**Pimpri Chinchwad Education Trust's**

# PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

**SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044**

**An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune**

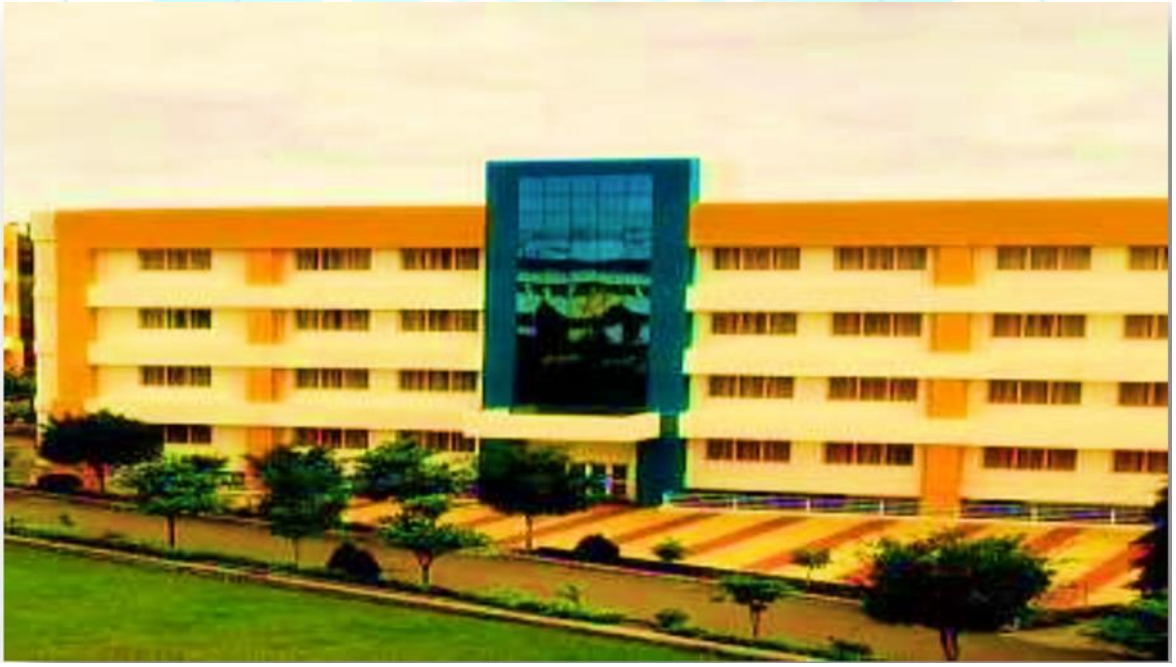
## DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

**Curriculum Structure and Syllabus**

**of**

**Honors in Electric Vehicle Technology**

**(Regulations 2023)**



**Effective from Academic Year 2026-27**
**(Updated with Minor Changes)**

## Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

## Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

## EOMS Policy

“We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute’s social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS).”

# Course Approval Summary

## Board of Studies - Department of E&TC Engineering

| Sr. No. | Name of the Course | Course Code | Page number | Signature and stamp of BoS chairman |
|---|---|---|---|---|
| 1 | Energy Storage System for Electric Vehicles | BET25HN21 | 8 | |
| 2 | Energy Storage System for Electric Vehicles Lab. | BET25HN22 | 10 | |
| 3 | EV Motor Drives and Controllers for Electric Vehicles | BET26HN21 | 11 | |
| 4 | EV Motor Drives and Controllers for Electric Vehicles Lab | BET26HN22 | 13 | |
| 5 | EV System Design and Architecture | BET27HN21/ BET28HN22 | 14 | |
| 6 | Project | BET28HN21/ BET27HN23 | 16 | |

**Approved by Academic Council:**

Chairman, Academic Council
Pimpri Chinchwad College of Engineering,Pune

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# Honors in Electric Vehicle Technology

# Preface

Looking at Global Scenario to enhance the employability skills and impart deep knowledge in emerging/ multidisciplinary areas, an additional avenue is provided to passionate learners through the Minors and Honors Degree Scheme in academic structure.

For Honors degree program, student has to earn additional 20 credits in emerging area of one's own domain.

Objectives of Honors Degree

1. To enable students to pursue allied academic interest in contemporary areas.
2. To provide effective yet flexible options for students to achieve basic to intermediate level competence in the contemporary area.
3. To enhance the employability skills with different combinations of competencies and flavors.
4. To provide an academic mechanism for fulfilling demand of specialized areas from industries for higher order skill jobs.
5. To provide a strong foundation to students aiming to pursue research/higher studies in the contemporary field of study.

## Electric Vehicle technology

Adopting e-mobility does not only change the way we approach the road but also improves the quality of our lives. The emergence of electric vehicles in recent years introduced a new viable mode of transportation. As a result, the e-mobility ecosystem has become the pillar of the economy, providing millions of jobs worldwide.

**Features of Electric vehicle technology course for Electronics Engineers**

This course helps to explore in following areas-

1. Components of the Electric vehicles
2. Complexity requirements of Electric vehicles technology
3. State-of-the-Art: analysis of existing Electric vehicles architecture models
4. Various aspects of Electric Vehicles, understand Mobility and its evolutions.

**Objectives:**

1. To explain the basics of electric vehicle system, their design methodologies, architecture and fundamentals.
2. To analyze various electric motor drives suitable for electric vehicles.
3. To emphasize on the various power electronics devices suitable for electric vehicles.
4. To discuss different energy storage systems used for electric vehicles and their management.
5. To demonstrate different configurations of electric vehicles and its components, sizing of components, design optimization and energy management.
6. To introduce the fundamentals of batteries, Charging and Swapping infrastructure in e-Mobility era.

**Outcomes: After completion of this course, students will be able to:**

1. Explain the basics of electric vehicles, their design methodologies, architecture and fundamentals.
2. Analyze the use of different electric motor drives in electric vehicles.
3. Analyze the use and suitability of various power electronics devices for electric vehicles.
4. Explain the use of different energy storage devices used for electric vehicles, their technologies and control and select appropriate technology
5. Interpret working of different configurations of electric vehicles and its components, performance analysis and Energy Management strategies in EVs.
6. Appreciate the importance of battery swapping technology in e-mobility domain.

# Curriculum Structure

# Curriculum structure- Scheme-A

| Sem-ester | Course Code | Course Name | Teaching Scheme | | | | | Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Hrs. | CR | FA1 | FA2 | SA | TW | PR | OR | Total |
| V | BET25HN21 | Energy storage system for electric Vehicles | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| | BET25HN22 | Energy storage system for electric Vehicles Lab | - | 2 | - | 2 | 1 | - | - | - | 25 | - | 25 | 50 |
| VI | BET26HN21 | EV motor drives and controllers for Electric Vehicles | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| | BET26HN22 | EV motor drives and controllers for Electric Vehicles lab | - | 2 | - | 2 | 1 | - | - | - | 25 | - | 25 | 50 |
| VII | BET27HN21 | EV system design and architecture | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| VIII | BET28HN21 | Project | - | 8 | | 8 | 4 | - | - | - | 100 | | 50 | 150 |
| **Total** | | | **12** | **12** | | **24** | **18** | **-** | **-** | **-** | **-** | **-** | **-** | **550** |

***Abbreviations:***

***1Lecturehour=1 Credit  2 LabHours=1 Credit  1 TutorialHour=1Credit Abbreviations are: L-Lecture,P-Practical, T-Tutorial, H- Hours, FA-Formative Assessment , SA- Summative Assessment,TW–Teamwork, OR –Oral, CR-Credits***

# Curriculum structure- Scheme-B

| Sem-ester | Course Code | Course Name | Teaching Scheme | | | | | Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Hrs. | CR | FA1 | FA2 | SA | TW | PR | OR | Total |
| V | BET25HN21 | Energy storage system for electric Vehicles | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| | BET25HN22 | Energy storage system for electric Vehicles Lab | - | 2 | - | 2 | 1 | - | - | - | 25 | - | 25 | 50 |
| VI | BET26HN21 | EV motor drives and controllers for Electric Vehicles | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| | BET26HN22 | EV motor drives and controllers for Electric Vehicles lab | - | 2 | - | 2 | 1 | - | - | - | 25 | - | 25 | 50 |
| VII | BET27HN23 | Project | - | 8 | | 8 | 4 | - | - | - | 100 | | 50 | 150 |
| VII | BET28HN22 | EV system design and architecture | 4 | - | - | 4 | 4 | 20 | 20 | 60 | - | - | - | 100 |
| **Total** | | | **12** | **12** | | **24** | **18** | - | - | - | - | - | - | **550** |

| Program: | B.Tech.(E&TC)-Honors In Electric Vehicle Technology | | | Semester: | V | | |
|---|---|---|---|---|---|---|---|
| Course: | Energy Storage System for Electric Vehicles | | | Code: | BET25HN21 | | |
| | Teaching Scheme (Hrs./Week) | | | Evaluation Scheme and Marks | | | |
| Credit | Lecture | Practical | Tutorial | FA | | SA | Total |
| | | | | FA1 | FA2 | | |
| 4 | 4 | - | - | 20 | 20 | 60 | 100 |

**Prior Knowledge of:**

1. General background on alternative energy sources and sustainability
2. Electric vehicles configuration Is essential

**Course Objectives:**

1. To learn fundamentals of energy storage systems for Electric vehicles
2. To understand advanced batteries, super capacitors, and fuel cells for Electric Vehicles
3. To discuss the Hybridization of various energy storage systems such as battery–super capacitors, Battery– fuel cell,and battery–super capacitor–fuel cell
4. To provide the fundamental of battery management systems.

**Course Outcomes:**

After the completion of the course, the students should be able to:

1. Compare various energy storage devices for Electric vehicles application.
2. Apply the knowledge of energy source technologies for vehicle electrification.
3. Differentiate the battery charging techniques.
4. Understand the fundamentals of battery management systems.
5. Realize the importance of battery recycling technologies.
6. Compare the topology of charging station for Electric Vehicles.

Detailed Syllabus:

| Unit | Description | Duration |
|---|---|---|
| 1. | **Energy Storage:** Introduction to Energy Storage Requirements in Electric Vehicles. Battery, Fuel Cell, Super Capacitor and Flywheel based energy storage and its analysis, Various aspects in hybridization of different energy storage devices. | 11 |
| 2. | **Energy Storage Systems:** Batteries-Advanced Lithium Batteries(LMO, NMC, LFP and LTO with their comparative study)and Beyond lithium batteries, Lead-acid battery, High temperature batteries for back-up applications, Double layer and Super capacitors for e- mobility application, Fuel Cells and Hydrogen Storage. | 9 |
| 3. | **Battery Chargers and Battery Testing Procedures:** Constant current and constant voltage methods, Hybrid methods, Inductive chargers, Battery power testing for various Vehicles, Battery capacity tester, Battery testing for urban and high way driving cycles | 11 |
| 4. | **Battery Management Systems (BMS):**Concept of Crating, WhandAhrating, SOH, SOC, DOD ratings, active and passive cell balancing, Fundamentals of battery Management systems, block diagram and controls | 9 |
| 5. | **Battery Recycling Technologies: Technology** and economic aspects of battery recycling, Battery Applications for Stationary and Secondary Use. Introduction of lithium recycling | 11 |
| 6. | **Electric Vehicles charging station:** System block diagrams, Topologies , Requirement of system, Working principle of EV charging, Types of EV charging systems and its main components of EV chargers. | 9 |
| | Total | 60 |

**Text Books:**


1. James Larminie, John Lowry,ElectricVehicleTechnologyExplained,Wiley,2003
2. D.A.J.Rand,R.Woods,andR.M.Dell,"BatteriesforElectricVehicles,"SocietyofAutomotive Engineers,"Warrendale PA, 2003.
3. Energy Storage by Robert A, Springer Publication Energy Management Handbook, Wayne C. Turner, The Fairmont

Press Inc.,5thEdition,Georgia.

**Reference Books:**

1. G-A.NazriandG.Pistoa,LithiumBatteries,ScienceandTechnology,KluwerAcademicPublisher, 2003.
2. H.A.Kiehne,"Battery Technology Handbook", Marcel Dekker,NYC,2003.
3. JamesLarminieandJohnLowry,"ElectricVehicleTechnologyExplained,"JohnWiley,2003.
4. D.LindenandT.S.Reddy,"HandbookofBatteries,"4th Edition,McGraw-Hill,2011.
5. Energy storage (An ew approach) by Ralph Zito Wiley Publication.
6. NPTEL courses on Energy storage Devices.

| Program: | B.Tech.(E&TC)-Honors In Electric Vehicle Technology | Semester: V |
|---|---|---|
| Course: | Energy storage system for Electric Vehicles Lab | Code: BET25HN22 |

| Teaching Scheme (Hrs./Week) | | | | Evaluation Scheme and Marks | | | |
|---|---|---|---|---|---|---|---|
| Credit | Lecture | Practical | Tutorial | TW | OR | PR | Total |
| 01 | -- | 02 | - | 25 | 25 | -- | 50 |

**Prior knowledge of: Electronic Devices is essential.**

**Objectives:**

1. Develop the student's simulation skill in energy storage device modeling.
2. Analyze parameter for energy storage device.
3. Understand the charging and discharging process of energy storage device.

**Outcomes:** At the end of Laboratory work, the students will be able to:

1. Analyze charging techniques of energy storage device for Electric Vehicle.
2. Analyze the role of C-rate in charging/discharging a battery.
3. Understand the testing procedure of battery.
4. Design battery pack for EV application.

**General Guidelines: Any Eight Experiments is to be performed.**

**Detailed Syllabus:**

| Expt. No. | List of Experiments |
|---|---|
| 1 | Study the basic parameters of battery |
| 2 | Measure the charging voltage and current of given battery. |
| 3 | Demonstrate any charging technique of lead acid battery/Lithium Ionbattery. |
| 4 | Demonstrate the discharging process of battery using various values of C-rate and compare it. Study of ratings of battery for ecycle, 2W EVs, Erickshaws, E-CARsetc |
| 5 | Simulate battery model of given battery using any simulation tool. |
| 6 | Simulation on charging techniques of battery. |
| 7 | Study the process of battery testing and measure the parameters of battery. |
| 8 | Study and Demonstration of Battery Temperature Measurement / thermal safety issues(Thermocouple,Thermistoretc) |
| 9 | Battery pack design for given EV application (Testing Various series parallel combinations for given application) |
| 10 | Case Study: Design,selection,sizingandcomponentsofanydevelopedchargingstation for EV. |
| 11 | Visit to any industry/EV charging station/Research laboratory related to battery and EV. |

**Reference Books:**


1. D. Lindenand T.S.Reddy,"Handbook of Batteries,"4th Edition, McGraw-Hill, 2011.
2. D.A.J. Rand, R. Woods, and R.M. Dell, "Batteries for Electric Vehicles, "Society of Automotive Engineers," Warrendale PA, 2003.
3. M.Westbrook,"TheElectricandHybridElectricCar,"SocietyofAutomotiveEngineers,"WarrendalePA, 2001.
4. MATLAB Documents.

| Program: | B. Tech. (E&TC) -Honors In Electric Vehicle Technology | Semester: | VI |
|---|---|---|---|
| Course: | EV motor drives and controllers for Electric Vehicles | Code: | BET26HN21 |

| Teaching Scheme (Hrs./Week) | | | | Evaluation Scheme and Marks | | | |
|---|---|---|---|---|---|---|---|
| Credit | Lecture | Practical | Tutorial | FA | | SA | Total |
| | | | | FA 1 | FA2 | | |
| 4 | 4 | - | - | 20 | 20 | 60 | 100 |

**Prior Knowledge of:** Basics of DC machines, Basics of Electrical Engineering **is essential**

**Course Objectives:**

1. To understand the components of Electric Vehicle systems.
2. To Study and understand the concepts of various power converters.
3. To learn about DC Motors Drives.
4. To understand speed control techniques of BLDC motor.
5. To learn about Induction motor and SRM motor.
6. Understand the Basic concepts of Electronics Control Unit (ECU) in Electric Vehicles

**Course Outcomes:**

**Students will be able to**

1. Explain the basic components of Electric Vehicle systems.
2. Describe the features of power converters for EV.
3. Apply the knowledge of DC motor drives for Electric Vehicle.
4. Apply the knowledge of Brushless DC Motor Drives.
5. Apply the knowledge of AC Motor drives.
6. Illustrate the Basic concepts of Electronics Control Unit (ECU) in Electric Vehicles.

**Detailed Syllabus:**

| Unit | Description | Duration |
|---|---|---|
| 1. | **Basics of EV System:** Need**,** Components of EV system : Battery pack, Motor, Controller, Convertor Requirement of EV motors, Motors used in EVs, Selection of operating voltages and power ratings of motors, sensors and actuators. | **9** |
| 2. | **Power Devices and Converters:** Introduction to SCR, MOSFET and IGBTs**,** need of converters, Classification: DC-DC(Buck, Boost, Buck-Boost, Flyback, isolated converters), DC-AC (Single-Phase DC–AC Inverter, Three Phase DC–AC Inverter), AC-DC, AC-AC, unidirectional/ bidirectional, magnetically isolated, selection of converter for EV, Location & power flow, four quadrant operation, input/ output voltage relations for converters | **11** |

| | | |
|---|---|---|
| 3. | **DC Motor Drives:** Basics of DC Motor: Construction , working principle of DC Motors- shunt, series, Torque speed characteristics, Comparison of DC motors, Various speed control techniques of DC Motors ,DC series motor drive using DC-DC converters | **10** |
| 4. | **Brush-Less DC motor Drives:** BLDC Machine construction, ,Operation of BLDC Motor, Torque and Rotating Field Production, BLDC Motor Control, BLDC Motor Torque–Speed Characteristics , Typical power, voltage, torque ratings of motors in 2/3/4 wheeler EVS,Sensor -less BLDC Motor Control | **10** |
| 5. | **AC Motor Drive:** Types of AC motors, their Construction and working principle Torque speed characteristics. Speed control techniques for induction motor, inverter fed induction motor drives, Configuration and control of SRM motor. | **10** |
| 6. | **Electronic Control Unit (ECU) in Electric Vehicles:** Introduction to ECU, ECU Components, ECU for EV Powertrain Control, Software in ECU, Data Management. | **10** |
| | **Total** | **60** |

Text Books:


1. K Wang Hee Nam: AC Motor Control & Electrical Vehicle Application, CRC Press, Taylor & Francis Group, 2019.
2. C.C Chan, K.TChau: Modern Electric Vehicle Technology, Oxford University Press Inc.,New York 2001 .
3. Rashid M. H.,"Power Electronics Circuits, Devices and Applications",Prentice Hall
4. M D Singh,K B Khanchandani," Power Electronics", Tata McGraw-Hill Education,2017


**Reference Books:**


1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press,2003.
2. JamesLarminie,JohnLowry,ElectricVehicleTechnologyExplained,Wiley,2003.
3. Chang Liang Xia,"Permanent Magnet Brushless DC Motor Drives and Controls" ,Wiley2012.
4. Ramu Krishnan," Permanent Magnet Synchronous and Brushless DC Motor Drives," CRC Press,2009
5. Austin Hughes and Bill Drury," Electric Motors and Drives Fundamentals Types and Applications",Elsevier,2019
6. Ned Mohan, T. Undeland& W. Robbins, "Power Electronics Converters Applications and Design, John Willey & sons, Singapore, 2 nd Edition Oxford University Press, New Delhi, 2005
7. "Applications Notes" by NXP

| Program: | B. Tech. (E&TC) -Honors In Electric Vehicle Technology | Semester: | VI |
|---|---|---|---|
| Course: | EV motor drives and controllers for Electric Vehicles Lab | Code: | BET26HN22 |

| | Teaching Scheme (Hrs./Week) | | | Evaluation Scheme and Marks | | | |
|---|---|---|---|---|---|---|---|
| **Credit** | **Lecture** | **Practical** | **Tutorial** | **TW** | **OR** | **PR** | **Total** |
| 01 | -- | 02 | -- | 25 | 25 | -- | 50 |

**Prior knowledge of: Electric circuits is essential**

**Objectives:**

1. To develop Student's simulation skills in Electric drives and controller
2. To analyze important parameters for Electric drives and controller 3.

**Course Outcomes**

**After completion of this course Students will be able to**

1. Analyze the performance of various electronics components used in EV such as SCR, IGBT, MOSFET etc.
2. Demonstrate the speed control techniques of DC and AC Motor Drives.
3. Evaluate the performance of inverters and Choppers.

**General Guidelines: Any Eight Experiments is to be performed.**

**Detailed Syllabus:**

| Expt.No. | List of Experiments |
|---|---|
| 1 | Study of sensors and actuators in Electric vehicles. |
| 2 | VI characteristics of SCR. |
| 3 | VI characteristics of IGBT. |
| 4 | VI characteristics of MOSFET. |
| 5 | Study of MOSFET based Step up and step down chopper. |
| 6 | Chopper fed DC motor drive. |
| 7 | Speed control of BLDC motor. |
| 8 | Speed control of SRM motor. |
| 9 | V/f control of three phase induction motor. |
| 10 | Three phase IGBT based PWM inverter control of Induction motor. |
| 11 | Industrial Visit to EV industry. |

**Reference Books:**


1. Power Electronics: Circuits, Devices and Applications- M.H Rashid, Pearson Education, PHI 3rdEdition,New Delhi2004
2. M D Singh,K B Khanchandani," Power Electronics", Tata McGraw-Hill Education,2017
3. Fumdamental of Electrical Drives,G.K.Dubey,New Age International Publication
4. MATLAB Documents

| Program: | B. Tech. (E&TC) Honors In Electric Vehicle Technology | Semester: | VII/VIII |
|---|---|---|---|
| Course: | EV system design and architecture | Code: | BET27HN21/ BET28HN22 |

| Teaching Scheme (Hrs./Week | | | Evaluation Scheme and Marks | | | | |
|---|---|---|---|---|---|---|---|
| Credit | Lecture | Practical | Tutorial | FA | | SA | Total |
| | | | | FA1 | FA2 | | |
| 4 | **4** | - | - | 20 | 20 | 60 | 100 |

**Prior Knowledge of:**

Basic Electrical principle and electrical technology is essential.

**Course Objectives:**

1. To learn the basics of Electric vehicles and its classification
2. To understand the Configurations, Performance and architecture of EV
3. To learn the Modeling and design of Electric vehicles as a system
4. To understand electric components used in electric vehicles and their details.
5. To learn the Energy Storage Systems and energy management strategies for EVs

**Course Outcomes:**

**Students should be able to:**

1. Compare Electric Vehicle against the Internal Combustion Engine.
2. Compare the performance of Electric and Plug-in Electric Vehicle.
3. Design EVs as a system.
4. Explain the complete Electric Propulsion unit of Electric vehicles.
5. Apply the knowledge of Energy Storage Systems and energy management strategies for EVs.

Detailed Syllabus:

| Unit | Description | Dura tion |
|---|---|---|
| 1. | **Introduction to Electric Vehicles:** Main Components of Electric Vehicle, Comparison with Internal Combustion Engine: Technology, Benefits and Challenges, EV classification and their electrification levels. Power and energy requirements of various types of EVs suchas2/3/4 wheelers, trucks and buses etc. | 11 |
| 2. | **ElectricandPlug-inElectricVehicle:**ConfigurationsofElectricVehicles(EV),PerformanceofEV,Architecturesof EV,Vehiclebatteriesanditsmodelling,BatteryoperatedEV, Plug-in EV | 9 |
| 3. | **ControlsModelingandDesignforEV:**Systemandsub-systems,ModellinganddesignofEVsas a system, principles of controls engineering for EV. | 11 |
| 4. | **Electric Propulsion unit:** Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motordrives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive efficiency. | 9 |
| 5. | **Energy Storage Systems:** Energy storage systems used, Battery electro-chemistry, battery design and construction, charging and discharging, Importance of power density and energy density, Battery interface vehicle and charging station. | 11 |

| | | |
|---|---|---|
| 6. | **Energy Management Strategies:** Introduction to energy management strategies used inhybridandelectricvehicles,classificationofdifferentenergymanagementstrategies,comparison of different energy management strategies, implementation issues of energy management strategies. | 9 |
| | Total | 60 |

**Text Books:**

1. Iqbal Husain," Electric and Hybrid Vehicles –Design Fundamentals",CRC Press
2. L.Guzzellaand, A.Sciarretta, Vehicle Propulsion Systems: Introduction to modeling and Optimization, Springer2007, Third Edition

**Reference Books:**

1. Mehrdad Ehsani, Yimin Gao, Sebastian E.Gsay,Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell vehicles-Fundamentals-Theory and Design", CRC Press
2. "Bosch'AutomotiveHandbook",8th Edition

| Program: | B.Tech.(E&TC)-Honors In Electric Vehicle Technology | Semester: | VII/VIII |
|---|---|---|---|
| Course: | Project | Code: | BET28HN21/ BET27HN23 |

| | Teaching Scheme (Hrs./Week) | | Evaluation Scheme and Marks | | | |
|---|---|---|---|---|---|---|
| **Credit** | **Lecture** | **Practical** | **FA 2** | **TW** | **OR** | **Total** |
| 4 | - | 8 | - | 100 | 50 | 150 |

**Prior Knowledge of :**Basic electric technology and motors is essential

**Course Objectives:**

1. To test students' knowledge of course implementation.
2. To make students ready for EV design and analysis..

**Course Outcomes :**After learning the course, the students should be able to:

1. Solve real time problems observed in industry.
2. Deal with EV technology, updates, management and analysis motors and drives.

Detailed Guidelines:

1. The students are encouraged to take projects for developing software solutions and hardware platforms using the concept of course taken under the certification.
2. Project should be individual and preferably form Industry.
2.The project guidelines mentioned in B.Tech(E&TC) structure will be followed for evaluation of performance and certification compliance.

# Vision and Mission of E&TC Department

**VISION :** To be recognized as a distinguished department in the field of electronics and telecommunication transforming students into competent technocrats by providing an Ethical, Sustainable and Value-Added Quality Education.

**MISSION :**

1. To create competent Electronics and Tele-communication engineers with Knowledge, Skill and Attitude by establishing a conducive learning environment.
2. To nurture technical competency, entrepreneurship skills and promote higher studies through the state-of-art facilities for building successful careers.
3. To facilitate research by engaging in projects of industrial requirement and national importance.
4. To impart Life skills, Ethical and Social values for self-sustainability.

# Programme Educational Objectives (PEO's)

1. Establish a strong base in mathematics, basic sciences, and the fundamental principles of Electronics and Telecommunication Engineering for the students.
2. Equip students with a comprehensive understanding of Electronics and Telecommunication Engineering, enabling them to effectively comprehend, analyse, design, and to innovate practical solutions for real-world challenges.
3. Foster the development of effective communication skills, teamwork, and professional ethics among students, in order to meet the demands of employers and prepare them for higher studies and successful careers.
4. Promote social consciousness and a sense of responsibility among students, creating awareness about their commitment and obligations to society.

# Program Outcomes (PO's)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply thesssse to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# Program Specific Outcomes (PSOs)

1. **PSO1:** Ability to exhibit the competency to solve the problems related to Electronics & Telecommunications Engineering by applying advanced knowledge in the fields of VLSI, Embedded Systems, Signal Processing, Communication, Computing and Automation.
2. **PSO2:** Ability to design and analyse Electronics & Telecommunications systems using state of the art hardware and software tools to address the needs of the industry and society.
3. **PSO3:** Ability to build research and problem-solving attitude through Project based learning to address the societal, environmental, health and safety issues.


PCET's Pimpri Chinchwad College of Engineering
PCCOE
"Knowlege Brings Freedom"
Progress Credibility Confidence
Optimism Excellence
Since 1999