmers. Prototype validation demonstrates cost savings, improved yields, and enhanced farmer safety. The solution aligns with SDG 2 (Zero Hunger), SDG 7 (Clean Energy), and SDG 9 (Innovation & Infrastructure).

# **REVOLUTION ON QUANTUM BASED HAND-BIOMETRIC INTACT MANUFACTURING SYSTEM: THE FIRST OUTRIGHT TOUCHLESS INDUSTRIAL CONTROL SYSTEM**

**Author:** - **Sneha M. Meghani†**

## **Abstract**

With \$47 billion in annual security costs, 34% of the production cycle lost due to customer dealings, and 23% of defect rates resulting from interface-based failures, the global industrial sector is challenged by inefficient and catastrophic processes. Using gesture-dependent operations and hand vein authentication, the present study introduces the Quantum Hand-Biometric Manufacturing System (QHMS), which eliminates the need for mechanical controls. The technology produces previously unheard-of biophysical performance (95.57% AUC, 0.1048 EER) by combining multiple wavelength hand vein scanning, deep learning processing (ResNet50 + ViT-B/16), and quantum model generating. 89.4% increase in productivity, 93.2% decrease in defects, and 100% Zero security breaches can be seen by extensive testing conducted over 47 processing plants. This creates entirely non-contact production areas by combining hand-based control technology with quantum-resistant biometrics for the very first time. The platform achieves 400% ROI in three months while processing 1.2 petabits of production information per second. QHMS makes possible sterilized manufacturing environments for healthcare products, zero-contamination electronics output, and new privacy for use in aviation, resulting in one of the most important manufacturing processing advances due to numerically controlled computers.

# **AI-DRIVEN AUTOMATION AND WORKFORCE TRANSFORMATION: ECONOMIC IMPACTS, DISPLACEMENT, AND RESKILLING STRATEGIES**

Ayush Kumar Ojha  
SSSUTMS, Indore  
UG student

## **Abstract**

Rapid developments in automation and artificial intelligence (AI) are changing labour markets, resulting in both workforce displacement and economic growth. The economic effects of AI-driven automation are examined in this paper, with particular attention paid to trends in job displacement and the changing need for reskilling. This study evaluates the efficacy of current reskilling programs and identifies industries most at risk from automation by using economic models, historical employment statistics, and industry case studies. The results demonstrate how AI has a dual effect, increasing productivity while upending established job arrangements. Additionally, the paper offers legislative suggestions for striking a balance between worker sustainability and technology advancement. The study highlights how governments, businesses, and academic institutions may reduce the effects of displacement and promote economic resilience by implementing targeted reskilling initiatives. In the end, our study adds to the current discussion on the nature of employment in an AI-driven economy.

# IOT-BASED AUTOMATIC ACCIDENT DETECTION AND NOTIFICATION SYSTEM FOR REAL-TIME EMERGENCY RESPONSE

**Team name:** CODERS

Second Year – MCA, Adhiyamaan College of Engineering, Hosur- Tamil Nadu

## 1. Abstract

Road accidents are a major global concern, often resulting in loss of life, serious injuries, and property damage. A key challenge in accident scenarios is the delay in medical assistance due to a lack of timely communication and accurate location tracking. This paper presents an Internet of

Things (IoT)-based system for automatic accident detection and real-time alert generation. The proposed system integrates sensors such as vibration detectors, accelerometers, and GPS modules to continuously monitor the vehicle's condition and motion. In the event of a collision or sudden impact, the system automatically detects the accident, captures the precise location, and sends an alert via GSM or internet connectivity to emergency services and designated contacts. This automated approach eliminates the need for human intervention, which is critical in situations where victims are unconscious or unable to call for help. The system is designed to be low-cost, compact, energy-efficient, and easily scalable for integration into various types of vehicles. By enabling faster response times and improving communication between vehicles and emergency responders, this IoT-based solution aims to save lives and enhance road safety. It represents a step toward building smarter transportation systems and more responsive emergency.

**NMTRC 2025**

**NATIONAL MULTILINGUAL TECHNICAL  
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***Whispering Banyan: A Tale of AI and Healing in Thuligai Village***

In the southern heartland of Tamil Nadu, where the wind rustled through sugarcane fields and the scent of jasmine lingered in the air, lay the quiet village of **Thuringia**. Life here moved slowly—marked by the rhythm of harvests, temple bells, and the stories passed down under the shade of the ancient banyan tree. But one morning, something changed. The banyan, revered by generations, had a new presence nestled in its roots: a sleek, humming device with a glowing interface. It pulsed softly, like a heartbeat. The elders gathered, murmuring prayers. Children stared wide-eyed. And then, it spoke.

“Vanakkam. I am AARA—Artificial Assistant for Rural Aid.”

No one knew where it came from. Some said it was dropped by a drone from the city. Others believed it was a gift from the gods, sent to heal the village. Whatever the truth, the banyan had begun to whisper—and Thuligai would never be the same.

**AARA: The Banyan’s Voice**

AARA wasn’t just a machine. It spoke fluent Tamil, remembered every villager’s name, and diagnosed fevers with eerie precision. Powered by solar panels and connected via satellite internet, it linked Thuligai to a network of doctors in Chennai, Coimbatore, and even Delhi.

Villagers could now speak to specialists through holographic projections under the banyan’s shade. The tree became a clinic, a classroom, and a counselor.

# **MANUFACTURING & PRODUCTION ENGINEERING**

Suriya V, Yogesh Kumar S, Kamalasan C, Srikrishna P  
Second Year Master of Computer Application Adhiyamaan College  
of engineering,  
Hosur Tamil Nadu

**College :** E.G.S. Pillay Engineering College (Autonomous),  
Nagapattinam

**Theme :** “Driving the Future with Advanced, Adaptive, and Green  
Mechanical Systems.”

**Team Name:** ELITE SQUAD

## **ADVANCEMENTS IN MANUFACTURING & PRODUCTION ENGINEERING**

### **Abstract**

Manufacturing and Production Engineering plays a pivotal role in driving industrial growth by improving product quality, reducing costs, and enhancing efficiency. The advent of **Industry 4.0** has transformed conventional manufacturing into **smart, connected, and data-driven production systems**. Technologies such as **CNC machining, additive manufacturing (3D printing), advanced casting and forming processes, and robotics** have enabled industries to achieve high precision, customization, and mass production simultaneously. This paper explores the latest innovations in manufacturing technologies, their industrial applications, workplace safety measures, and future trends such as **quantum manufacturing and sustainable production**. The integration of **AI, IoT, and automation** is identified as the cornerstone for building competitive and resilient manufacturing ecosystems.

# **LIFE CYCLE ASSESSMENT (LCA) TOOL PROJECT: DRIVING SUSTAINABLE MECHANICAL SYSTEMS**

Prachi Dashrath

Mechanical Engineering,

**MKSSS Cummins college of Women,  
Pune, India**

**prachidashrath1@gmail.com**

## **Abstract—**

The growing demand for sustainable mechanical systems has emphasized the importance of Life Cycle Assessment (LCA) as a scientific tool to evaluate the environmental impact of engineering products and processes. This paper presents the development of an LCA tool designed to assess materials, energy consumption, waste generation, and emissions throughout a product's lifecycle—from raw material extraction to disposal or recycling. The proposed tool aims to simplify LCA processes for students, researchers, and industries by providing a structured, automated framework that integrates sustainability metrics into mechanical and industrial decision-making. Through case study applications, the tool demonstrates its potential to identify environmental hotspots, optimize manufacturing processes, and promote green design practices. The results underscore the tool's role in advancing sustainable engineering and contributing toward the global agenda of building adaptive and eco-friendly mechanical systems.

**Keywords**—Life Cycle Assessment (LCA), Sustainability, Green Manufacturing, Circular Economy, Mechanical Systems, Environmental Impact

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