Program	Automobile Engineering	Semester	5
Course Code	20AT54I	Type of Course	L:T:P (104: 52: 312)
Specialization	Electric and Hybrid Vehicle Technology	Credits	24
CIE Marks	240	SEE Marks	160

Introduction:

Welcome to the curriculum for the Specialisation Pathway – **Electric and Hybrid Vehicle Technology**. This specialisation course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur.

Vehicle is a fundamental requirement of modern life, but the CI engines is quickly becoming outdated. Petrol or diesel vehicles are highly polluting and are being quickly replaced by fully electric vehicles. Fully electric vehicles (EV) have zero tailpipe emissions and are much better for the environment and HEVs combine the benefits of high fuel economy and low tailpipe emissions with the power and range of conventional vehicles. The electric vehicle revolution is here, and you can be part of it. In this pathway the student will learn different subsystems in electrical & hybrid vehicle and service or troubleshoot it for any problems identified.

You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn different subsystems in electrical & hybrid vehicle and service or troubleshoot it for any problems identified.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an **Internship** in an organisation working on **Electric and hybrid vehicles** or take up a **Project** in the related field. After the completion of your Diploma, you shall be ready to take up roles like Electric/hybrid vehicle technician, Shopfloor technician, Production In-charge and also can become Entrepreneur in the related field and more.

Pre-requisite

Before the start of this specialisation course, you will have prerequisite knowledge gained in the first two years on the following subjects:

1st year -Engineering Mathematics, Communication Skills, Computer Aided Engineering Drawing, Statistics & Analysis, Basic IT Skills, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Mechanical Science & Engineering and Automotive Engines.

2nd year-Automobile Chassis and Transmission System, Automotive Electrical System, Thermal Engineering and Engine Testing, Automotive Manufacturing Processes, Advanced Automotive Systems, Design and Drafting, Vehicle Body Engineering and Dynamics and Fuel and Pollution Control. In this year of study, you shall be applying your previous years learning along with specialised field of study into projects and real-world applications.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Instruction to course coordinator

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for industrial/Service center/showroom visits.
7. Cohort owner shall maintain and document the industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom can augment or use for supplementally teaching on line courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademic, SWAYAM, etc.
10. Report should be maintained for industrial/field visit, such report shall be considered as industrial assignment.

Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Analyze the different architectures in Electric and Hybrid Electric Vehicles, technologies and test and repair to ensure that it provides the necessary output/result as required.
CO-02	Analyze the use of different energy storage systems used in electric vehicles, their control techniques, and select appropriate energy balancing technology.
CO-03	Demonstrate subsystems in electrical & hybrid vehicle and service or troubleshoot it for any problems identified.
CO-04	Explore different EV charging stations, its control and configurations and decide suitable station for particular EV.
CO- 05	Test, diagnose and service the air conditioning system of a given EV.

Detailed course plan

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
1	1	1	1	**Introduction to the course.** About Specialization – Future-Companies and Service sectors in India and outside India, Career opportunities. History of electric vehicle. Components of electric vehicle.	2		2	**Indian and global scenario:** Technology Scenario. Market Scenario – Market overview, market trends. Benefits and Challenges of EV's. The future scope of electric vehicles.	2		1
	1	1	2	**Policies and Regulations:** Polices in India – Incentives, PLI (Production Linked Incentive) scheme, battery swapping policy, special E-mobility zone. *Using Web browser, Practice to search and applying for PLI scheme.*	2		2	**Regulations for EV in India:** Need for regulation and standards, ARAI Regulations and standards, Category and Type of Approval Required for EVs.	3		
	1	1,2	3	**RTO Regulations for EVs:** Electrical car registration and road tax, Driving licence policies for EV, Number plate policy for EV, RTO permission for Advertising on EVs.	2		2	Comparison- EV with IC engine vehicles technology, EV Configuration. EV classification and EV Terminology. Video demonstration.	2		1

	1	1,2	4	**Basic Vehicle Performances:** Introduction, Tractive Effort, Vehicle Resistance-Rolling Resistance Force, Aerodynamic Drag, Gradient resistance. *Calculation of the Acceleration, Range, Gradeability and Maximum speed of BEV's*	2		2	*Calculation of the Acceleration, Range, Gradeability and Maximum speed of BEV's*			3
	1		5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	1		6	**Industry Class on environmental impact analysis and economical analysis of EV +Industry assessments**	2		3				
2	1	2,4	1	**PEER Discussion on Industry Assignment**		4		*Calculation of the Acceleration, Range, Gradeability and Maximum speed of BEV's*			3
	1,2	2,4	2	**Vehicle power plant:** Compare Typical performance characteristics of gasoline engines and Typical performance characteristics of electric motor for traction (*By showing the graph, traction motor characteristics*) **Battery Technology:** Types of batteries - Lead Acid, Lithium Ion, Lithium Potassium, NiMH (Nickel metal hydride battery), Aluminium air.	2		2	Battery terminologies - SoC, DoD, SoH. *Battery charging and discharging calculation.* *Cell selection and sizing.* *Battery layout design.* *Battery pack configuration.*			3
	2	2,4	3	Battery selection criteria. Battery pack construction. Lithium battery manufacturing process.	2		2	*Cell selection and sizing, handling cells, understanding cell charging and discharging curves.*			3

				Practice to build battery pack with series and parallel configuration.				*Voltage, temperature and current Measurement.*			
	2	2,4	4	**Battery Management System:** Need of BMS. Functions of BMS. BMS building blocks. Mode of power. Design consideration of BMS. Battery cell balancing. Balancing methods – Active cell and Passive cell balancing.	2		2	*Conduct an experiment to measure Voltage, current and temperature with BMS.* *Balance cells with external circuits – Practical/Video demonstration.*			3
	2		5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	2		6	**Industry Class EV battery management system +Industry assessments**	2		3				
3	2	2,4	1	**PEER Discussion on Industry Assignment**		4		Battery degradation. Lifespan for EV battery. Extend lifespan for EV battery. Safety of EV battery.			3
	2	2,4	2	*Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging.*			4	*Check battery assembly sensors for proper functioning*			3
	2	2,4	3	Battery Disposal, Storing Batteries, Battery recycling. *Diagnose, repair, and test high voltage battery systems.*	1		3	*Diagnose, repair, and testing of EV battery controls.*			3
	2	2,4	4	**Fuel Cells:**	3		1	Hydrogen production methods – Electrolysis, POX reforming.	2		1

				Fuel cell technologies: Operating principle -Proton exchange membrane. Solid oxide fuel cell.				*Demonstration of (video) various hydrogen production methods.*			
	2		5	**CIE 1– Written and practice test**				**Assessment Review and corrective action**			3
	2		6	**Industry Class battery maintenance +Industry assessments**	2		3				
4	1	1,2,4	1	**PEER Discussion on Industry Assignment**		4		Hydrogen storage - Cryogenic liquid storage. Hydrogen Transportation. *Demonstration of (video) hydrogen storage and transport.* Hydrogen as Alternate fuel for motor vehicles.	2		1
	1	1,2,4	2	**Fuel Cell Electric Vehicle** • **Fuel Cell Electric Vehicle-** Working of hydrogen engine **https://auto.economictimes.indiatimes.com/news/passenger-vehicle/cars/investment-in-hydrogen-fuel-falls-20-in-2020-fuel-cell-vehicle-demand-to-be-fragile/82575173** • **Hydrogen Fuel Cell Bus** **Filling up of fuel cell electric vehicle**			4	**Electric Vehicle Architecture**: Types of EVs – Battery EV, Hybrid EV, Photovoltaic EV, Fuel cell, Solar operated EV.	2		1

	1	1,2,4	3	Electric vehicle architecture powertrains - BEV, HEV, PHEV, FCEV, Solar.	2		2	**Electric Vehicle Chassis and Body Design:** Body/chassis requirements. Body/chassis layout. EV body material selection.	1		2
	1	1,2,4	4	Effect of weight on efficiency and range. Comparison of different materials (features and safety). Body stability.	2		2	Suspension for EVs – Types – Working principle - Electric, Electromagnetic, Air suspension.			3
	1		5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	1		6	**Service station Visit**			5				
5	3	1,2,4	1	**PEER Discussion on Industry Assignment**		4		**Brakes for EVs** – Types - Regenerative braking, Plugging type braking. Dynamic braking - Working principle- Advantages – Disadvantages.	2		1
	3	1,2,4	2	Diagnose, repair, and test regenerative braking.			4	Comparison between conventional and regenerative braking. *Field visit/Video demonstration on regenerative braking.*	1		2
	3	1,2,4	3	**Steering System:** Construction and working of Electrical Power steering.	2		2	Perform Electronic Power Steering Identification of EPS components and related sensors.			3
	3	1,2,4	4	Fault diagnosis of electrical power steering.	1		3	Troubleshooting and remedies for electrical power steering.			3
	3		5	**CIE 2– Written and practice test**				**Assessment Review and corrective action**			3
	3		6	**Showroom Visit (EV and Hybrid vehicle)**			5				
6	3	4	1	**PEER Discussion on Industry Assignment**		4		**Electric Propulsion System:** Block diagram.	2		1

								DC motor drives – Principle of operation and performance – Separate shunt motor, series motor and cumulative compound wound field DC motors.			
	3	4	2	Induction motor drives - Principle and working.	2		2	Testing and servicing of DC motor drives.			3
	3	4	3	Permanent magnet BLDC drives – Principle of operation – Advantages and disadvantages. Video demonstration on working of BLDC.	2		2	Control of BLDC motor drives – Block diagram: Torque control. Speed control.	2	1	
	3	4	4	Switched Reluctance Motor drives (SRMs) – Principle of operation with block diagram.	2	1	1	Basic magnetic structure of SRM-6/4 SRM, 8/6 SRM	2		1
	3	2,4	5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	3		6	**Industry Class on BLDC drives +Industry assessments**	2		3				
7	3	1	1	**PEER Discussion on Industry Assignment**		4		Fault diagnosis of SRM - Field visit.	1		2
	3	1	2	Component sizing. Physical locations. Mechanical connection of motor. Electrical connection of motor.	2		2	Selection and sizing of motor. RPM and Torque calculation of motor.	2		1
	3	1	3	**Configuration of EVs:** Illustration of general EV configuration.	2		2	1. Conventional driveline with multi-gear transmission and clutch. 2. Single gear transmission.	2		1
	3	1	4	1. Integrated fixed gearing differential. 2. Separate motor and fixed gearing drive shaft.	2	2		1. Direct drive. 2. Separating wheel motor drive.	1		2

								Traction motor characteristics with graph.			
	3		5	**CIE 3– Written and practice test**				**Assessment Review and corrective action**			3
	3		6	**Industry Class on** multi-gear transmission and clutch. **+Industry assessments**	2		3				
8	3	1	1	**PEER Discussion on Industry Assignment**		4		**Hybrid Electric Vehicles:** Introduction. Concept of hybrid electric drive train. Types of HEVs, Torque-Coupling, speed coupling, torque and speed coupling parallel HEV.	2		1
	3	1	2	Complex HEVs, Dynamic Response of HEV. Degree of Hybridization. **Architectures of Hybrid Electric Drive Train:** 1.Series (electrically coupling)-Operation modes – Advantages and disadvantages. 2. Parallel (mechanical coupling)-Operation of drive train configuration with speed coupling.	2		2	3. Series-parallel (mechanical and electrical coupling). 4. Complex (mechanical and electrical coupling).	2		1
	3	1	3	**Power flow Control:** 1. Power flow control in series Hybrid 2. Power flow control in series Hybrid **3.** Power flow control in series-parallel Hybrid 4. Power flow control in complex Hybrid	2		2	Comparison between series-parallel and complex drive drain. (Video demonstration.)			3

	3	1	4	**Vehicle Control Unit:** Introduction - Development process-Software – Hardware.	2		2	Data management. Sensor integration. CAN communication. Interfaces.	1		2
	3		5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	3		6	**Industry Class VCU +Industry assessments**	2		3				
9	4	2	1	**PEER Discussion on Industry Assignment**		4		**EV Charging Technologies:** Classification of different charging technology for EV charging station.	3		
	4	.2	2	Introduction to Grid-to-Vehicle, Vehicle to Grid (V2G) operations.	2		2	Vehicle to Buildings (V2B) or Vehicle to Home (V2H) operations. Video demonstration/Field visit.			3
	4	2	3	Bi-directional EV charging systems, energy management strategies used in hybrid and electric vehicle.	2		2	Wireless power transfer (WPT) technique for EV charging. Video demonstration/Field visit			3
	4	2	4	Diagnose, repair, and test vehicle charging interface/infrastructure.			4	Operate standard chargers and determine charging time under various conditions.			3
	4		5	**CIE 4– Written and practice test**				**Assessment Review and corrective action**			3
	4		6	**Industry Class** V2B and V2H **+Industry assessments**	2		3				
10	4	2,4	1	**PEER Discussion on Industry Assignment**		4		Requirement of charging inputs for different types of chargers.			3
	4	2,4	2	Diagnosis and remedy for charger not responding, charger not delivering expected current.			4	Components of charging station, block diagram of charging station. Terms associated with EV charging station.			3
	4	4	3	**Testing and adjustment of EV sub-systems:**			4	Identify Proximity sensor, Parking sensor, crash sensor, Rain and Light Sensor.			3

				Identify different location of various ECUs in vehicle.							
	4	4	4	Practice on Recognition of EV symbols.		4		Practice of safety precautions and procedures to be observed while working with EV Kit and related tools.			3
	4	4	5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	4	4	6	**Visit to charging station**			5				
11	4	2	1	**PEER Discussion on Industry Assignment**		4		Practice on measuring voltage drop.			3
	4	2	2	Disassemble and assemble various components of EV using appropriate fasteners and hand tools.			4	Trace the wiring circuit of lighting system.			3
	4	2	3	Troubleshoot and repair accelerator pedal.			4	Diagnosis and remedy for charger not responding, charger not delivering expected current.			3
	4	2	4	Troubleshoot and repair brake.			4	Drive an EV following safety rules for driving. **EV Safety:** Preventive measures for electrical accidents & steps to be taken in such accidents.			3
	4		5	**CIE 5– Written and practice test**				**Assessment Review and corrective action**			3
	4		6	**Industry Class** safety rules to be followed in EV **+ Industry assessments**	2		3				
12	5	2,4	1	**PEER Discussion on Industry Assignment**		4		**Air Conditioning System Servicing:** Identification of air conditioning system components.			3

	5	2,4	2	Working of Air-conditioning ECU			4	Preventive maintenance of FATC/HVAC machine.			3
	5	2,4	3	Adjustment of AC inside the cabin. Blower speed control and ventilation systems.			4	Identification and testing of ambient temperature sensor, air temperature sensor- Working.			3
	5	2,4	4	Testing and servicing of Air-conditioning system.			4	Testing and servicing of Air-conditioning system.			3
	5		5	**Developmental Weekly Assessment**				**Assessment Review and corrective action**			3
	5		6	**Industry Class on** HVAC **+Industry assessments**	2		3				
13				**Internship** **a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.** **c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.**		4		**Project** **a)Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **b)Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **c)Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**			

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 7	CIE 3– Written and practice test	4	30
Week 9	CIE 4– Written and practice test	4	30
Week 11	CIE 5– Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

* The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Sample Questions For CIE-1

Programme	**Automobile Engineering**	**Semester**		**V**	
Course	**Electric and Hybrid Vehicle Technology**	**Max Marks**		**30**	
Course Code	**20AT541**	**Duration**		**4 hours**	
Name of the course coordinator					
Note: Answer one full question from each section.					
Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
Section-1 (Theory) – 10 marks					
1.a)	Compare, Draw and explain the ideal traction power plant characteristics in EV and IC vehicles.	L3	1	1	10
b)	Justify how rolling resistance effect the tire road contact in EV system.	L4	1	1	10
2.a)	There are few factors which effect the performance of batteries used in EV's. Explain with proper justification.	L3	2	2,4	10
b)	Is fuel cell and flywheel being energy source element in electric and hybrid EV's, Justify.	L4	2	2,4	10
Section-2 (Practical) - 20 marks					
3)	Construct a model to build battery pack with series configuration.	L3	2	2,4	20
4)	Conduct the experiment to test voltage, temperature and configuration current for EV	L3	2	2,4	20

Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)

Programme : AUTOMOBILE ENGINEERING	**Semester : V**
Course : Electric and Hybrid Vehicle Technology	**Max Marks : 100**
Course Code : 20AT54I	**Duration : 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)	Compare, Draw and explain the ideal traction power plant characteristics in EV and IC vehicles.	L3	1	10
b)	In fuel cell in hydrogen production method using electrolysis, does electrolysis produce pure hydrogen. Justify your answer using proper explanation (draw the sketch if required).	L4		10
2.a)	There are different drive train configurations in EV, with neat sketch explain any 2 types.	L3		10
b)	Justify how rolling resistance effect the tire road contact in EV system.	L4		10
	Section-2			
3.a)	There are few factors which effect the performance of batteries used in EV's. Explain with proper justification.	L3	2	10
b)	Is fuel cell and flywheel being energy source element in electric and hybrid EV's, Justify.	L4		10
4.a)	Is there a need for considering the electrical and mechanical constrains while sizing an electric machine for EV. Justify your answer	L4		10
b)	"The batteries take up a lot of space in the EV car" Is this statement true or false. Justify your answer. How Batteries packs are placed in EV, Explain with neat sketch.	L3		10
	Section- 3			
5.a)	Enlist the architecture of hybrid electric drive train and explain with neat sketch the configuration of Series hybrid electric drive train.	L3	3	10
b)	I.C.E is not decoupled with the wheels; so, it cannot be charged at standstill in parallel hybrid electric vehicle. Is the above statement true, Justify your answer. Explain the different power flow control modes of a typical parallel hybrid system with the help of block diagrams.	L4		10

6.a)	Compare Hybrid vehicle with conventional vehicle. Dissect the environmental importance of EV and their social impacts.	L3		10
b)	The Vehicle System Controller is the level of decision to assess the torque requirements of the engine, generator, ICE, and mechanical brake according to the torque demand of the driver" How does this Vehicle System Controller work in HEV	L4		10
	Section-4			
7.a)	Energy management system improves the fuel economy and optimize the performance of HEV, is this statement true? Elaborate energy management system and issues of energy management strategies of EHV	L4	4	10
b)	If the charger not delivering expected current how to Diagnosis and give remedial solution.	L3		10
8.a)	Write a flowchart the procedure to determine charging time under various conditions.	L3		10
b)	If the mechanic has to diagnose a hybrid vehicle's ground fault, which tool is used to test the high voltage in hybrid system. What actions are needed to disable the high voltage HV circuit?	L4		10
	Section-5			
9.a)	Write a detailed procedure for testing of ambient temperature sensor. How does it work.	L3	5	10
b)	In the car, the AC has kept ON but the driver notices that no air coming from the vent, what might be the problem and how to solve it.	L4		10
10.a)	Write a detailed procedure followed in testing and servicing of Air-conditioning system.	L3		10
b)	When you're driving and the air suddenly goes from comfortably cool to horribly hot, what might be the problem and how to solve this.	L4		10

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
Problem Statement	The driver has noticed a problem in the power steering of the vehicle, he is finding it difficult to turn wheel/ stiff wheel. What might be the problem, give the remedial solution by troubleshooting or servicing it.	
1	Analyzing the problem	10
2	Fault finding	20
3	Assembly and disassembly	20
4	Result/ solution to the problem	30
5	Viva voce	20
Total		**100**

References:

1	Modern Electric, Hybrid Electric and Fuel Cell Vehicles by Mehrdad Ehsani, Yimin Gao and Ali Emadi, CRC Press.
2	Electric Motors and Drives BY AUSTIN HUGHES and BILL DRURY
3	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, by Mehrdad Ehsani, Yimin Gao, Stefano Longo and Kambiz Ebrahimi
4	Hybrid Electric Vehicles, Principles and Applications with practical perspective: Chris Mi, Wiley publications
5	Modern Electric, Hybrid Electric and Fuel cell vehicles, Fundamentals, theory and Design: Mehrdad Ehasani. CRC press.
6	Electric and Hybrid Vehicles by Tom Denton, .Routledge, 2016.

Tools and Equipment:

1. Electric Vehicle – 2-wheeler.
   Motor Power 1200 – 1800 W
   Motor Type – BLDC
   Drive Type - Hub Motor
   Battery Type - Li-ion
   Battery Capacity 72 V/26 Ah

2. Electric Vehicle – 4-wheeler.

   Engine Type – 3 Phase Induction Motor

   Max Power – 25.5 bhp @3750 rpm

   Max Torque – 53 Nm@ 0-3500 rpm

3. Hybrid Electric Vehicle – 4-wheeler.

4. Battery testing kit for voltage 6 V to 60 V.

5. Lithium Battery Pack.

   Nominal Voltage – 12.8 V

   Nominal Current – 32 A

6. Lithium-Ion Battery Charger.

   Input Voltage: 180-250 V AC
   Output Voltage: DC 54.6V
   Application: Suitable for 48V E-Bike Batteries
   Output Current: 3-4 A

7. Hydrogen Fuel Cell.
8. Electrical Power Steering Kit.
9. Brushless DC Motor.
10. Electric Vehicle Control Unit.
11. Car Air Conditioning Kit