Lok Jagruti Kendra University
University with a Difference

Diploma
in
Electrical Engineering

LJ Polytechnic

Course Code: 025070603
Electrical Vehicle Technology

Programme / Branch Name	Diploma in Electrical Engineering					
Course Name	Electrical Vehicle Technology				**Course Code**	025070603
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total**
4	0	2	5	50	50	50	150

Legends: L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Knowledge about Fundamentals of Electrical and Electronics Engineering.
- ✓ Power Electronics.
- ✓ Digital Electronics
- ✓ Electrical Machines.

3. Rationale

Now-a-days uses of Electrical Vehicles increases. Electrical diploma holders have to work as Technicians and Supervisors in manufacturing and maintenance of Electric Vehicles. They should be able to prepare components used in EV and HEV, Converters and Inverters Design and their Maintenance, Battery requirement for particular EV and maintenance of it. Essential efforts are made in this course to develop above skills in the students.

4. Objectives

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:

- ✓ Interpret the salient features of electric vehicles.
- ✓ Interpret the salient features of hybrid electric vehicles and fuel cell electric vehicles.
- ✓ Select the batteries for EV & HEV applications.
- ✓ Select the motor for EV & HEV applications.
- ✓ Select the charging for EV & HEV applications

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1	**Introduction to Electric Vehicles**	1.1. Evolution of Electric vehicles 1.2. History of Hybrid vehicles 1.3. Need for Electric Vehicle 1.4. Advantages and Disadvantages of Electric Vehicle 1.5. Major Components of Electric Vehicle 1.6. Classification of Electric Vehicles. 1.7. Problems of Electric Vehicles	• Evolution of Electric Vehicles • Components of EV • Classification of EV • Problems of EV	20	10
2	**Energy Sources and Motor of EV**	2.1 Requirements of EVs energy sources 2.2 Requirement of EV batteries 2.3 Selection of battery 2.4 Deep cycle batteries 2.5 Types of batteries for EVs 2.6 Performance parameters of a battery 2.7 Alternative energy storage devices. 2.8 Requirements of EV motor 2.9 Types of electric motors for EV 2.10 Electric motor comparison. 2.11 Motor Controllers.	• Types of batteries used in EV • Types of motors used in EV • Motor controllers of EV	20	12
3	**Configurations and Performance of EV**	3.1 Configuration with Clutch and without Clutch 3.2 Single Motor and Multiple Motor 3.3 Performance of EVs 3.4 Charging 3.5 Locations and types of chargers 3.6 Transmission in EVs 3.7 Indian Electric Vehicles 3.6.1 Four Wheelers 3.6.2 Three Wheelers 3.6.3 Two Wheelers	• Configurations of EVs • Performance of EVs • Charging • Transmission in EVs • Indian Electric Vehicles	20	12
4	**Hybrid Vehicles**	4.1 Introduction of HEV 4.2 Components of HEV	• Components and working of HEVs	25	14

		4.3 Working of HEV 4.4 Hybridisation 4.5 Drive Configurations of HEVs 4.6 Performance of HEVs 4.7 Hybrid Cars in India.	• Drive configurations of HEVs • Performance of HEVs. • Hybrid cars in India		
5	**Fuel Cell Electric Vehicle**	5.1 Fuel Cell construction 5.2 Fuel Cell working 5.3 Advantages of Fuel Cell 5.4 Introduction about FCEVs 5.5 Components of FCEVs 5.6 Advantages and Disadvantages of FCEVs 5.7 Comparison of ICEVs and EVs 5.8 Comparison of ICEVs, BEVs, HEVs and FCEVs 5.9 Best Electric and Hybrid Cars	• Components of FCEVs • Advantages and Disadvantages of FEVs • Comparison of ICEVs, BEVs, HEVs and FCEVs • Best Electric and Hybrid cars.	15	8
				Total Hours	**56**

6. List of Practical's / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practical / Exercises	Key Competency	Hours
1	To study about Electric Vehicle Evolution.	EV Evolution.	2
2	To study about History of Hybrid Vehicles.	History of HEVs.	2
3	To study about Major Components of Electric Vehicles.	Components of EVs.	2
4	To study about Classification of Electric Vehicles.	Classification of EVs.	2
5	To study about Battery used in Electric Vehicles.	Batteries of EVs.	2
6	To study about Electric motor used in Electric Vehicles.	Motors of EVs.	2
7	To study about Configurations and Performance of Electric Vehicles.	Configuration and Performance of EVs.	2
8	To study about charging of Electric Vehicles.	Charging of EVs.	2
9	To study about Components of Hybrid Electric Vehicles.	Components of HEVs.	2
10	To study about Drive configurations and Performance of Hybrid Electric Vehicles.	Configuration and Performance of HEVs.	2
11	To study of Fuel Cell Electric Vehicle.	Fuel Cell Vehicles.	2
12	To study about EVs and HEVs in India.	EVs and HEVs of India	2

7. Suggested Specification Table for Evaluation Scheme

Unit	Unit Name	Teaching	Distribution of Topics

No.		Hours	According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Introduction to Electric Vehicles	10	30	20	30	5	5	10
2	Energy Sources and Motor of EV	12	30	30	10	10	10	10
3	Configurations and Performance of EV	12	30	30	10	10	10	10
4	Hybrid Vehicles	14	20	30	20	5	5	20
5	Fuel Cell Electric Vehicle	8	40	20	10	10	10	10

Legends: R - Remembering App – Applying E- Evaluating
U - Understanding C – Creating An- Analyzing

8. Textbooks

1) Electric & Hybrid Vehicles by A.K. Babu, Khanna Publishing House, Latest Edition
2) Electric and Hybrid Electric Vehicles by I. Husain, CRC Press, Latest Edition

9. Reference Books

1) Modern Electric Vehicle Technology by Chan C. C. and K. T. Chau, Oxford Science Publication, Latest Edition
2) Hybrid Vehicles and the Future of Personal Transportation by Fuhs, A. E., CRC Press, Latest Edition
3) Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design by Ehsani, M., CRC Press, Latest Edition.

10. Open Sources (Website, Video, Movie)

1) https://www.electrical4u.com/
2) https://www.nptelvideos.in/electrical power
3) https://enwikipedia.org/wiki/Electric_power_transmission
4) https://www.powergridindia.com/