Diploma EE LNCT University
VI Semester Syllabus

ELECTRICAL VEHICLE TECHNOLOGY (DEX-603-B)

COURSE OUTCOMES:

After Completing the course student should be able to:

CO-1	Understand the fundamentals, classifications, and components of electric vehicles.
CO-2	Analyse and evaluate different types of electric motors and power electronic converters used in EVs.
CO-3	Demonstrate knowledge of battery technologies, configuration, and battery management systems used in electric vehicles.
CO-4	Understand the infrastructure, standards, and technologies involved in EV charging systems.
CO-5	Apply control strategies and emerging digital technologies in electric vehicle systems.

UNIT 1: FUNDAMENTALS OF ELECTRIC VEHICLES

Introduction to Electric Vehicles, History and Evolution of EVs Classification: BEVs, HEVs, PHEVs, FCEVs, EV vs. ICE (Internal Combustion Engine) Vehicles Components of an EV: Motor, Battery, Controller, Charger. Basic Physics of EV Motion (Force, Torque, Speed)

UNIT 2: ELECTRIC MOTORS AND POWER ELECTRONICS

Types of Motors used in EVs: BLDC (Brushless DC), PMSM (Permanent Magnet Synchronous Motor), Induction Motors, Motor Characteristics and Selection, Introduction to Power Electronics, Inverters, Converters, Controllers, Motor Drive Circuits and Efficiency.

UNIT 3: BATTERY TECHNOLOGY AND MANAGEMENT

Battery Types: Lead-Acid, NiMH, Lithium-Ion, $LiFePO_4$. Battery Pack Configuration (Series/Parallel), Charging and Discharging Cycles. Battery Management System (BMS) Overview and Function. Safety, Thermal Management and Lifecycle. State of Charge (SoC) and Depth of Discharge (DoD).

UNIT 4: CHARGING SYSTEMS AND INFRASTRUCTURE

Types of Charging: AC, DC, Level 1/2/3. EVSE (Electric Vehicle Supply Equipment). Charging Standards: CCS, CHAdeMO, GB/T and Type 2. Grid Interface and Load Impact, Wireless and Fast Charging Technologies. Renewable Energy Integration (e.g., Solar Charging).

UNIT 5: EV CONTROL SYSTEMS AND EMERGING TRENDS

Control Systems in EVs: Speed, Torque and Regenerative Braking. Vehicle Dynamics and Drive Cycle Analysis. IoT and AI Applications in EVs (Real-time Monitoring). CAN Communication Protocol in EVs. EV Safety Standards and Certifications (ISO, AIS, IEC). Future of EVs: Solid-State Batteries, V2G (Vehicle to Grid).

List of Suggestive Experiments: -

1. Identification and function study of key EV components (motor, controller, battery, charger).
2. Comparative teardown: ICE vs. EV drivetrain components.
3. Demonstration of force, torque, and speed relationships in electric drive systems.
4. Basic wiring and assembly of a simple EV subsystem (e.g., DC motor + battery + controller).
5. Measurement of mechanical output torque using a small-scale motor setup.
6. Study of the classification of electric vehicles using actual or virtual models.
7. Study and demonstration of a Battery Management System (BMS).
8. Study of different charging connectors: CCS, CHAdeMO, GB/T, Type 2.
9. Smart EV charging simulation using software (e.g., MATLAB/Simulink).
10. Analysis of wireless charging efficiency.

Reference Books: -

1. Electric Vehicle Technology Explained James Larminie & John Lowry.
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Mehrdad Ehsani.