

ECE Newsletter

VOLUME II

JUNE 2024



Contents

• GREETINGS	01
• MESSAGE FROM THE VC	02
• MESSAGE FROM THE HOD	03
• PUBLICATIONS	04
• PATENTS	07
• PROJECTS	09
• EVENTS	10
• NEW MEMBERS	17
• PROMOTIONS	18
• DELEGATES VISITS	19
• COLLABORATIONS	22
• GUEST LECTURES	27
• FACULTY SPOTLIGHTS	29
• STUDENT CORNER	35
• NEW PROGRAMS	42
• EXISTING PROGRAMS	46
• LAB DEVELOPMENTS	52
• TESTIMONIALS	60
• ERRATUM: LAST NEWSLETTER	63
• MEET THE TEAM	64

VOLUME 11

GREETINGS

We are delighted to welcome you to the latest edition of the Department of Electrical and Computer Engineering Newsletter. This edition serves as a testament to the tireless efforts and exceptional achievements of our faculty, staff, and students. Within these pages, you will find a comprehensive overview of our department's recent endeavors, highlighting contributions across research, education, and outreach activities.

This issue showcases a breadth of accomplishments, including groundbreaking publications, innovative patents, and insightful book chapters penned by our esteemed faculty members. We celebrate the dedication of our students as well, featuring their participation in conferences and workshops, along with the valuable knowledge gained from visiting scholars and guest lectures. Additionally, we take pride in sharing the success of our ongoing collaborations and the impressive milestones achieved by our talented student body.

As you delve into this newsletter, we invite you to be inspired by the dynamism and ingenuity flourishing within the ECE Department. We are committed to fostering a vibrant learning environment that fuels discovery and propels our community towards the forefront of electrical and computer engineering.

Warm Regards,
Content Team, ECE Newsletter.

A MESSAGE FROM THE VICE CHANCELLOR



I am pleased to announce the release of the ECE 2024 Newsletter.

Mahindra University strives to equip students with cutting-edge technical skills and fosters innovation through industry partnerships. All schools emphasize experimental learning and research, preparing students to excel in their chosen fields. This immersive learning environment empowers students to develop critical thinking skills and prepares them to become the next generation of innovators.

Additionally, students at MU have the opportunity to join Mahindra e-hub Incubation Program, designed to accelerate and scale up early-stage to mid-stage start-ups. Entrepreneurs joining Mahindra e-hub program are provided with the best opportunities and knowledge to refine their idea, launch their enterprises, and grow it into scalable business.

The Department of Electrical and Computer Engineering (ECE) at Mahindra University remains persistent in its commitment to providing a world-class engineering education. To keep pace with the dynamic nature of technology, we continuously update our curriculum, ensuring our students have the latest skills.

This year, we are revamping our B. Tech in Electrical Engineering program with specialization in E-Mobility – to equip students with the knowledge and skills to design, develop, and implement electric vehicle (EV) technologies. In consonance with Govt's India Semiconductor Mission (ISM) to establish a semiconductor ecosystem in India, we are offering a specially curated B. Tech. in VLSI Design and Technology program, which will enable students to become proficient in design and development of semiconductor devices and integrated circuits (ICs) that power almost everything electronic in our world. These additions strategically align with evolving industry demands, ensuring our graduates are exceptionally prepared to lead in today's world.

Furthermore, the ECE department is also introducing M. Tech. in Smart Grid and Energy Storage Technologies, enabling students to learn and address critical challenges in the area of smart grids with focus on renewable energy systems and energy storage technologies. Our pedagogical approach emphasizes hands-on learning, interdisciplinary research, and technology integration. This nurtures the development of well-rounded engineers equipped with the technical expertise, adaptability, and problem-solving skills necessary to excel in the global marketplace.

Best wishes to all for the ECE 2024 Newsletter.

YAJULU MEDURY

A MESSAGE FROM THE HOD



Dear students,

Welcome to the latest edition of the ECE Department newsletter, where we bring you the latest updates, valuable insights, and engaging content from our department.

As we are nearing the end of the semester and you are busy preparing for your major exams, it is the right time to reflect on what you have achieved this year and take pride in those accomplishments. Very soon, you will head off for your summer break and take your time off studies, but remember that students that utilize the summer break to review what they have learned so far and look into the coming semester do better. Do take some time to relax but also find some time to study for the upcoming semester. I wish all of you a very safe summer break.

In the Fall semester of 2024 you will see two new B. Tech. programs being offered in the department – B. Tech. in VLSI Design & Technology (VDT) and B. Tech. in Electrical Engineering & E-mobility (EEM). As evident from the names, the former (VDT) will focus on teaching the students the engineering of chip design and fabrication technology, which is aligning with India Semiconductor Mission - an initiative by the Government of India to become self-reliant in the area of semiconductor manufacturing. The latter program (EEM) will focus on the study of control and electronics with an emphasis on electric vehicles and related areas. These two new programs will be introduced as an addition to the already existing ECE and ECM program.

In addition to the B. Tech. programs, we will also be introducing a new M. Tech. program in the area of Smart Grid and Energy Storage Technologies (SGET). With the continued focus on shifting away from fossil fuels as a source of power, this program will concentrate on renewable sources of energy and the smart grid which relies on sourcing from smaller sources of power generation feeding into the supply grid.

This edition of the newsletter will have articles on the major events that have taken place during the last year. You will learn about the major accomplishments of some of your fellow students – including some start up companies that are originating from Mahindra University. Some students have published papers in journals and papers, while others have received patent awards. There is no end to what can be accomplished and I hope learning about the accomplishments of your fellow students will motivate more of you to achieve and surpass these accomplishments in the coming years!

As always and more so now than ever before, it is important that we understand the value of sustainability and do our part to leave the world a better place than what we received. Not enough can be said about the value of community and the importance of connection. As in the previous editions, we will be highlighting the achievements, stories, and experiences of our incredible community. We encourage you to share your success stories, suggestions, and feedback, as this newsletter is a platform for all of us to learn and grow together.

I would like to appreciate the effort put in by the faculty members and students who have worked hard to bring this edition of the department newsletter to all of you. I hope this edition of our newsletter brings you joy, knowledge, and a renewed sense of environmental responsibility. Thank you for being a part of our vibrant community, and we look forward to sharing an incredible journey with you in the coming months and year. Happy reading! Good luck to all the students for your final exams of the semester. Have a productive and safe summer!

RAM MOHAN VEMURI

PUBLICATIONS

June 2023 to May 2024

Journal Papers

- Shantikumar and Sreedhar Madichetty, "A Novel and Instantaneous AHM-Based Technique to Find Faulty/Partially Shaded Panel in an SPV Array", IEEE Transactions on Industrial Applications , May 2024
- S.P.C. Machina, S. S. Koduru, S. Madichetty and S. Mishra, " Sensor Attack Detection and Mitigation Using Hybrid Physics Informed Neural Networks – A Real-time Implementation for DC-DC Converter," in IEEE Transactions on Industry Applications (2024) (Accepted and Under Press). April 2024
- S.P.C. Machina, S. S. Koduru, S. Madichetty, and S. Mishra, "Design and implementation of model parameter independent robust current control scheme of three phase inverter — A neural network-based classification approach," in CPSS Transactions on Power Electronics and Applications, doi: 10.24295/CPSSTPEA.2023.00052. January 2024
- S.P.C. Machina, S. S. Koduru, Banda M.K, S. Madichetty, and S. Mishra "Detection and mitigation of false data injection attack in DC-DC synchronous boost converter: A real-time implementation using shallow neural network model." IET Power Electronics (2023), doi: 10.1049/pel2.12634. December 2023
- S. Madichetty, S.P.C. Machina, S. S. Koduru, R. Anchuri and S. Mishra, "Deep Learning Defined Power Electronic Converters," in IEEE Power Electronics Magazine, vol. 10, no. 4, pp. 39-46, Dec. 2023, doi: 10.1109/MPEL.2023.3328164. December 2023
- S. Madichetty, S.P.C. Machina, S. S. Koduru, R. Anchuri and S. Mishra, "Deep Learning Defined Power Electronic Converters," in IEEE Power Electronics Magazine, vol. 10, no. 4, pp. 39-46, Dec. 2023, doi: 10.1109/MPEL.2023.3328164. December 2023
- Banda, Mohan Krishna, Sreedhar Madichetty, and Shanthi Kumar Nandavaram Banda. 2023. "Implementation of Deep Learning-Based Bi-Directional DC-DC Converter for V2V and V2G Applications—An Experimental Investigation" Energies 16, no. 22: 7614. <https://doi.org/10.3390/en16227614>. November 2023
- Subbarao Boddu, Tathababu Addepalli, Jagadeesh Babu Kamili, Rajasekhar Manda, Anvesh kumar Nella, Bandi Kiran Kumar, A 4-element crescent shaped two-sided MIMO antenna for UWB, X and Ku band wireless applications, Springer International Journal on Wireless Networks, June, 2023
- S. S. Koduru, S.P.C. Machina and S. Madichetty, "Cyber Attacks in Cyber-Physical Microgrid Systems: A Comprehensive Review". Energies 2023, 16, 4573. doi: 10.3390/en16124573. June 2023

PUBLICATIONS

- Sneha Chennamsetty and Subbarao Boddu, Analysis and Emulation of Proposed Testbed for OFDMA 4G and 5G Cellular Networks, International Journal of Communication Systems, Article DOI: 10.1002/dac.5794 Internal Article ID: 17959821 Article ID: DAC5794. April 2024
- S.P.C. Machina, S. S. Koduru, S. Madichetty and S. Mishra, "A Novel Standalone Implementation of MDNN Controller for DC-DC Converter Resilient to Sensor Attacks- A Design Approach," in IEEE Journal of Emerging and Selected Topics in Power Electronics, doi: 10.1109/JESTPE.2023.3242299. February 2023

Conference Papers

- Nitesh Kumar Rathore, Ankur Beohar, Pooran Singh, "4X4 Array Multiplier Using Transmission Gate Full Adder", 9th IEEE International Conference for Convergence in Technology (I2CT), 5-7 April 2024, Pune, Maharashtra, India. April 2024
- Subbarao Boddu, Tatha Babu Addepalli, Jagadeesh Babu Kamili, Jayshri Kulkarni, Bhuvaneshwari Subburama, Padmaja Nimmalagadda, "Design of Triangular Shaped Multiple Input Multiple Output Antenna with Defected Substrate for 5G Sub 6 GHz and WLAN Applications", 2024 Wireless, Antenna and Microwave Symposium (WAMS), Vishakhapatnam, 2024, 29 Feb - 03 March 2024
- Subbarao Boddu, Jagadeesh Babu Kamili, Tatha Babu Addepalli, D. Rajendra Prasad, Kiran Kumar Bandi, Bhaskara Rao Perli, RVS Harish, "Radiation Pattern Improvement of Bowtie Antenna Using Annular Ring for Vehicle-to-Vehicle Communication", 2024 Wireless, Antenna and Microwave Symposium (WAMS), Vishakhapatnam, 2024, 29 Feb - 03 March 2024
- Shaik Firoz, Sreedhar Madichetty, B. Mohan Krishna, "Design and Implementation of Isolated DC-DC Low voltage and High power converter" ICSSSES-2024, Siddaganga Institute of technology Tumukur. February 2024
- S. Chennamsetty, S. Boddu and P. Chandhar, "Real Time Measurement and Analysis of 4G and 5G Spectrum Occupancy in Andhra Pradesh and Telangana - India," 2023 IEEE 20th India Council International Conference (INDICON), Hyderabad, India, 2023, pp. 31-36, doi: 10.1109/INDICON59947.2023.10440824. December 2023
- Akshat Raj Patil, Abin TS, Pooran Singh, "Assist Techniques for Radiation Hardened SRAM in Space Applications," 9th IEEE International Symposium on Smart Electronic Systems (IEEE - iSES), 18-20 Dec. 2023, Nirma University, Ahmedabad, Gujarat, India. December 2023

PUBLICATIONS

- Akshat Raj Patil, Abin TS, Pooran Singh, "Overall Performance Improvement of Radiation Hardened SRAM cells through Assist Techniques," 20th India Council International Conference (INDICON) 2023, 14-17 Dec. 2023, Hyderabad, India. December 2023
- F. A. Vaidhyan and S. Madichetty, "Autonomous Vehicle Development and Navigation on Lane-Less Roads Using Enhanced Lane Detection Techniques," 2023 First International Conference on Cyber Physical Systems, Power Electronics and Electric Vehicles (ICPEEV), Hyderabad, India, 2023, pp. 1-9, doi: 10.1109/ICPEEV58650.2023.10391893. September 2023
- S. Chennamsetty and S. Boddu, "Analysis of Neural Networks Based OTFS Wireless System," 2023 International Conference on Emerging Techniques in Computational Intelligence (ICETCI), Hyderabad, India, 2023, pp. 54-59, doi: 10.1109/ICETCI58599.2023.10331412. September 2023
- S. Chennamsetty and S. Boddu, "Cognitive Performance Analysis of the Proposed Testbed for OFDMA Wireless System," 2023 First International Conference on Cyber Physical Systems, Power Electronics and Electric Vehicles (ICPEEV), Hyderabad, India, 2023, pp. 1-5, doi: 10.1109. September 2023

BOOK CHAPTERS

June 2023 to May 2024

- Energy Efficient and Reliable Embedded Nanoscale SRAM Design, Authored by Bhupendra Singh Reniwal, Pooran Singh, Ambika Prasad Shah and Santosh Kumar Vishvakarma, Taylor and Francis Group Publications, 1st ed., Nov. 2023.
- Soha Maqbool Bhat, Pooran Singh, Ramakant Yadav, Shiromani Balmukund Rahi, Billel Smaani, Abhishek Kumar Upadhyay, Young Suh Song, "Technical Demands of Low-Power Electronics," Book Chapter on Negative Capacitance Field Effect Transistors: Physics, Design, Modeling and Applications (1st ed.), CRC Press, Oct. 2023.
- Muhammad H. Rashid, Shu Yuen (Ron) Hui, Henry Shu-Hung Chung, Sreedhar Madichetty, N.B. Shanthi Kumar, B. Mohan Krishna, Chapter 11 - Resonant and Soft-Switching Converters, Editor(s): Muhammad H. Rashid, Power Electronics Handbook (Fifth Edition), Butterworth-Heinemann, 2024, Pages 345-405, ISBN 9780323992169., Sept 2023

PATENT GRANTED

June 2023 to May 2024



TITLE OF THE INVENTION: A HIGHLY METHODODOLOGY FOR SOLAR PVFARMS BY USING SYNCHRONOUS BYPASS AND BLOCKING SWITCHES.

Indian Patent Granted-
Inventors:
Dr. Sreedhar Madichetty,
ShanthiKumar NB,
Nandini Somarapu

Date of grant: 11-March-2024

TITLE OF THE INVENTION: A SYSTEM FOR DETECTING FAULTS OCCURRING ON PANEL LEVEL IN SOLAR PHOTOVOLTAIC ARRAYS

Indian Patent Granted-
Inventors:
Dr. Sreedhar Madichetty,
ShanthiKumar NB

Date of grant: 30-May-2024



PATENTS PUBLISHED

June 2023 to May 2024

- AN INSTANTANEOUS AND SENSORLESS APPROACH FOR IDENTIFYING THE PRECISE LOCATION OF MISMATCHED/FAULTY PANELS IN AN SPV ARRAY, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Pannela Chandrakala
- A COMPACT DUAL-MODE CONVERTER FOR DYNAMIC ENERGY OPTIMIZATION, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Durga Mahesh Natham
- A HYBRID MPPT-BASED VARIABLE FREQUENCY DRIVE (VFD) FOR INDUCTION PUMPS ALONG WITH REMOTE OPERATING FACILITATED BY ADDITIONAL MODULAR HARDWARE, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Pannela Gowthami
- SOLAR-POWERED ELECTRIC VEHICLE CHARGING SYSTEM WITH MAXIMUM POWER EXTRACTION AND CCS PROTOCOL INTEGRATION, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Shaik Mahammad Firoz
- A DUAL FUNCTION BASED BOOST INDUCTOR FOR IV CURVE TRACER AND BOOST CONVERTER OPERATION, Indian Patent, Published- Inventors: "Dr. Sreedhar Madichetty, Nandavaram Banda Shanthi Kumar "
- SUPPRESSION OF GATE-SOURCE VOLTAGE OSCILLATIONS OF GAN DEVICES BY USING OP-AMP BASED CLAMPING CIRCUIT, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Avulamanda Ushaswini
- TWIN NEURAL NETWORK BASED DETECTION AND MITIGATION OF FALSE DATA INJECTION ATTACKS ON DC-DC CONVERTERS, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Koduru Sriranga Suprabhath, Machina Venkata Siva Prasad Chowdary, Banda Mohan Krishna
- DESIGN OF DATA DRIVEN UNIFIED CONTROLLER FOR CONTROL AND CYBER ATTACK DETECTION & MITIGATION IN POWER ELECTRONIC CONVERTERS, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Koduru Sriranga Suprabhath, Machina Venkata Siva Prasad Chowdary
- ACTIVE COOLING SYSTEMS WITHOUT ANY POWER REQUIREMENT, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, Rama Krishna Mogilinedi
- FLEXIBILITY AND OPTIMIZATION WITH ACCURATE OBJECT IDENTIFICATION WITH MULTIFUSED DEEP LEARNING TECHNIQUE, Indian Patent, Published- Inventors: Dr. Sreedhar Madichetty, AbeeB Akorede Bello

PROJECT

June 2023 to May 2024



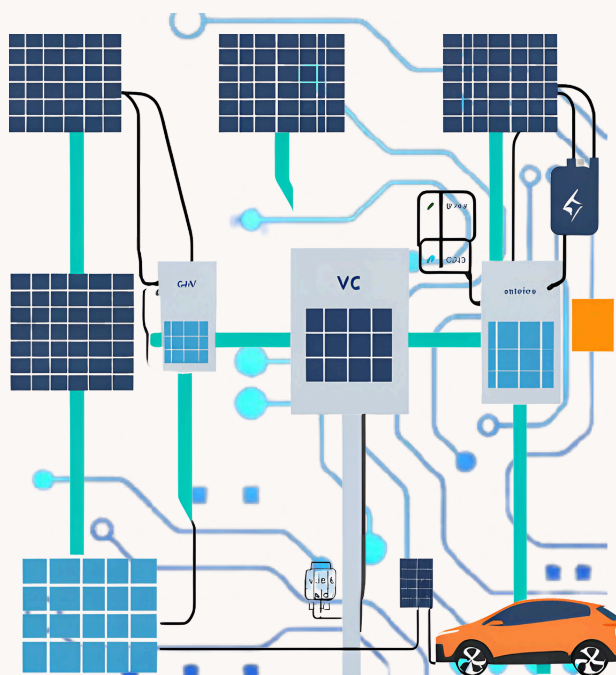
सत्यमेव जयते

विज्ञान एवं प्रौद्योगिकी मंत्रालय MINISTRY OF SCIENCE AND TECHNOLOGY

The Department of Science and Technology (DST), under the Government of India, has recently sanctioned a groundbreaking project “OFF-Grid PV-VRFB-SC Based Electric vehicle charging Infrastructure” aimed to develop the off-grid EV charger with PV (Photo voltaic), VRFB (Vanadium Redox Flow Battery) and SC (Super Capacitor). This initiative aligns with India’s commitment to sustainable development and reducing carbon footprints. The DST sanctioned Rs. 191.550 Lakh for this project for 3 years (Sep 2023-Aug 2025) duration.

PI: Dr. Sreedhar Madichetty

Co-PI: Prof. Bhaskar Tamma



EVENTS : CONFERENCES

ICPEEV-2023 Conference



The **First International Conference on Cyber Physical Systems, Power Electronics and Electric Vehicles- ICPEEV 2023** was held at Mahindra University, Hyderabad, India, from **September 28th to 30th 2023**. The conference provided a platform and opportunities for various domain experts to exchange their research experiences and share new ideas to promote their research progress in the field of IoT, Cyber Physical Systems, Power Electronics, Electric Vehicles and Vehicle Engineering with the discussion on practical issues, challenges encountered as well as solutions adopted.

The conference consisted of keynote lectures by invited experts and technical paper presentations by practitioners. People across various domains were invited to submit papers from all areas of Power Electronics and Power Systems Engineering, Electric vehicles and Battery charging and Computational Intelligence.

The keynote speakers included **Dr Shankar Venugopal** (Vice President, Mahindra & Mahindra), **Ned Mohan** (Regents Professor, Oscar A. Schott Professor, Department of Electrical and Computer Engineering), **Dr. Rajendra Naik** (GE Healthcare) & **Prof. Subhashish Bhattacharya** (Duke Energy Distinguished Professor, Electrical and Computer Engineering, North Carolina State University). Participants got valuable insights from the keynote speakers. For more information [click here](#).

VOLUME 11 EVENTS : CONFERENCES

ICPEEV-2024 Conference



Mahindra University is proud to host the **Second International Conference on Cyber physical Systems, Power Electronics and Electric Vehicles- ICPEEV 2024** will be held at Mahindra University, Hyderabad, India, from **September 26th - 28th 2024**. The objective of this conference is to provide a platform and opportunities for researchers, scientists, scholars and engineers to exchange their research experiences and share new ideas to promote their research progress in the field of IoT, Cyber Physical Systems, Power Electronics, Electric Vehicles and Vehicle Engineering with the discussion on practical issues, challenges encountered as well as solutions adopted. For more information [click here](#).

VOLUME 11

EVENTS : IET ON CAMPUS

“Beginning of a new chapter”



The Institution of Engineering and Technology (IET) is a prestigious international organization for engineers and technicians. **IET On Campus chapter was inaugurated at Mahindra University, Hyderabad in the presence of dignitaries including Hon. VC Prof. Y Medury and Ms. Varsha Kothari, South Asia Head IET.** This marks the first IET campus chapter in Telangana State. This signifies IET's recognition of Mahindra University and its aim to collaborate with them. Having an IET chapter allows students to connect with a global network of engineers, participate in professional development activities, and gain insights into the latest engineering advancements. IET's mission aligns with inspiring the next generation of engineers to tackle global challenges, and this new chapter provides Mahindra University students with greater opportunities to contribute.

IET

VOLUME 11

EVENTS : WORKSHOPS

The IET student chapter at Mahindra University has already conducted two successful workshops this year. A one-day workshop on LabVIEW Programming and Data Control was held on February 17th, 2024 with participants from across India. The second workshop, a two-day program on Leveraging Ansys Solutions for Electric Vehicle Development, took place on March 21st and 22nd 2024. Students from various years and disciplines participated in both workshops.

LabVIEW Programming and Data Control

Conducted a One-Day Hands-on Training and Workshop on “LabVIEW Programming and Data Control” 17th Feb 2024 with 51 participants across the India.



Leveraging Ansys solutions for Electrical Vehicle Developments

Conducted a Two-Days Workshop on “Leveraging Ansys solutions for Electrical Vehicle Developments” 21st-22nd March 2024 with 40 participants across the India. This event offered a comprehensive exploration of Ansys tools and methodologies crucial for designing and optimising electric vehicles.



VOLUME 11

EVENTS : WORKSHOPS

Recent Trends on VLSI Design and Embedded systems



The ECE department recently organised a 4-day workshop on **“Recent Trends on VLSI Design and Embedded Systems”** sponsored by SERB & Mahindra University from April 30 to May 3, 2024. This immersive experience brought together research scholars, undergraduate, postgraduate students, and entrepreneurs to equip them with the skills to craft high-performance integrated circuits from the fundamentals of devices, circuits to systems design.

As part of the workshop, we also had talks from the distinguished guests **Dr. Niranjana Soundararajan**, Principal Member of Technical Staff, AMD India, **Dr. Surya Shankar Dan**, BITS Pilani, Hyderabad Campus, **Ms. Pratyusha** and **Mr. Venkatesh Narasimhan** from Silicon Labs. The workshop covered a wide range of topics, including performance modeling for CPU core development, the physical design flow for VLSI and embedded systems, low-power SRAM design, high electron mobility transistors, and the application of machine learning in VLSI design.



VOLUME 11

EVENTS : WORKSHOPS

Recent Trends on VLSI Design and Embedded systems



The workshop was a huge success, with participants praising the organisers for the well-structured program, informative talks, and hands-on training sessions. The event provided a unique platform for participants to network with peers and experts in the field, and we are confident that the knowledge and skills gained will have a lasting impact on their research and professional pursuits.

The success of the workshop would not have been possible without the tireless efforts of our volunteers, who worked diligently behind the scenes to ensure the smooth execution of the event. We extend our heartfelt gratitude to them for their dedication and commitment.

The department is grateful to the esteemed speakers, participants, and organisers for making this workshop a memorable experience. We look forward to organising more such events in the future.

Feedback from the guest speaker Dr. Niranjan Soundararajan:

"I had a wonderful experience visiting the lush Mahindra University and meeting the faculty and students. I got a first-hand experience in the effort the faculty put in making the syllabus interesting and relevant. The Master's students are sharp and inquisitive and clear on the problems they are working on. The undergraduate students are curious to explore emerging domains. The RTVDES workshop is a wonderful gateway to expose students to cutting-edge tools in the VLSI domain and it was great to see a lot of students and faculty, both from Mahindra and outside, attending the workshop."

EVENTS : AETHER

Embedded Challenge



The annual Aether techno-cultural fest was abuzz with the Embedded Challenge, expertly organized by ECM students Adarsh Saraf, Hiten Sachani, Sudhamshu Suri, Neha Pandey, Aadarsh Kanchibhotla, and Venkata Rajeev Durga under the mentorship of Dr. Bharghava Rajaram. Participants put their Arduino skills to the test, tackling GPIO interfacing, sensor integration, serial communication, signal decryption, and error correction. Judged by esteemed faculties Dr. Ram Vemuri, Dr. Gopinath, and Dr. Subbarao Boddu, the competition saw fierce but friendly rivalry.

🏆 WINNERS 🏆

FIRST PLACE

Team Bala

- Bala, SE23UMEC006
- Srikar, SE23UMEC034
- Ananya, SE23UMEC004

AND

Team Jayanth Varma

- Jayanth, SE21UECM024
- Pramod, SE21UCSE156
- Bhuvana SE21UCSE035

SECOND PLACE

- Reuben, SE21UMEC012
- Parth, SE21UCSE145
- Abhishek, SE21UECM003

THIRD PLACE

- Mouneesh, SE21UMEC010
- Murali, SE21UMEC005



NEW MEMBERS IN THE DEPARTMENT



Dr. Bhogeswara Rao Angara is an Assistant Professor in the Electrical and Computer Engineering Department at Mahindra University École Centrale School of Engineering. He has received his Ph.D. Degree from IIT Madras in April 2024.

Prior to Ph.D., he worked as an Assistant Professor in the Department of Electronics and Communications Engineering at the SRKR Engineering College in Andhra Pradesh.

Welcome TO THE TEAM



Mr. V. V. Satyanarayana Akula is a Faculty Associate in Electrical and Computer Engineering department at Mahindra University École Centrale School of Engineering. With 16 years of experience, he previously taught at MVSR Engineering College, JNTU College of Engineering (JNTU-H) Kukatpally, St. Martin's Engineering College, and Swarnandhra Engineering College. His research interests include Power Converters, FACTS Devices, and HVDC Transmission.

PROMOTIONS IN THE DEPARTMENT



Dr. Gopinath G R has been promoted to Associate Professor in the Electrical and Computer Engineering department at Mahindra University École Centrale School of Engineering. He has notable industry experience at IBM India Pvt. Ltd. and research expertise in sensorless electric drives, power electronic converters, power convertors for renewable energy integration and FPGA based implementation of advanced Kalman filters.

CONGRATULATIONS
CONGRATULATIONS
CONGRATULATIONS



Mr. Bharat Lal Rai has been promoted to Sr. Lab assistant in the Electrical and Computer Engineering department at Mahindra University École Centrale School of Engineering. He is associated with advanced electronics lab of the department.

DELEGATES VISITS

Visit from International Delegate faculties



Mahindra University had the privilege of hosting a delegation of esteemed faculty members to explore potential collaborative opportunities.

The visitors toured the university's advanced Cyber-Physical System Lab, led by Dr. Sreedhar Madichetty, where they observed leading-edge research in autonomous vehicles and the application of power electronics for electric vehicles. Discussions provided in-depth insights into these technologies. The exchange of ideas and knowledge between the universities will undoubtedly lead to innovative research projects and advancements in relevant fields.

Visit from Hyderabad Battery Limited (HBL)

Mahindra University had the honor of hosting a delegation of distinguished industry members from Hyderabad Battery Limited (HBL) for an enlightening visit.



The purpose of the visit was to explore the possibility of establishing a Memorandum of Understanding (MoU) between HBL and Mahindra University. During their time at the university, the delegation was given a comprehensive tour of Mahindra University's cutting-edge Cyber-Physical System Lab, where they had the opportunity to observe various ongoing research projects, many of which are at the forefront of technological innovation. The discussions centered around the latest developments in electric vehicles and the application of power electronics.

DELEGATES VISITS

Visit from Airbus Company



Airbus company personnel visited our Cyber-Physical System lab where they explored how power electronics innovations can contribute to sustainable transportation.

We showcased a variety of products customized for electrical vehicles (EVs). From high-efficiency electric drive trains to intelligent battery management systems, they experienced the engineering marvels shaping the future of mobility. They gained invaluable insights into EV propulsion systems, charging infrastructure like high-power DC-DC converters, and energy storage solutions, including battery pack design and thermal management of battery pack.

Visit from EVretron Energies India Private Limited

EV Retron Energies is an innovative energy storage systems and power management start-up based in Hyderabad, born with the idea of providing cutting-edge technology solutions. They visited cyber-physical lab of the ECE department.



During their visit, the team gained firsthand experience with various EV components, including high power DC-DC converter, inverters for grid connected solar PV system applications. This exposure to the latest advancements in both solar PV systems and automotive technology equipped the EV Retron Energies team with a deeper understanding of the intricate relationship between these two rapidly evolving fields.

DELEGATES VISITS

Visit from Tektronix Company



A team from Tektronix, India's leading oscilloscope manufacturing company, visited the CPS Lab to explore cutting-edge products related to electric vehicles (EVs).

During their visit, they gained valuable insights into advanced EV technology and its applications, including high-power DC-DC converters, bi-directional converters for G2V and V2G applications, battery management systems, and charging infrastructure. The exposure to the latest EV products led to the collaboration between MU and Tektronix.

Visit from Ecole Centrale Team

We are pleased that a delegation from Ecole Centrale recently visited Mahindra University, marking a significant step in fostering international academic collaborations. The visit included a detailed tour of our cutting-edge Cyber Physical Systems Lab.



The Ecole Centrale team, consisting of teachers and researchers, interacted with our students, discussed ongoing research initiatives, and explored potential collaboration areas. They were particularly impressed by advanced research in power electronics and development of products. The lab, known for its pioneering work in integrating physical processes with computation and networking, showcased several innovative projects. Highlights included demonstrations of smart manufacturing systems, real-time monitoring frameworks, and autonomous electrical vehicles.

COLLABORATIONS

In today's interconnected world, collaborations with institutions and industries offer a wealth of benefits for faculty, students, and the organizations themselves. ECE department of MU is also leading in making connections with the outside world. We are making connections with the universities and industries to seek academic and research partnerships. Merging expertise and resources from different domains can lead to groundbreaking discoveries and advancements in various fields.

With Industries

Telangana Academy for Skill and Knowledge (TASK)



Mahindra University signs Memorandum of Understanding (MoU) with Telangana Academy for Skill and Knowledge (TASK), an initiative of the Department of IT E&C, Govt. of Telangana, to set up the TASK-Kalam Centre for Automotive Excellence. Together, we will skill the youth of Telangana for the EV industry.

The signing ceremony took place on World Youth Skills Day in the presence of **Shri Malla Reddy**, Minister of Labour and Employment, Govt. of Telangana; **Mr. Deepak Anand**, Member Of Provincial Parliament, Ontario; and **Mr. C Shekar Reddy**, Chairman, CII Telangana State Council where **Mr. Shrikant Sinha**, CEO, TASK and our VC, **Dr. Yajulu Medury**, exchanged the MoU.

COLLABORATIONS

(With Industries)

Tektronix



Tektronix, a leading technology company, has recently signs a MoU with Mahindra University's Cyber-Physical Lab. This partnership aims to foster collaborative research and development in the fields of cyber-physical systems and advanced technology integration.

Tektronix company specializes in innovative solutions ranging from wearable technology to advanced materials. Their collaboration with Mahindra University's Cyber-Physical Lab will provide a unique opportunity for students and researchers to engage in cutting-edge projects, leveraging both academic expertise and industry insights.

Through this MoU, Tektronix and Mahindra University aim to drive innovation, knowledge exchange, and skill development in emerging technological domains. The partnership underscores a commitment to pushing the boundaries of research and development, ultimately contributing to advancements in the technology landscape.

COLLABORATIONS

(With Industries)

Hyderabad Battery Limited (HBL)



HBL POWER SYSTEMS LIMITED

Hyderabad Battery Limited (HBL) and Mahindra University have announced a collaborative initiative to offer students training under the expert guidance of HBL group professionals. This collaboration represents a significant opportunity for students to enhance their skills and knowledge. The primary objective of the collaboration is to provide students with insights into the latest industry developments and requirements.

Through industrial training and exposure facilitated by this partnership, students will gain confidence and readiness for a seamless transition from academia to their professional careers. Students will have the opportunity to engage in workshops, live projects, and internships provided by HBL group mentors.

India Nippon Electricals Pvt. Ltd.

The collaboration between India Nippon Electricals Pvt. Ltd. (INL) and Mahindra University, facilitated by a MoU, aims to strengthen industry-academic synergy. Through this partnership, INL Group will provide students with opportunities to engage in practical projects, enabling them to tackle real-world challenges and enrich their educational journey.



India Nippon Electricals Ltd

Especially, students from the M.Tech AEV program will benefit significantly from this collaboration. They will have the opportunity to apply their theoretical knowledge to real-world scenarios, gaining practical experience and enhancing their skills. Moreover, students may secure employment with INL group upon completing their courses.

COLLABORATIONS

With International Universities

University of Southern Denmark (SDU)



Mahindra University and the University of Southern Denmark (SDU) have announced a collaborative effort to promote student exchange programs. This initiative will provide students from both universities with

the enriching opportunity to study abroad and broaden their academic horizons. Students will gain experience of a different culture and education system. As a part of this initiative, two M.Tech. AEV students from MU will be visiting SDU for a four-month internship. During their visit, they can explore new courses, perspectives, and research opportunities. This is just the beginning of a productive partnership between Mahindra University and SDU. This paves the way for future student exchanges as well as research collaboration, allowing students from various disciplines to participate in this exciting initiative.

La Trobe University, Melbourne Victoria Australia

Mahindra University and La Trobe University (LTU) are pleased to announce the signing of a MoU to explore and develop collaborative initiatives across various academic disciplines. This exciting partnership aims to foster a vibrant exchange of knowledge and expertise, creating new opportunities for faculty, students, and researchers from both institutions.



POTENTIAL COLLABORATIONS

(With international Universities)

University of Tasmania



On 23rd April 2024, Mahindra University had productive discussions with the **University of Tasmania** regarding potential collaborative research initiatives. The discussions focused on exploring potential research collaborations in fields that align with both institutions' strengths.

Both universities identified common research interests in critical areas like renewable energy, battery charging technologies and smart grid development. The discussions concluded with a positive agreement between both universities to move forward and explore collaborative research opportunities in the identified areas. This is a promising step towards a fruitful partnership that will allow researchers from both institutions to combine their expertise and tackle critical challenges, which in turn will open up more opportunities for students interested in these areas of study.

VOLUME 11

GUEST LECTURES

Title: “Unravelling the Evolution of WiFi Technology”
Talk by Dr. Srikanth from Nanocell Networks Pvt Ltd



On April 2nd, 2024, the ECE Department had the privilege of hosting **Dr. Srikanth**, Chief Knowledge Officer at Nanocell Networks Pvt Ltd, who delivered an enlightening talk on the evolution of WiFi technology. The event was a huge success, with students and faculty members alike gathering to learn about the fascinating journey of WiFi from its inception to its current state.

In the talk, he started with the origins of Wifi, its implementation from inception to the latest and upcoming WiFi 7 generation. Then it delved into the fundamental 802.11 standard that underpins Wi-Fi and explored the latest advancements. The talk also covers the advancements into Spectrum, PHY & MAC layers. He shed light on the concept of Multi-Link in WiFi, which allows devices to aggregate multiple links to increase reliability. Later the audience were exposed to various features of WiFi technology that have contributed to its widespread adoption. To conclude, an interactive session allowed students and faculties to engage with the speaker on topics like future of security in the growing adoption of wifi, adoption of spectrum and more.

The evolution of WiFi technology talk by Dr. Srikanth was a timely reminder of the rapid pace of innovation in the field of electronics and wireless communication. The insights shared by Dr. Srikanth will undoubtedly inspire our students to explore the vast opportunities in this field and contribute to its future growth.

GUEST LECTURES

Tech Talk on Real Life Design Aspect from Silicon Labs

The recent tech talk hosted by Silicon Labs provided valuable insights into the company's operations. **Mr. N Venkatesh**, Senior Director at Silicon Labs, discussed the company's vision for growth and its interest in recruiting talent from educational institutions like ours.



Silicon Labs, a nearly \$4 billion company, presented itself as a dynamic entity poised for further expansion. **Ms. Pratyusha** outlined the diverse roles available for student internships, emphasizing the company's commitment to nurturing young talent and providing hands-on industry experience.

Our fourth-year student, **Pravallika Nori**, shared her internship journey at Silicon Labs, offering firsthand insights into the internship experience and the transition to a full-time role. The tech talk allowed students to engage with industry professionals, gain a deeper understanding of Silicon Labs' operations, and explore potential career avenues.

Overall, the tech talk bridged the gap between academia and industry, benefiting both students and organizations.



VOLUME 11

FACULTY SPOTLIGHTS

Prof. G. Bhuvaneshwari's accomplishments include prestigious appointments within the IEEE and recognition for her expertise in the field of electrical engineering. She currently serves as a member of IEEE Fellow nomination resource committee for the Power and Energy Society from R10 (Asia Pacific Region). Additionally, she is a member of fellow evaluation committee in IEEE Transportation Electrification Council (TEC).

She is also an Associate Editor for the Electrical Engineering section of the Transactions of the Indian National Academy of Engineering (INAE).



Prof. G. Bhuvaneshwari



Prof. Ram Mohan Vemuri

Prof. Ram Mohan Vemuri, HOD of ECE, has been invited to chair two sessions at the GLSVLSI'24 conference, held from 12th to 14th June 2024 in Clearwater, Florida. He has accepted the invitation and will chair two sessions focusing on Computer-Aided Design (CAD) and IoT and Smart Systems.

VOLUME 11

FACULTY SPOTLIGHTS

Dr. Subbarao Boddu's quote on World Telecommunication and Information Society Day 2024

"In the realm of sustainable development, digital innovation takes center stage, with telecommunications playing a pivotal role. The introduction of 5G technology marks a transformative era in India's education sector, ushering in unparalleled advancements in connectivity and learning. Leveraging 5G's high-speed, low-latency networks, online education becomes seamless, bridging geographical divides between urban and rural areas. Collaborative efforts between academia, telecommunications firms, and research institutions are fostering the growth of private 5G campus networks, enriching educational infrastructure and accessibility.



Dr. Subbarao Boddu

Moreover, 5G-enabled remote and virtual labs revolutionize traditional learning environments, offering students immersive experiences virtually. These advancements enhance educational content also promote environmental sustainability by reducing reliance on physical resources and travel. At Mahindra University, our Wireless Innovation and 5G Lab are dedicated to crafting technical solutions for private 5G networks, empowering students with real-time experiences and limitless exploration. As we continue to integrate digital technologies into education, the symbiotic relationship between academia and the telecommunications industry becomes imperative in propelling sustainable development and equipping future generations for a globally connected world."

Media Coverage:

- Voice and Data
- Techglobal
- InsightConvey
- Fintech Biz News
- CXO Today

FACULTY SPOTLIGHTS

Panel discussion (ET's 5G/6G Congress 2024)

Dr. Subbarao Boddu was a panelist at the prestigious ET Telecom's 5G/6G Congress event held on March 14 at ITC Maurya, New Delhi.

Monetisation: Making 5G Work for Enterprise Verticals

Touted as an early use case, telcos are banking on fixed wireless access (FWA) but a few policy measures are needed to boost it further. Telecom players have been trying to monetise 5G networks following huge investments. Enterprises across sectors are expected to adopt 5G in a big way. With telecom players showcasing multiple use cases for healthcare, retail, logistics, mining, automobiles and manufacturing sectors, the real test of deployment begins now.



In addition, 5G together with IoT is set to revolutionise the consumer and enterprise verticals in the coming years. 5G's low latency, high bandwidth, and faster data speeds will enable IoT-connected devices to execute tasks smartly. It is high time for telecom carriers and technology partners to bring awareness and collaborate with enterprises closely. The government should sensitize public sector departments and organisations to adopt 5G-led transformation for a cost-friendly and efficient workflow.



VOLUME 11 FACULTY SPOTLIGHTS

Guest Lectures by our faculties

- **Prof. G. Bhuvaneshwari** delivered a talk titled “Challenges and opportunities for women in academia” at the IEEE ICASSP satellite event on April 2, 2024, held at the Hyderabad Convention Center.
- **Prof. G. Bhuvaneshwari** spoke about “Importance of IEEE Fellow nomination form and process” under the aegis of IEEE India Council on December 8, 2023.
- First A.S. Rao memorial lecture titled “Are we poised for a complete EV transition in the next few years?” was delivered by **Prof. G. Bhuvaneshwari** under the aegis of IEEE-IES Chapter of Hyderabad section as a distinguished lecturer on October 31, 2023.
- On April 5, 2023, **Prof. G. Bhuvaneshwari** gave a talk on “Can we do away with oil completely for road transport in the next few years?” under the aegis of IEEE IES in the program “Extraordinary women in IES” Webinar series.
- The IEEE Power & Energy Society (PES) Jt Chapter-Hyderabad section, and the IEEE Education Society - Hyderabad section offered a five-day Professional Development Program on “E-Mobility and its challenges for sustainability” from April 2nd to April 6th, 2024. Addressing the Sustainable Development Goals (SDGs), the program digs into the importance of electric vehicles (EVs) in building sustainable cities. During this program, **Dr. Sreedhar Madichetty** delivers a lecture on the importance of cyber security in Autonomous Electric Vehicles (AEV).

INNOVATION COUNCIL
HYDERABAD

IEEE Education Society

A Five-day Professional/ Faculty Development Program (PDP/FDP)
on
E-Mobility and its Challenges for Sustainability
2nd- 6th April, 2024 (Hybrid Mode)
Organised by
Department of Electrical and Electronics Engineering, GCET
in association with
IEEE Education Society and IEEE Power & Energy
Society(PES) Jt Chapter – IEEE Hyderabad Section
Venue: Geethanjali College of Engineering and Technology

SPEAKERS:

 Mr. Ravi Mahankali CEO and Founder Aventry Tech Systems	 Dr. P V Rajgopal General Manager (R&D), I&E, Corporate R&D, Hyderabad
 Mr. Deepesh Kumar Barla Co-Founder, EV Kernels (Energy India, Pvt Ltd, Hyderabad, Telangana, India)	 Dr. Bulusu Venkata Sarada Scientist 'F', International Advanced Research Centre for Nanoscale Metallurgy and New Materials (IARC), Bapatla (AP), Hyderabad
 Dr. Sreedhar Madichetty Sabbath, MIT, Chongqing Software Institute Datta, Associate Professor, KJ Somaiya University, Hyderabad	 Mr. K N Hemanth Kumar Director, E-mobility - Innovations, Cooper Association India
 Dr. Naveen Kumar Marati Hitachi Energy, Switzerland	 Mr. Siddhartha Ramakanth Keshavadasu Assistant Professor, ILL Administrative Staff College of India-CPE, Hyderabad
	 Dr. Madhuri Bayya Associate professor, WILP BITS Pilani, Hyderabad Campus

VOLUME 11

FACULTY SPOTLIGHTS

Guest Lectures by our faculties

- **VNR VIJET Hyderabad** held a two-day workshop on “Hands-on Training Program on PCB Design and Fabrication for Power Converters” on May 3rd and 4th, 2024. In this workshop, **Dr. Sreedhar Madichetty** delivered a talk on the necessity of designing PCBs for power electronics converters.



- **ESCI Hyderabad** conducted a guest lecture on “power train architecture in EV” in December 2023. In this program, **Dr. Sreedhar Madichetty** delivered a lecture on important aspects of power train in electric vehicles.



FACULTY SPOTLIGHTS

Guest Lectures by our faculties



In March 2024, **Prof. Ram Vemuri** and **Dr. Sayantan Hazra** visited **Vignan Institute of Technology and Science (VITS)**, Hyderabad. The visit aimed to strengthen collaboration between the two institutes.

- **Prof. Vemuri** presented an informative session on the various M.Tech. programs offered by the ECE department at Mahindra University. This provided VITS students with valuable insights into potential postgraduate studies at MU.
- **Dr. Hazra** delivered a talk on the topic "Digital Signal Processing for Wireless Communication". This talk was focused on the technical aspects of signal processing and its applications in modern wireless communication systems.
- After the presentations, faculty members from both the VITS and MU had discussions about the possibility of student exchange program. The primary focus of the discussion was on the possibility of VITS students visiting the MU specialized Labs (e.g. 5G Lab). Furthermore, VITS expressed interest in hosting more technical talks by the faculty members of MU.

STUDENT CORNER

Electronics Club



Calling all Electronics Enthusiasts!

Get ready to spark your passion for electronics! Mahindra University is thrilled to announce the launch of our brand-new Electronics Club starting in the Academic Year 2024-25!

What's in it for you?

- **Explore and Learn:** Dive deeper into the exciting world of electronics.
- **Get Creative:** Bring your electronic design ideas to life! Build awesome projects and showcase your skills at exciting events.
- **Connect and Collaborate:** Network with industry leaders in VLSI/Electronics for potential projects, internships, and even job opportunities!
- **Build Your Future:** Get insider tips and guidance on higher education and career paths in the electronics field.

Sounds exciting? Here's how to get involved:

Whether you're a seasoned electronics buff or just starting out, the Electronics Club welcomes everyone! We're here to learn, build, and grow together. For more information, get in touch with Dr. Pooran Singh at pooran.singh@mahindrauniversity.edu.in

Let's get those circuits buzzing!



STUDENT ACHIEVEMENTS



R Jitesh Reddy
(SE22UECE012)

Award Winning Certificate Statement :

One of our students Jitesh Reddy's paper, "RF Front End Combinational Filter for Airborne V/UHF Communication System" received the Best Paper in the Microwave Track at WAMS 2024. This accolade was bestowed during the IEEE Conference on Wireless, Antenna, and Microwave Symposium (WAMS) held from February 29th to March 3rd, 2024. The event took place at Raghu Engineering College (A) in Visakhapatnam, Andhra Pradesh, India. The paper's recognition underscores its significance and contribution to the field of microwave technology, particularly in advancing RF front-end filters for airborne V/UHF communication systems.

DROIDCREW

DroidCrew: Pioneering Companion Robotics

DroidCrew, a dynamic startup founded by **Soumik Rao (SE20UEEE033)** and **Shashank (SE20UCSE022)**, is pushing the boundaries of companion robotics. Their cutting-edge robots seamlessly integrate advanced AI technology to offer personalized support, assistance, and entertainment. Whether providing companionship during lonely hours, helping with tasks, or simply being a fun presence, DroidCrew's creations are designed to improve everyday life. Their dedication to innovation promises to shape the future of human-robot interaction, making a positive impact on how we live.



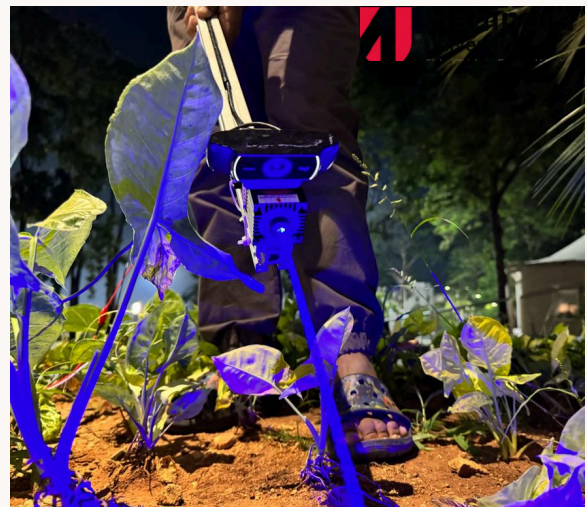
STUDENT ACHIEVEMENTS

HARVESTED ROBOTICS



Rahul, a final-year Computer Science student along with his friends Pranav Mogli (SE20UECM063), Nitesh Reddy (SE20UECM058) and Likith Gadde (SE20UECM039) sought to address the pervasive challenge of weeds in agriculture. His solution, Rakshak, is an innovative laser-weeding system designed to protect crops with precision.

Rakshak features a custom-designed scanner to direct the laser beam, coupled with camera-based feedback and advanced computer vision algorithms for intelligent weed identification. A set of microcontrollers orchestrates the system's operation, ensuring seamless execution. To power this solution, Rahul integrated a power conversion module that efficiently transforms energy from tractor batteries, fueling the laser that selectively eliminates weeds.



harvested
ROBOTICS

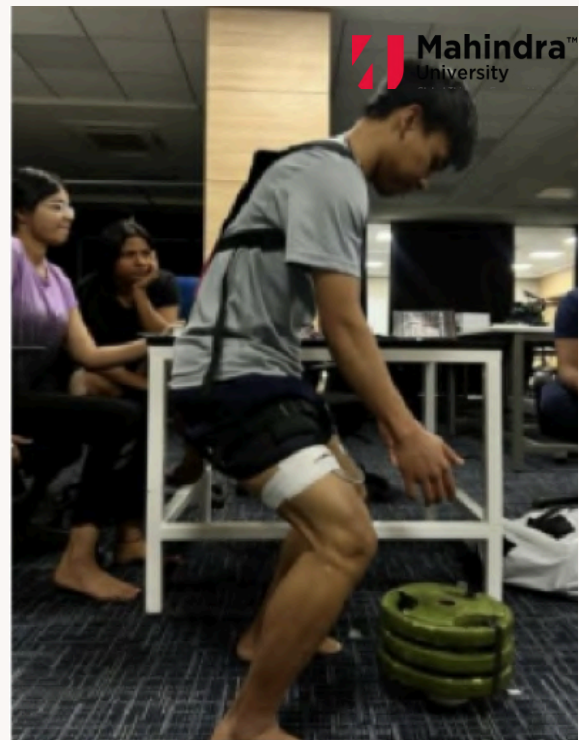
STUDENT ACHIEVEMENTS

EXTRIVE INNOVATIONS



Making waves in industrial ergonomics are **Abhishek Pratap** (SE21UECM003), **Ronak Oinam** (SE20MEE031), **Prem Ningombam** (SE21UMEC020), and **Yashaswi Matla** (SE22UCSE300). Their startup, Extrive Innovations, is a shining example of how engineering can address real-world challenges. Extrive's pathbreaking exosuit, the "Kanglei Backex," tackles worker fatigue, muscle strain, and posture issues in logistics and assembly lines.

This innovative product leverages EMG sensors, tested and developed at Mahindra University's Robotics Lab, to track and record muscle activity in the back and thighs. By integrating advanced exosuit technology, Extrive is poised to revolutionize industrial work environments, enhancing worker well-being and productivity.



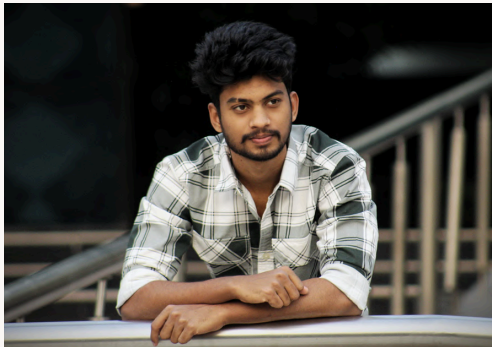
EXtrive
INNOVATIONS

STUDENT ACHIEVEMENTS

M. Tech (AEV) 2023-2025

(Internships Opportunities)

The Autonomous Electric Vehicle course was developed in collaboration with the **University of Southern Denmark (SDU)** and Mahindra University. Students from both colleges will be able to participate in summer internships through this relationship. For this initiative, two of our M.Tech. AEV students, **Durga Mahesh** and **M. Rama Krishna**, are selected to do their summer internship in the SDU.



M. Rama Krishna



Durga Mahesh

Recently, two of our M.Tech. AEV students, **P.Gowthami** and **P. Chandrakala**, received internship offer of 5 lakh per annum from **HBL Hyderabad**. These internships may lead to full-time employment after successful completion.



P. Gowthami

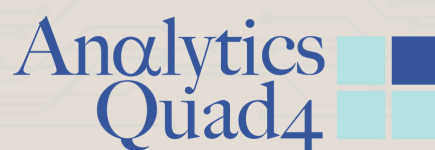


P. Chandrakala

STUDENT ACHIEVEMENTS

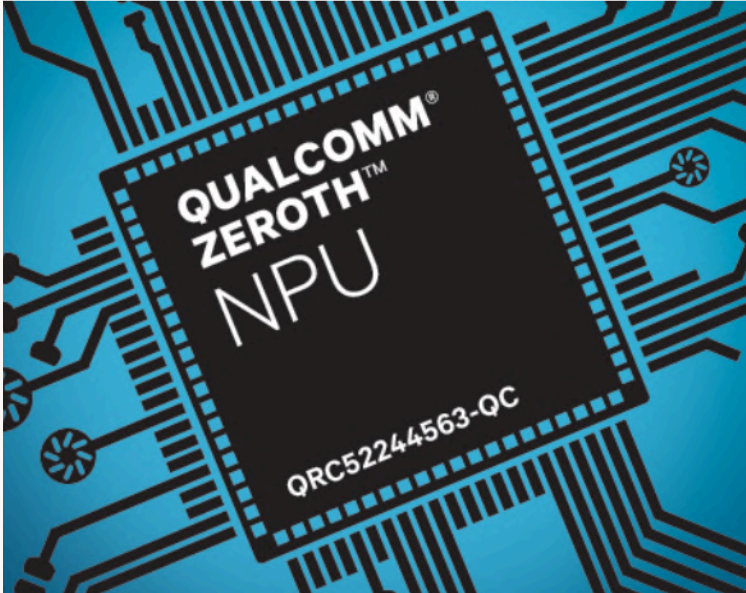
(Placements)

B. Tech. (EEE & ECM)
M. Tech. (AEV)



STUDENT ARTICLES

The evolution of CPU->GPU->NPU



We have come along a long history of having different processing units in our computers.

CPUs - The Beginning

Let's go back to mid-20th century when a computer is expected to perform tasks like calculations, execute instructions, etc. That's where CPUs took charge of work and made the desired things possible. CPUs evolved over time in performing tasks faster, efficient in lesser amount of time.

GPUs - The Emergence

It was the early 70s when computer graphics began to gain popularity, particularly in the fields of engineering, architecture and video games. The need for a processor that could render graphics and perform parallel computing was a need of the time as CPUs weren't enough capable of performing these tasks and were designed to perform serial processing. Over time GPUs were designed to handle tasks such as graphics rendering, data processing and machine learning.

NPU - The Newcomer

In recent years, with the exponential rise of Artificial Intelligence, Machine Learning, Deep Learning and Neural Network processing tasks to be performed, the need for a separate processor came into rise for these workloads. NPUs are optimised for matrix multiplication, a critical component of AI and ML algorithms.



Chennuru Yashwanth Reddy
SE22UECM009



B.Tech.

- Electrical Engineering and E-Mobility
- VLSI Design and Technology

M.Tech.

- Smart Grid and Energy Storage Technologies (SGETs)

NEW B.TECH. PROGRAM

Electrical Engineering and E-Mobility



This B.Tech. degree in Electrical Engineering and Electric Mobility offers a comprehensive and practical curriculum. Students gain hands-on experience through laboratory and project courses focused on power converters, drives, and EVs. The first four semesters cover basic sciences and electrical engineering fundamentals, including signals and systems, digital and analog circuits, microcomputers, and electrical machines. Advanced courses in electric mobility include power electronics, electric drives, smart grid energy storage systems, and battery management. Additionally, four elective courses and projects allow students to specialize further in the EV sector.

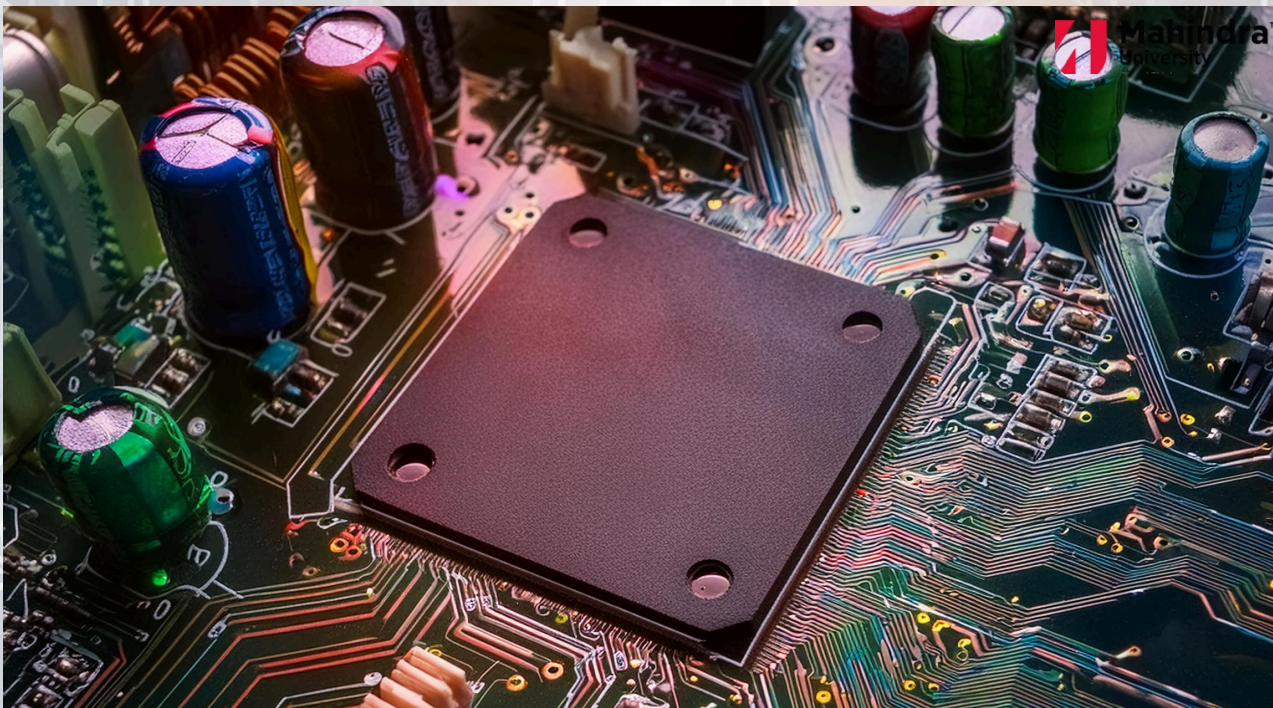
Potential employers for graduates include:

- Railways and Metro Rail Corporations
- 2/3 Wheeler Industries
- Electric Car/Bus Companies
- EV Feeder Industries
- Battery Manufacturers
- Battery-Charging Industries

[Click here to Apply](#)

NEW B.TECH. PROGRAM

VLSI Design and Technology



Mahindra University's B. Tech. in VLSI Design and Technology program is designed to teach engineering students in conformity with AICTE criteria. The Indian government is pursuing the India Semiconductor Mission (ISM) to create a semiconductor ecosystem in India. MU is committed to becoming a part of this effort to teach the human resources needed for the semiconductor industry in coming years. This four-year curriculum will expose students to VLSI Design, Advanced Algorithms in Design Automation, Analog VLSI Design, Logic Synthesis, Testability and Design for Testability, Semiconductor Devices, and Physical Verification Flows. The VLSI Design program has been intended to meet the ever-changing demands of the VLSI industry as well as societal issues via research.

This program aims to improve the world through transformative education and impactful research by producing outstanding graduates who are knowledgeable, creative, and passionate about developing a vibrant semiconductor ecosystem to help India emerge as a global hub for electronics design and manufacturing.

Scope of Employment:

Students of the B. Tech. program can expect to work with prospective employers such as Intel, Qualcomm, Synopsys, Cadence, Siemens, Dell, Broadcom, AMD, NVidia, Apple, TSMC, Global Foundries, Samsung, Apex Semiconductors, NXP Semiconductors, ST Microelectronics and many other companies that are in the semiconductor design or manufacturing and are having difficulty in finding talent to meet their needs.

[Click here to Apply](#)

NEW M.TECH. PROGRAM

Smart Grid and Energy Storage Technologies (SGETs)



As the demand for clean energy and the integration of renewable energy sources continue to grow, the role of energy storage in smart grids will become increasingly important. Advances in energy storage technologies, such as improved battery chemistries and materials, will further enhance the performance and cost-effectiveness of storage systems. Energy storage systems help address the inherent challenges associated with electricity generation and consumption, such as fluctuating demand, variable renewable energy generation, and grid reliability. The key benefits of energy storage in smart grids include:

Grid stability: Energy storage systems can instantaneously respond to abrupt changes in demand or supply, helping maintain grid stability and prevent power outages. **Integration of renewable energy:** Fluctuating renewable sources can be operated along with energy storage systems can increase the share of renewable energy in the grid and minimize reliance on fossil fuels.

Peak load shaving: Energy storage systems can discharge stored energy during peak demand periods, reducing the need for additional generation capacity and lowering electricity costs.

Load leveling: Energy storage can help balance energy consumption throughout the day, reducing the stress on the grid and improving overall efficiency.

[Click here to Apply](#)

B. Tech.

- Electronics & Computer Engineering (ECM)
- Electronics and Communication Engineering (ECE)

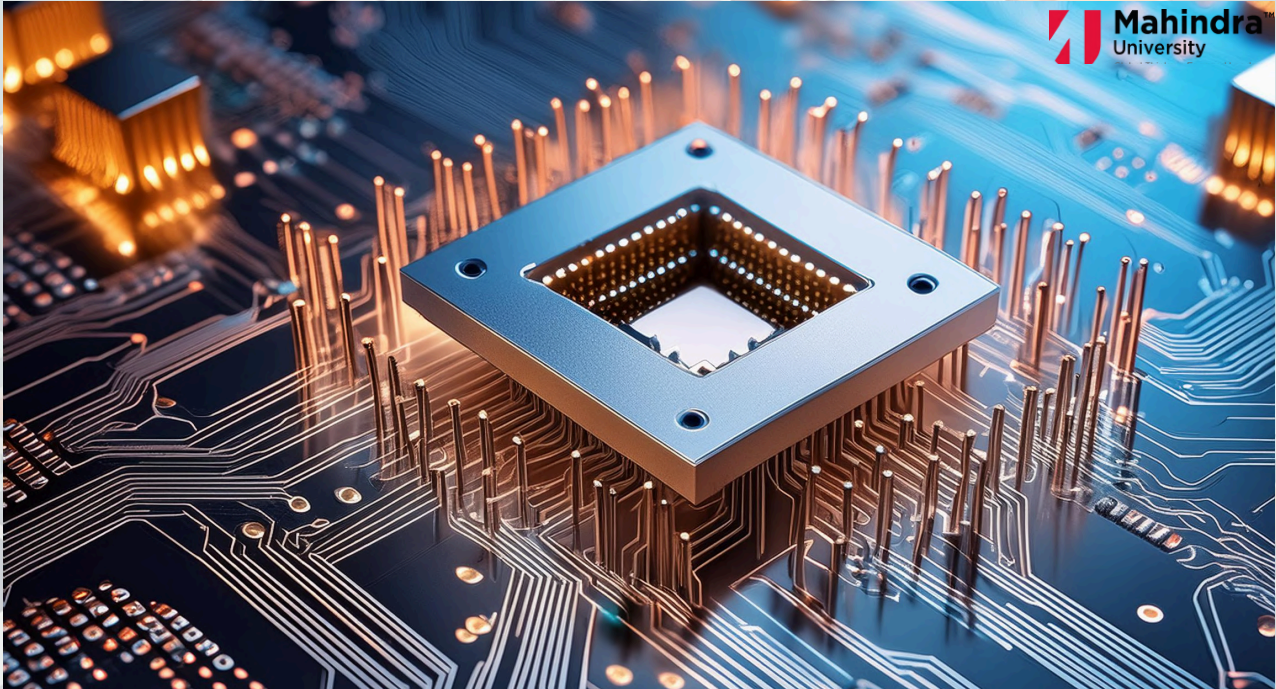
M. Tech.

- Autonomous Electric Vehicles (A-EVs)
- VLSI Design and Embedded Systems (VLSID&ES)



EXISTING B.TECH. PROGRAM

Electronics & Computer Engineering (ECM)



The B. Tech in Electronics and Computer Engineering (ECM) program is a comprehensive four-year undergraduate degree that fosters a unique blend of skills in both electronics and computer science. It caters to students with a passion for understanding how hardware and software work together to create complex systems. This is a four-year program that starts with strengthening their concepts in Physics, Chemistry, and Mathematics and introducing them to the basics of Electrical/Electronics engineering concepts in the first two semesters of study. Progressively, the students delve into the more complex subjects and learn with an emphasis on Electronics and Computer engineering. In addition to the core subjects, there will be electives that will be offered which allow students to get more in-depth insight into certain areas of the subject and develop further expertise. Many of the core subjects also have laboratories associated with them that will expose the students to practice what they learn in the classroom.

Potential employers for graduates include:

Companies that can be potential employers can belong to the IT & Computer Engineering domains like Amazon, Microsoft, Google, Meta, etc.

Semiconductor companies like Intel, AMD, NVIDIA, Texas Instruments, Silicon Labs, Synopsys, etc

[Click here to Apply](#)

EXISTING B.TECH. PROGRAM

Electronics and Communication Engineering (ECE)



The Electronics and Communication Engineering (ECE) program is offered as part of the Electrical and Computer Engineering Department at Mahindra University. This is a four-year program that starts with strengthening their concepts in Physics, Chemistry, and Mathematics and introducing them to the basics of Electrical and Electronics engineering concepts in the first two semesters of study. Progressively, the students delve into the more complex subjects and learn with an emphasis on Electronics and Communication engineering. In addition to the core subjects, there will be electives that will be offered which allow students to get more in-depth insight into certain areas of the subject and develop further expertise. Many of the core subjects also have laboratories associated with them that will expose the students to practice what they learn in the classroom.

Potential employers for graduates include:

Some companies that can be potential employers are Juniper Networks, Thales, Qualcomm, Untangle, Advansis Consulting, Schlumberger, Accolite Digital, Telstra, L&T, M&M, and many others.

[Click here to Apply](#)

EXISTING M.TECH. PROGRAM

Autonomous Electric Vehicles (A-EVs)



The Electric Vehicles market is projected to grow at 40% annually from 2020 to 2027, with new players entering daily, from e-bike makers to Level-3 autonomous electric vehicles. Achieving a fully electric ecosystem requires advancements in power trains, motors, batteries, charging stations, and power electronics, with the value chain expected to reach USD 5 billion by 2025.

Simultaneously, the market for vehicle intelligence and connectivity is expected to grow at 50% annually. These are crucial for fully autonomous vehicles, requiring expertise in sensors, embedded computing, vehicular communication, and AI algorithms. With the booming automobile market and the rise of Electric and Autonomous Vehicles, engineers must be well-versed in these interdisciplinary fields. The proposed M. Tech. program on A-EVs aims to meet this need.

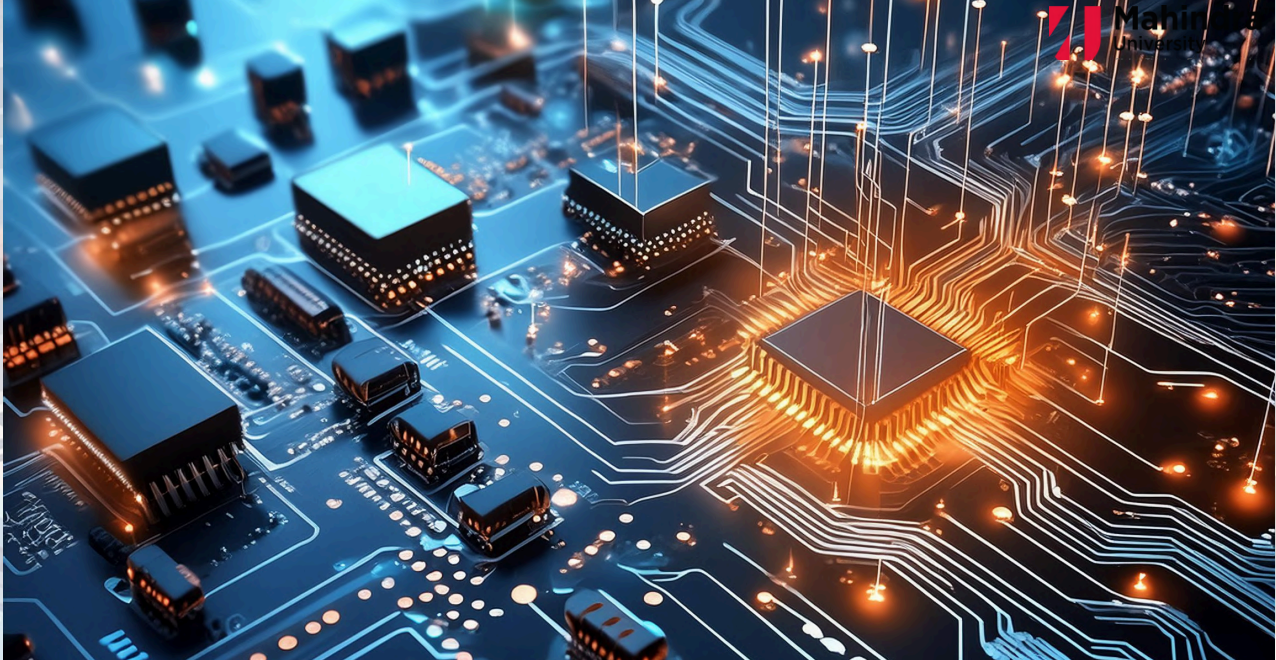
Students who complete this program should:

1. Be able to appreciate and understand the many components of an electric vehicle, both individually and as a whole.
2. Be able to envision, build, and construct an electric drive system for vehicles, including accompanying electrical circuitry.
3. Be able to characterize and develop Battery Management Systems (BMS) for electric vehicles.
4. Understanding the nature of intelligence in automobiles.
5. Be able to synthesize intelligent mechanisms for improving vehicle operation.

[Click here to Apply](#)

EXISTING M.TECH PROGRAMS

VLSI Design and Embedded Systems (VLSID&ES)



Mahindra University provides a two-year M.Tech. degree in VLSI Design and Embedded Systems. The course covers VLSI Design, Advanced Computer Architecture, Machine Learning for VLSI, Low Power VLSI Design, Logic Synthesis, Testability, and Physical Verification. Students will use Synopsys design automation software and Cadence EDA tools for a variety of design and verification activities. They can develop bespoke circuits using technologies like UMC 65nm and GPDK 45, 90, and 180nm.

Mahindra University has a laboratory facility that will give students the opportunity to use the latest design automation software from the leading EDA company Synopsys. This lab will be made available to all M. Tech. students to learn using the entire suite of tools from Architectural Design to Physical Verification tools such as Design Compiler, ICC2, PrimeTime, StarRCXT, Sentaurus TCAD (Device and Process simulation of semiconductor devices, interconnect modeling and extraction). Students will only be limited by their creativity and initiative for the types of designs they can develop using the automation provided by these tools.

Graduates may look forward to working for firms like Intel, Qualcomm, Synopsys, Broadcom, AMD, NVidia, Apple, TSMC, Global Foundries, and Samsung.

[Click here to Apply](#)

BOARD OF STUDIES (BOS)

In April 2024, we have successfully gone through the Board of Studies for the following B.Tech. and M.Tech. programs offered by the ECE department.

- B.Tech. in Electronics & Computer Engineering (ECM)
- B.Tech. in Electronics and Communication Engineering (ECE)
- B.Tech. in VLSI Design and Technology (VDT)
- B.Tech. in Electrical Engineering and E-Mobility (EEM)
- M.Tech. in VLSI Design and Embedded Systems (VLSI&ES)
- M.Tech. in Smart Grid and Energy Storage Technologies (SGETs)



The Board of Studies plays a critical role in ensuring the program's continued relevance and effectiveness. The Board assessed the program's curriculum and course content for its alignment with current industry needs and emerging technologies. This ensures that the program equips graduates with the necessary skills and knowledge to excel in their chosen careers.

External Panel Members of BoS:

- Prof. Vijaykumar Panganamala from IISc Bangalore
- Prof. R. N. Biswas from IIT Kanpur
- Prof. C. V. Jawahar from IIIT Hyderabad
- Dr. Niranjana Soundararajan from AMD Bangalore
- Dr. Srikanth from Nanocell Bangalore
- Mr. Navin Bishnoi from Marvell Technology
- Dr. Ramani Kalpathi from Industry Expert
- Prof. R Chudamani from SVNIT Surat



LAB DEVELOPMENTS

Power Electronics Lab



Electronic Load

Introducing the IT8600, a small and sophisticated AC/DC electronic load with 420V/20A/3600W input power. Its features include an oscilloscope display, inrush current measurement, voltage/current input waveform analysis, and measuring modes for various parameters. Allows you to set the Power Factor and Crest Factor values to evaluate your device's performance. The equipment has RS232, LAN, and USB connection interfaces, making it an excellent choice for testing AC power supply and related electrical components.

The IT6000C series is a programmable DC power supply based on third-generation SiC technology, capable of producing up to 2 MW. It has regenerative capabilities, a built-in waveform generator, and master-slave parallelism with averaging current distribution. It is ideal for high-speed source and sink current seamless switching and may be used in PCS, EV batteries, BOBCs, and bidirectional DC-DC modules.



Bi-Directional Power Supply

LAB DEVELOPMENTS

Power Electronics Lab



**Hydrogen Fuel
Cell Power Plant**

A hydrogen fuel cell power plant (or station) generates energy for the power grid by using a hydrogen fuel cell. They are larger in size than backup generators like the Bloom Energy Server and can convert hydrogen to power with up to 60% efficiency. The fuel cell process, which occurs in a combined cycle hydrogen power plant, produces little to no nitrogen dioxide or sulfur dioxide. If hydrogen could be created using electrolysis, commonly known as green hydrogen, it might provide a solution to renewable energy's energy storage dilemma.

Electric vehicle (EV) charging entails recharging the battery with an external power source. There are three types of EV chargers: level one, level two, and DC rapid chargers. Level 1 chargers are simple and connect into a typical 220-volt outlet, offering 6-12 kilometers of range per hour. Level 2 chargers require a dedicated circuit and can charge up to 40 km per hour. DC fast chargers are commercial units that can charge up to 80% in 30 minutes. The CCS connection allows for both DC rapid and AC charging.



**CCS 2 Electric Vehicle
Charger**

LAB DEVELOPMENTS

Power Electronics Lab



Electric Bug

The “Electric Bug,” a tiny, agile electric vehicle focused on efficiency and last-mile applications, represents the CPS Lab’s distinctive approach to electric cars. The Electric Bug focuses on light weight design and economical power consumption, making it perfect for urban situations for short-distance deliveries. This initiative investigates alternate vehicle layouts and their ability to meet specific transportation demands.

The creation of the Electric Bug demonstrates the Lab’s dedication to pushing the frontiers of electric vehicle technology. This project investigates novel solutions for sustainable urban mobility, laying the groundwork for a greener and more efficient transportation future.

The Lab is taking riding to the next level with a project to convert a standard bicycle into an electric-assisted (e-bike) variant. This effort seeks to raise awareness about the benefits of e-bikes by displaying the power of conversion technology. The project entails adding an electric motor, battery pack, and control system to a normal bicycle frame.



E-Bike

The motor will give the pedals more power, increasing acceleration and climbing abilities, while the battery will store the energy required for electric assistance. This e-bike refit project demonstrates the Lab’s commitment to make sustainable transportation accessible. By demonstrating the potential of conversion technology, the initiative promotes a greener and more inclusive approach to riding.

LAB DEVELOPMENTS

Power Electronics Lab



Autonomous Golf Cart

The CPS Lab is adopting a futuristic approach with the creation of an autonomous golf cart! This revolutionary initiative incorporates self-driving technology into a familiar car, with the goal of revolutionizing mobility on campus and beyond. The autonomous golf cart will perceive its environment using a variety of sensors, including point LiDAR and cameras.

These sensors will generate a real-time map of the area, allowing the cart to move securely while avoiding impediments. Advanced algorithms will then interpret this information, directing the cart along pre-programmed courses or responding to human directions. The creation of an autonomous golf cart demonstrates Power Electronics and EV Lab's dedication to cutting-edge technology. This project has the potential to transform the way we traverse our surroundings, ushering in a future of safe, efficient, and easily accessible autonomous vehicles. Solar panels installed on the roof gather sunlight and convert it into electricity to run this self-contained golf buggy. This energy is then stored in a battery pack and used to power the electric motor that moves the cart.

Our lab is attacking dirt and garbage straight on by developing an electric sweeping truck. This unique idea combines environmentally friendly electric vehicle technology with the functionality of a typical sweeper, providing a long-term solution for keeping our streets and sidewalks clean. The electric sweeping truck will run on an electric motor and battery pack, ensuring a clean and quiet operation. Brushes and a suction system will gather dirt, leaves, and debris, while the electric motor provides smooth operation and low emissions.



Electric Sweeping Vehicle

LAB DEVELOPMENTS

Power Electronics Lab



Hydrogen Gas based Vehicle

The CPS Lab is exploring the future of transportation by designing a hydrogen gas-powered car. This research investigates the potential of hydrogen fuel cell technology as a cleaner and more efficient alternative to standard gasoline and electric cars. The hydrogen car will use a fuel cell to create power by combining hydrogen gas and oxygen from the surrounding air. This electricity drives an electric motor, which propels the car with no exhaust emissions. The car can travel 80 kilometers with a single fill of hydrogen gas.

The "Autonomous Electric Trike" designed and built by one of our M. Tech (AEV) students, Sidhartha Mohanta under the guidance of Dr. Sreedhar Madichetty, exemplifies the Power Electronics Lab's advanced studies into autonomous vehicles. This vehicle has two modes of operation:

1. Electric manual drive, and
2. Electric autonomous drive.

The major emphasis is on cost-effectiveness. This automobile senses its surroundings and performs accelerating, deceleration, and steering actions using basic microcontrollers and twelve distance sensors with 30-degree viewing angles each. Manual speed and steering controls are positioned on the dashboard. Image processing and artificial intelligence (AI) may be used with sensor fusion in the future.



Autonomous Electric Trike

LAB DEVELOPMENTS

Power Electronics Lab



Mahindra XUV400

Our honourable Vice-Chancellor Prof. Yaj Medury's steadfast support was instrumental in acquiring the Mahindra XUV400 for Mahindra University's research endeavors. This contribution is a big step forward in our efforts to lead the way in automotive innovation. The Mahindra XUV400 will be a valuable tool in our research efforts, providing us with a platform to investigate cutting-edge technology and solutions. This vehicle will not only improve our research capacities, but also help to progress automotive technology and sustainable mobility.



LAB DEVELOPMENTS

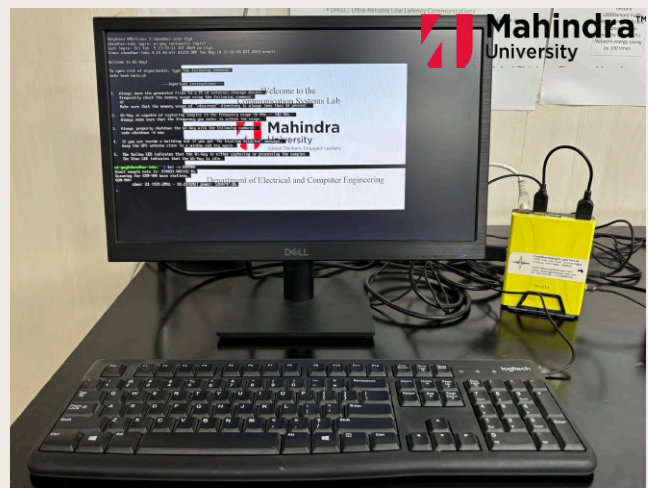
5G Communication Lab



Deep Radio

It can transmit and receive signals from 50 MHz to 6 GHz. It is basically an open-source platform. So, it can be programmed and managed as a standalone system. It is used to test, develop, and modify the model for contemporary RF signals surrounded by radio waves such as Broadcasting stations, Wi-Fi, Smartphones, Bluetooth, and GPS systems. HackRF can have the ability to adopt the above-mentioned technology and these signals are captured easily. It contains a telescopic antenna which is suitable for 75 MHz to 1 GHz. So, we can capture the real-time RF signals from GSM (900 MHz) and LTE (883 MHz for Jio) bands.

Wi-Guy is a software defined radio (SDR) based wireless communication learning kit designed especially for understanding the present day advanced wireless communication access technologies. SDR is the main part of the Wi-Guy's radio unit. SDR is a reconfigurable radio communication system where hardware components can be implemented in software.

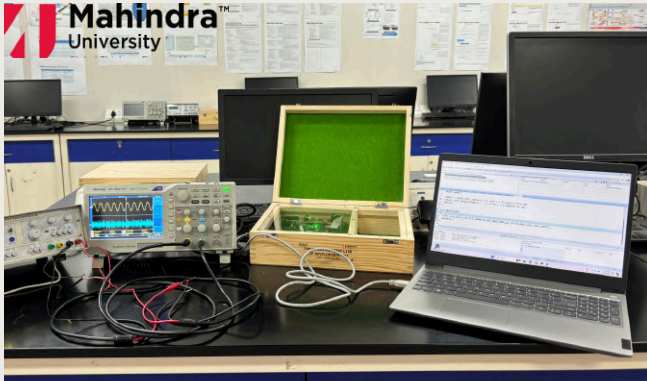


Wi-Guy

The SDR converts the continuous-time radio signals captured by the antenna into discrete-time baseband signals. The baseband signals are then processed by the computing unit for decoding the information transmitted by different broadcasting stations at various frequency bands.

LAB DEVELOPMENTS

5G Communication Lab



TMS3206748

Analog-based TMS3206748 - The equipment shown is the Digital Signal Processing based processor TMS3206748, which is operated with the Code Composer Studio platform by embedded C programming. This processor takes the input and obtains the output by processing the inputs inside the hardware equipment. Here the input is in the analog format. For this analog processing, the function generator is used as the input provider and CRO is used for displaying the output plots.

Digital-based TMS3206748 - The equipment shown is the Digital Signal Processing based processor TMS3206748, which is operated with the Code Composer Studio platform by embedded C programming. This processor takes the input and obtains the output by processing the inputs inside the hardware equipment. Here the input is in the digital format. The input for processing is given in the coding platform itself. This processor works with the audio input in addition to the two different inputs.



TMS3206748

VOLUME 11

TESTIMONIALS

B. Tech. students



Soumik Rao

Mahindra University's diverse course structure, extending beyond electronics and electrical engineering, equipped me with essential career skills. Supportive professors guided me through both academic and personal challenges. These skills helped me secure an internship at Tworks Telangana, India's largest and the world's second-largest prototyping center. At Tworks, I utilize advanced equipment for rapid prototyping and manage real-world projects from ideation to product development.

The interdisciplinary nature of my projects allowed collaboration with other departments, enhancing my knowledge in 3D printing, laser cutting, and CNC milling. Additionally, I conducted workshops on soldering and IoT wearables, fostering leadership and teamwork skills. This enriching experience has been incredibly rewarding, and I'm eager to learn more.

Mahindra University (MU) was pivotal in my academic journey. The B.Tech program provided foundational knowledge and skills for advanced research. Professors like J.L. Bhattacharya, Ram Vemuri, Dr. Gopinath, and Dr. Sreedhar Madichetty significantly shaped my understanding of Power Electronics, Power Systems, and Electrical Engineering, emphasizing both theoretical and practical problem-solving skills. This foundation led to an internship at the International Institute of Information Technology, Hyderabad (IIITH), in the Center for VLSI and Embedded Systems Technologies (CVEST), where I worked on "Energy Harvesting for Wearable Devices." Under Dr. Anshu Sarje's mentorship, I gained valuable theoretical and practical insights.

I am grateful to MU for nurturing my academic and research skills, preparing me well for advanced research at IIITH through comprehensive education, hands-on projects, and independent research opportunities.



Nandini Somarapu

VOLUME 11

TESTIMONIALS

M. Tech. students

My journey at MU has been truly transformative. Pursuing my M.Tech. at MU has provided an excellent opportunity for personal and professional growth. The vibrant campus environment, along with top-notch facilities and culinary delights, made each day enriching. The cutting-edge labs equipped with the latest technology significantly enhanced my learning experience. Moreover, MU's proactive career services not only offered tailored workshops but also facilitated valuable industry connections, leading to securing my prestigious internship at Elmot Alternators Pvt. Ltd., Hyderabad. This internship marks a significant turning point in my professional journey, and I owe it all to MU for profoundly shaping my academic and career trajectory. I have benefitted significantly from the extensive expertise of our highly skilled faculty. My heartfelt thanks to them for their unwavering support and guidance throughout my academic pursuit.



Chandrakala Pannela



Durga Mahesh

The MTech program at Mahindra University is exceptional, fostering intellectual growth and critical thinking under the mentorship of distinguished faculty. The university's cutting-edge research facilities and resources, including advanced labs and extensive libraries, create an environment conducive to innovation and interdisciplinary collaboration. A standout aspect of my experience was securing an internship in Denmark, highlighting Mahindra University's commitment to research excellence and global opportunities. The supportive community, clear communication, work-life balance, and recognition of achievements have empowered me to excel and produce outstanding work.

VOLUME 11

TESTIMONIALS

M. Tech. students

I'm thrilled to share my transformative journey at Mahindra University, pursuing my M.Tech. in autonomous electric vehicles. Immensely grateful to Professor Dr. Sreedhar for this incredible opportunity, who helped me polish my resume, securing me an internship at Elmot, setting me up for future success. The engaging academic environment, coupled with unwavering faculty support, enriched my experience. MU's workshops, presentations, and conferences provided invaluable learning and networking opportunities. Real-time lab experiments solidified my understanding by blending theoretical knowledge with practical exposure. The vibe here is super motivating, and I've made some lifelong buddies along the way. Overall, my journey at MU has been incredibly fulfilling, shaping me into a confident professional. I am grateful to the dedicated faculty, supportive peers, and the excellent facilities at MU for nurturing my growth and preparing me for a successful career ahead.



Gowthami Pannela



M. Rama Krishna

I got into Mahindra University through my senior's reference and the M.Tech program at Mahindra University offers rigorous academic training and fosters critical thinking. With distinguished faculty and state-of-the-art research facilities, it provides an environment conducive to innovation and interdisciplinary collaboration. Mahindra University stands out for its stress-free research atmosphere, promoting work-life balance and clear expectations. Access to resources, professional development opportunities, and recognition of achievements further enhance the academic journey. Notably, the university's impact extends globally, as evidenced by opportunities like my internship in Denmark. I'm grateful for the transformative experience Mahindra University has offered, propelling me towards academic and professional success.

VOLUME 11

TESTIMONIALS

Ph.D. Student

The PhD program at Mahindra University is a rigorous and comprehensive program that fosters intellectual growth and encourages critical thinking. The faculty members are distinguished experts in their respective fields, and their guidance and mentorship throughout my doctoral journey have been invaluable. The research facilities and resources at Mahindra University are state-of-the-art. MU management is very supportive and has encouraged me to push the limits. The university has made significant investments in creating an environment that fosters innovation and encourages interdisciplinary collaboration. I had access to well-equipped laboratories, extensive libraries, and advanced technological tools that allowed me to conduct cutting-edge research in my field. One aspect that truly sets Mahindra University apart is a stress-free and effective PhD atmosphere. With a supportive community, open communication, work-life balance, clear expectations, access to resources, professional development opportunities, and recognition of achievements, Mahindra University has propelled me to thrive and produce high-quality research.



**Venkata Siva Prasad
Chowdary Machina**

ERRATUM: LAST NEWSLETTER

1. In the Vol. I of the newsletter on page 12, we incorrectly stated that Prof. G. Bhuvaneshwari had retired. Whereas Prof. Bhuvaneshwari was on leave and rejoined after the leave.
2. In the Vol. I of the newsletter on page 28, the team visit was incorrectly attributed to "Tech Mahindra Team visit." but the team that visited us was from "Mahindra & Mahindra".

We apologize for the above errors. We regret any confusion this may have caused.

MEET THE TEAM

DIGITAL



Sidhartha Mohanta

ARTIST

CONTENT WRITERS



**Chennuru
Yashwanth Reddy**



Mohita Kolluri



Ramaa Vaidya

CONTENT WRITERS



**Gayathri Reddy
Konkeesa**



Shrey Agrawal



**Praharsha
Chigullapally**

FACULTY



Ankita Jain

ADVISOR



Fancy a game?



HINT: THINK ELECTRONICS