
**FACULTY OF ENGINEERING & TECHNOLOGY (CO-EDUCATION)**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**REPORT ON**

# One week FDP on "Advanced Computational Techniques for Electric Vehicles and Renewable Energy Systems"

**02/04/2025 to 06/04/2025**

The Department of Electrical & Electronics Engineering at Sharnbasva University Kalaburagi, organized a One-Week Faculty Development Program (FDP) on Advanced Computational Techniques for Electric Vehicles (EVs) and Renewable Energy Systems. This program was held with the aim of updating and enhancing the knowledge and technical skills of faculty members in the fields of electric vehicles and renewable energy, focusing on the computational techniques essential for design, optimization, and integration of these technologies. The program also encouraged collaboration between academia and industry, exploring new research directions and fostering innovation.

## Inaugural Ceremony

The Inaugural Ceremony marked the official start of the one-week FDP. The event was attended by faculty members, industry experts, and resource persons.

Guests of Honor The event was graced by the presence of eminent personalities:

- **Dr. V. Sandeep** Assistant Professor & HOD of Electrical Engineering, National Institute of Technology (NIT) Andhra Pradesh (Resource Person).
- **Prof. Anilkumar Bidve,** Vice-Chancellor, Sharnbasva University, Kalaburagi.
- **Dr. Sannabasanagouda G Dollegoudar,** Registrar, Sharnbasva University, Kalaburagi.
- **Prof. Shivakumar Jawaligi**, Dean, Faculty of Engineering and Technology (Co-Education).
- **Dr. M. Sasikala**, Professor, FETW, Sharnbasva University, Kalaburagi.
- **Prof. Jagadish Patil**, Chairperson, Department of Electrical and Electronics Engineering.



## Program Sessions Overview

**The FDP consisted of the following detailed sessions:**

**DAY-1: 02/04/2025 Wednesday**

**Session – 1: Introduction to EVs: Overview of Electric Vehicles, Architecture, Components & Challenges**

- **Speaker: Dr. V. Sandeep** Assistant Professor & HOD of Electrical Engineering, National Institute of Technology (NIT) Andhra Pradesh.

Topics covered:

- Overview of Electric Vehicles (EVs): Definition, types (BEVs, PHEVs, FCEVs).
- EV architecture: Powertrain, Battery, Inverter, Motor, and Charger.
- Components of EVs: Battery management systems, regenerative braking systems, and electric drive systems.
- Key challenges in EVs: Battery life, charging infrastructure, cost, and energy efficiency.
- Impact of EVs on the environment and transportation systems.

Provided participants with a comprehensive understanding of the fundamentals of Electric Vehicles, their architecture, key components, and the challenges faced in their development and adoption.


**Session – 2: Introduction to Renewable Energy: Solar & Wind and Microgrids**

Topics covered:

- Overview of Renewable Energy sources: Solar, Wind, Hydro, Biomass, and Geothermal.
- Focus on Solar and Wind energy systems: technology, working principles, and efficiency.
- Understanding of Smart grids: Definition, types, and applications of Smart grids in renewable energy systems.
- Energy storage options for renewable energy integration in microgrids.

Introduced the participants to renewable energy systems, specifically focusing on solar and wind energy technologies and the role of microgrids in integrating renewable energy efficiently.


**Session – 3: Emerging and Future Trends in EVs and Renewable Energy for Research**

Topics covered:

- Emerging trends in EV technologies, including autonomous driving, vehicle-to-grid (V2G) integration, and smart charging.

- Future research directions in renewable energy systems, including advanced solar technologies, wind turbine optimization, and energy storage innovations.
- Role of Artificial Intelligence (AI), Machine Learning (ML), and Blockchain in the optimization and integration of EVs and renewable energy.
- Sustainability in future EV and renewable energy developments.

Discussed the latest advancements and future research trends in Electric Vehicles and Renewable Energy Systems, with a special focus on emerging technologies and innovative research areas**.**



**Session – 4: Industry & Academia Collaborations and Startups**

Topics covered:

- Importance of collaboration between industry and academia in driving research and development in EVs and renewable energy.
- Real-world examples of industry-academia partnerships in electric vehicle technologies and renewable energy innovations.
- Challenges and opportunities for startups in the clean energy sector, especially in EV infrastructure and renewable energy storage solutions.
- Government policies and funding opportunities for research and startups.

Provided insights into how industry-academia collaborations foster innovation and research in the fields of Electric Vehicles and Renewable Energy Systems, and to encourage startup culture in these domains.



**DAY-2: 03/04/2025 Thursday**

**Session – 5: Introduction to Grid Integrations: Grid-Connected EV Charging & Renewable Energy Integration**

- **Speaker:** Dr. L N Sastry Varanasi, Faculty, National Institute of Technology (NIT) Andhra Pradesh, Training partner in NDEEP CONNECT, Founder and Director of Radhanu Technologies Pvt Ltd.

Topics covered:

- Grid Integration concepts: the role of EVs and renewable energy sources in the smart grid.
- EV charging infrastructure: Grid-connected charging stations and the challenges of large-scale EV adoption.
- Integration of solar and wind energy into the grid: balancing supply and demand, grid stability, and energy storage solutions.
- Challenges in distributed generation and voltage regulation with renewable energy sources.

Introduced the key concepts and challenges related to the integration of EVs and renewable energy into the electric grid, with a focus on charging infrastructure and grid stability.



**Session – 6: Advanced Control Strategies and Optimization for EVs and Renewable Systems**

Topics covered:

- Control strategies for EVs: Battery management, regenerative braking, and energy efficiency optimization.
- Optimization techniques for renewable energy systems, including power management, grid integration, and load forecasting.
- Use of advanced control algorithms (e.g., model predictive control and fuzzy logic) to optimize the operation of EVs and renewable energy systems.
- The role of real-time data in optimizing the performance of both EVs and renewable energy systems.

Equipped participants with knowledge of advanced control and optimization techniques used in EVs and renewable energy systems, enabling better system performance and efficiency.


**Session – 7: Introduction to MATLAB for EV: MATLAB Basics: Programming & Simulink for EV Modeling**

Topics covered:

- Introduction to MATLAB and Simulink for modeling Electric Vehicles.
- Basics of MATLAB programming for EV simulations, including functions, scripts, and toolboxes.
- Overview of Simulink for modeling complex systems, such as EV powertrains and battery management systems.
- Building simple EV models and running simulations in Simulink.

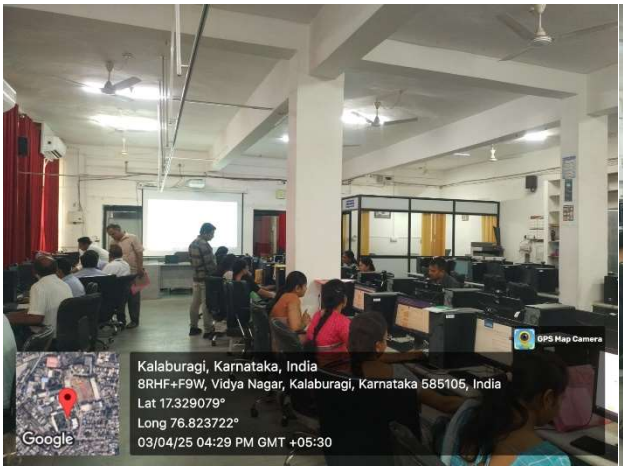
Familiarize participants with the use of MATLAB and Simulink for EV modeling and simulation, enabling them to analyze and optimize EV performance.


**Session – 8: Hands-on Session: EV Powertrain Modeling in MATLAB/Simulink**

Topics covered:

- Powertrain components: electric motor, battery, and inverter.
- Modeling the EV powertrain in Simulink: dynamic modeling of motor control, energy flow, and efficiency.
- Simulation of powertrain performance under various driving conditions.
- Optimization of powertrain components for energy efficiency.

Provided participants with hands-on experience in modeling and simulating an EV powertrain using MATLAB/Simulink, focusing on performance evaluation and optimization.




**DAY-3: 04/04/2025 Friday**

**Session – 9: Hands-on Session: Battery Modeling and Management Systems in MATLAB**

Topics covered:

- Battery modeling techniques: equivalent circuit models, electrochemical models, and thermal models.
- Simulating battery performance in MATLAB/Simulink.
- Design and implementation of battery management systems (BMS): charging, discharging, state-of-charge (SOC) estimation.
- Safety aspects and thermal management in EV batteries.

Provided practical knowledge of battery modeling and the design of battery management systems for EV applications using MATLAB/Simulink.

**Session – 10: Hands-on Session: EV Charging Station Optimization using MATLAB**

Topics covered:

- Different charging techniques for Electric Vehicles, including Level 1, Level 2, and DC fast charging.
- Charging station infrastructure and the integration of EV chargers with smart grids.
- Modeling the charging process in Simulink and evaluating charging time, power consumption, and cost.

Enabled participants to model and simulate EV charging systems, focusing on charging stations and the impact on grid systems.


**Session – 11: Hands-on Session: Power Electronics for EVs using MATLAB/Simulink**

Topics covered:

- Power electronics components in EVs: inverters, converters, and rectifiers.
- Simulating power electronics circuits for energy conversion in EV applications using MATLAB/Simulink.
- Efficiency optimization of power electronics for enhanced EV performance.

Provided participants with hands-on experience in modeling and optimizing power electronics systems for Electric Vehicles.

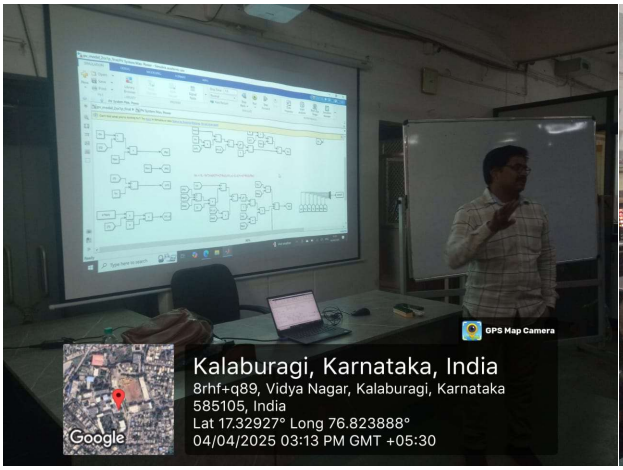


**Session – 12: Introduction to Python with Applications: Basics of Python for Engineering Applications**

Topics covered:

- Introduction to Python programming for engineering applications.
- Python libraries for scientific computation: NumPy, SciPy, Pandas, Matplotlib.
- Basic Python programming techniques for modeling and simulation of engineering systems.

Introduced participants to the basics of Python programming and its applications in engineering, providing a foundation for further learning in Python-based modeling and analysis.




**DAY-4: 05/04/2025 Saturday**

**Session – 13: Hands-on Session: Solar PV System Simulation in Python**

Topics covered:

- Introduction to Solar Photovoltaic (PV) systems and their components.
- Theoretical background on solar power generation and its applications.
- Practical demonstration of simulating a **Solar PV system** using Python libraries like **NumPy**, **Pandas**, and **Matplotlib**.
- Understanding the key parameters in solar PV systems, including **irradiance**, **temperature**, and **efficiency**.
- Simulating different solar panel configurations and evaluating their performance using Python.

Equipped participants with the skills to simulate and analyze Solar PV systems using Python, focusing on performance prediction under various conditions.


**Session – 14: Hands-on Session: Wind Energy System Modeling in Python**

Topics covered:

- Overview of wind energy systems and types of wind turbines.
- Wind resource assessment and its importance in energy system modeling.
- Using Python to model **wind energy systems**, incorporating variables like **wind speed**, **turbine efficiency**, and **capacity factor**.
- Simulating wind energy generation using data analysis techniques in Python.
- Plotting results and interpreting performance data.

Enable participants to model and simulate wind energy systems in Python, understand the dynamics of wind turbines, and assess system performance through data analysis.


**Session – 15: Hands-on Session: Renewable Energy Forecasting using Machine Learning (Python)**

**Topics covered:**

- Introduction to forecasting techniques for renewable energy generation.
- Application of **Machine Learning (ML)** algorithms for **predicting** solar and wind energy generation.
- Training machine learning models using Python libraries such as **scikit-learn** and **TensorFlow**.
- Features used in forecasting, including historical weather data, energy production, and geographical information.
- Evaluating model accuracy and improving prediction reliability.

Equipped participants with skills to apply machine learning for **renewable energy forecasting**, helping them understand how to predict energy production based on historical data.



**Session – 16: Hands-on Session: Machine Learning for EV Battery State Estimation (Python)**

**Topics covered:**

- Introduction to **Electric Vehicle (EV)** battery systems, including types of batteries, their operation, and performance characteristics.
- Techniques for **state-of-charge (SOC)** and **state-of-health (SOH)** estimation using machine learning.
- Practical implementation of **regression models** and **neural networks** for battery performance estimation in Python.
- Training and validating models on real-world data to predict battery states.

Provided participants with hands-on experience in applying machine learning techniques for **EV battery state estimation**, enabling more efficient battery management systems.


**DAY-5: 06/04/2025 Sunday**

**Session – 17: Hands-on Session: Optimization Techniques for EV Energy Management**

**Topics covered:**

- Overview of energy management in Electric Vehicles, including energy efficiency and optimization.
- Key optimization techniques like **dynamic programming**, **genetic algorithms**, and **linear programming**.
- Application of optimization models for **energy management** in EVs, focusing on minimizing energy consumption while maximizing range.
- Implementing optimization algorithms in Python for EV systems.

Help participants understand optimization strategies and their practical application for enhancing the energy efficiency of **Electric Vehicles**.



**Session – 18: Hands-on Session: Artificial Intelligence for EV and Renewable Systems**

**Topics covered:**

- The role of **Artificial Intelligence (AI)** in **smart energy management** for both EVs and renewable energy systems.
- AI techniques such as **neural networks**, **deep learning**, and **reinforcement learning**.
- Practical demonstrations of AI models for real-time energy decision-making in EVs and renewable energy systems.
- Optimizing the interaction between **EVs** and **renewable energy sources** using AI.

Introduced participants to advanced AI techniques and their application in **optimizing energy systems** for both **Electric Vehicles** and **renewable energy sources**.


**Session – 19: How to Write a Quality Publication and Project Proposals for Government Agencies**

Topics covered:

- The process of writing **scientific publications** in the field of **Engineering & Technology**.
- Structure and guidelines for creating compelling research papers, including **abstract writing**, **literature review**, and **methodology**.
- Understanding the **proposal writing process** for government-funded projects.
- Tips on crafting proposals for **renewable energy systems**, **electric vehicles**, and **AI applications**.
- Importance of clear writing and communicating ideas effectively.

Guide participants on how to prepare high-quality academic publications and project proposals tailored for government agencies, with an emphasis on research in renewable energy and electric vehicles.

**Feedback and Valedictory**





The valedictory function was presided over by esteemed dignitaries:

- **Prof. Shivakumar Jawaligi**, Dean, Faculty of Engineering and Technology (Co-Education)
- **Dr. Nagabhushan Patil**, Professor, Department of EEE
- **Prof. Jagadish Patil**, Chairperson, Department of Electrical and Electronics Engineering

They commended the collective efforts of the organizing team, resource persons, and participants. Prof. Shivakumar Jawaligi highlighted the importance of continued professional development and encouraged faculty members to implement the insights gained in their academic and research work.

The week-long sessions were delivered by the expert speaker **Dr. L. N. Shastry**, who shared his extensive knowledge on various advanced computational techniques relevant to electric vehicles and renewable energy systems. Topics included:

- Modeling and simulation of EV systems
- Optimization in renewable energy integration
- Applications of computational intelligence in smart grids

Participants benefited immensely from his clear explanations, case studies, and hands-on demonstrations using modern simulation tools.

## Anchoring & Engagement:

The valedictory function was efficiently anchored by **Prof. Soumya H**, who guided the event with poise and professionalism, ensuring a smooth flow of proceedings.

## Participant Feedback:

During the valedictory, feedback was shared by selected participants:

- **Prof. Shrutishree** from VNEC, Shorapur appreciated the relevance of the FDP content and the clarity of delivery throughout the sessions.
- **Prof. Abhishek** from the Department of Energy Engineering, Sharnbasva University, highlighted the practical applications of the topics covered and expressed interest in further collaborative research in the field.

Their positive feedback reflected the overall satisfaction and success of the FDP.

## Vote of Thanks:

The ceremony concluded with a heartfelt **vote of thanks** by **Prof. Prashantkumar S. Chinamalli**, who expressed gratitude to:

- The resource person, **Dr. L. N. Shastry**, for his invaluable contribution
- The university leadership and faculty for their support
- The organizing committee and technical staff for their coordination
- All participants for their active engagement and enthusiasm