

This document contains Syllabi for TWO courses:

1. "Certificate course in Electric Vehicle Charging System and Photovoltaic Integration"
2. "Certificate course in Operation and Maintenance of Electric Two Wheelers and Charging System"

Course 1: "Certificate course in Electric Vehicle Charging System and Photovoltaic Integration"

Name of the Faculty: **Science and Technology**

Name of the Board: **Ad-hoc Board of Energy Technology**

Duration of the Course: **120 hours**

Module 1 - Introduction: Electric Vehicle

History of EV; Components of Electric Vehicle; Comparison with Internal combustion Engine: Technology; Comparison with Internal combustion Engine: Benefits and Challenges; EV classification and their electrification levels.; EV Terminology

Module 2 - Types of EV Chargers

Electric Vehicle Technology and Charging Equipment's; Basic charging Block Diagram of Charger; Difference between Slow charger and fast charger; Slow charger design rating; Fast charger design rating; AC charging and DC charging; Inboard and off board charger specification; Type of Mode of charger Mode -2, Mode-3 and Mode-4; EVSE associated charge times calculation.

Module 3 - Selection and sizing of fast and slow charger (AC & DC)

AC Pile Charger; DC Pile Charger; EVSE Power Module selection and technical specification; Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module); Communication gateway; Specification of open charge point protocol (OCCP 1.6/2.0); Bharat DC001 & AC001 Charger specification; Communication Interface between charger and CMS (central management system); Payment apps

Module 4 - Selection and sizing of Common types of connectors and applications

Selection of AC charger type-1 , type -2 and type -3; Communication between AC charger and EV; Selection of DC charger connector GB/T, CHAdeMO , CCS-1 and CSS-2; Communication methodology of DC fast chargers; IS/ IEC/ARAI/ standard of Charging topology ,Communication and connectors (IEC 61851-1, IEC 61851-24,62196-2); Selection sizing of Charger connector cable

Module 5 - Public Charging infrastructure / Electrical system design

Assessment of site Location for Public charging station; Selection and Sizing of Distribution transformer; Selection and sizing of HT Equipment (VCB , CT , PT , Metering); Selection and Sizing HT Cables and LT cables; Selection and sizing of Distribution Board / feeders; Sizing calculation of LT and HT cable; Selection and of Compact Substation (CSS for EV CS)/ Power Sub station); Selection of relay and calculation; Preparation of EV Charger Single Line Diagram; Preparation of EV Charger Electric; Assessment of site Location for Public charging station; Selection and Sizing of Distribution transformer; Selection and sizing of HT Equipment (VCB , CT , PT , Metering); Selection and Sizing HT Cables and LT cables; Selection and sizing of Distribution Board / feeders; Sizing calculation of LT and HT cable; Selection and of Compact Substation (CSS for EV CS)/ Power Sub station); Selection of relay and calculation; Preparation of EV Charger Single Line Diagram; Preparation of EV Charger Electric;

Module 6 - EV Charger Integration with Solar Power Plant

Selection of PV module technology; Crystalline technology; Thin film technology; Bi-facial technology; Comparison between PV module technology; Comparison between solar power plant energy out put; Selection and Sizing inverter; Selection and sizing of Cable and Earthing; Ref. Std. IEC IEC 60068-2 (1,2,14,30),IEC 61683,IEC 60227,IEC 60502 IEC 60947 part I,II, III ,IEC 61215

Module 7 - Mathematical Modeling of Vehicle

modeling and simulations based on contemporary requirements in the field of EV.

Reference Books:

- 1) Enge, Per, Nick Enge, and Stephen Zoepf. 2021. Electric Vehicle Engineering. 1st ed. New York: McGraw Hill.
- 2) Car That Could: The Inside Story of Gm's Revolutionary Electric Vehicle by Shnayerson, Michael, ISBN 10: 067942105X ISBN 13: 9780679421054 Publisher: Random House Inc, (1996)
- 3) Electric Vehicle Technology Explained, 2nd Edition, James Larminie, John Lowry, ISBN: 978-1-119-94273-3, Wiley, (2012)
- 4) Objective Electrical Technology, V K Mehta & Rohit Mehta; ISBN : 9788121920971; S. Chand Publishing (2002)
- 5) Enge, Per., Enge, Nick., Zoepf, Stephen. Electric Vehicle Engineering. United States: McGraw-Hill Education, 2021.
- 6) Meade, Norman G.. The Electric Vehicle, Its Construction, Operation and Maintenance. United States: Creative Media Partners, LLC, 2018.
- 7) P. Van den Bossche, G. Maggetto. Safety characteristics of electric vehicles in city traffic. Second edition, CITELEC, Brussels, October 1993 [study report on behalf of the European Commission]
- 8) Electric Vehicle related standards by IEC / BIS / ARAI : e.g.
IEC 718, Electrical equipment for the supply of energy to battery-powered road vehicles, 1992
IEC 783, Wiring and connectors for electric road vehicles 1984
IEC 784, Instrumentation for electric road vehicles, 1984
IEC 785, Rotating machines for electric road vehicles, 1984
IEC 786, Controllers for electric road vehicles, 1984
ISO/DIS 6469.2, Electric Road Vehicles - Specifications , 1994
BS 6287, British Standard Code of Practice for safe operation of traction batteries , 1982.

Course 2: “Certificate course in Operation and Maintenance of Electric Two Wheelers and Charging System”

Name of the Faculty: **Science and Technology**

Name of the Board: **Ad-hoc Board of Energy Technology**

Duration of the Course: **120 hours**

Module 1 - Introduction: Electric Vehicle

History of EV; Components of Electric Vehicle; Comparison with Internal combustion Engine: Technology; Comparison with Internal combustion Engine: Benefits and Challenges; EV classification and their electrification levels.; EV Terminology; Importance of electric vehicles – Advantages.

Module 2 - Components of Electric Two Wheelers

Introduction to various parts of an EV; Electricity basics – In relation with electric vehicles

Module 3 - Instruments for Operation and Maintenance of Electric Vehicle

Use of electrical instruments like multimeter, clamp meter, etc. for analysis of the various parts of an electric vehicle.

Module 4 - Fundamental of Batteries for Electric Vehicles

Batteries Basics for electric vehicles; Average Motor Power Calculations; Driving Cycle; Torque Speed Characteristic of Vehicle.

Module 5 – Fundamentals of Electric Motors and controllers used for Electric vehicles

Chargers, Wiring harness, Connectors, DC-DC converters, electrical connections of the electric scooter

Module 6 – Electric Two-Wheeler Technologies and Variant available in Indian market

Present Scenario of EV – Companies and products available and their specifications, Prospective full time / part time jobs in EV

Calculations of battery charging time, kWh consumption, Motor power, current, DC usage for auxiliaries

Module 7 – Operation and Maintenance of Electric Two Wheelers

Mechanical maintenance of electric vehicles – Chassis, Body parts, Tyres, Brakes, Swing arm, Suspensions, cone set and handle bars, stand, sensors for safety

Battery – Advanced battery systems, BMS, Issues, diagnostics and Solutions

Charging network & Battery Swapping concepts

Reference Books:

- 1) Enge, Per, Nick Enge, and Stephen Zoepf. 2021. Electric Vehicle Engineering. 1st ed. New York: McGraw Hill.
- 2) Car That Could: The Inside Story of Gm's Revolutionary Electric Vehicle by Shnayerson, Michael, ISBN 10: 067942105X ISBN 13: 9780679421054 Publisher: Random House Inc, (1996)
- 3) Electric Vehicle Technology Explained, 2nd Edition, James Larminie, John Lowry, ISBN: 978-1-119-94273-3, Wiley, (2012)
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- 6) Meade, Norman G.. The Electric Vehicle, Its Construction, Operation and Maintenance. United States: Creative Media Partners, LLC, 2018.
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