



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE04IAA011

Course / Subject Name : Fundamentals of Electric Vehicles

w. e. f. Academic Year:	A.Y. 2024-25
Semester:	4 th
Category of the Course:	Core Course

Prerequisite:	Basics of Mechanical Engineering & Basics of Electrical Engineering
Rationale:	The course content outlined has been designed to equip learners with the knowledge, skills, and practical experience necessary to work safely and effectively in an automotive repair and maintenance setting. The course covers a range of topics, from safe working practices to troubleshooting procedures, ensuring that learners are equipped with a broad set of skills and knowledge to succeed in the industry.

Course Outcome:

Sr. No.	CO Statement	Topics Mapped	% weightage
CO-1	Explain and apply safe working practices in an automotive repair and maintenance setting, minimizing the risk of injury or harm to themselves or others	1	5%
CO-2	Demonstrate an understanding of environmental and sustainability best practices and apply them to automotive repair and maintenance tasks	1	5%
CO-3	Apply knowledge of petrol and diesel engine operation to identify and diagnose engine problems and perform regular maintenance.	1	20%
CO-4	Check and maintain batteries and jump-start vehicles safely and efficiently.	1	10%
CO-5	Perform troubleshooting procedures to diagnose and resolve vehicle issues quickly and accurately.	1	20%
CO-6	Explain the basic principles of electricity and circuits.	2	20%
CO-7	Describe the operation and function of automotive sensors.	3,4	20%

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (Total Course Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
45	0	60	5	100	0	0	0	100



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Automotive Fundamentals Safe working practices, Maintain environmental and sustainability best practices, Apply knowledge of Petrol and diesel engine operation, Check and maintain batteries and Jump start vehicles, and Perform Troubleshooting procedures.	27	26
2.	Automotive Electricals & Electronics Basics of electrical circuits, Automotive Electrical Fundamentals, Troubleshoot and Rectify basic Electrical Circuits.	27	26
3.	Automotive Sensor Technology Types of Sensors used in an Automobile, Working Principle of the Sensors, and their Applications.	26	25
4.	Electric Vehicle CarTrain Operations of different sensors, the signals generated and fault diagnosis	25	23
	Total	105	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	25	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze E: Evaluate and C: Create and above Levels (Revised Bloom's Taxonomy)

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE05IAA011

Course / Subject Name : Introduction to Electric & Hybrid Vehicles

w. e. f. Academic Year:	A.Y. 2024-25
Semester:	5th
Category of the Course:	Core Course

Prerequisite:	Fundamentals of Electric Vehicles
Rationale:	This course is designed to provide students with a thorough understanding of automotive electrical systems and the skills needed to diagnose and repair common issues. Through a combination of lectures, hands-on exercises, and real-world case studies, students will understand the working of Electric & Hybrid Vehicles along with various types of Motors being used in the Vehicles.

Course Outcome:

Sr. No.	CO Statement	Topics Mapped	% weightage
CO-1	Understand the design and function of electric motors used in EVs, including their characteristics, performance parameters, and applications in the automotive industry.	2	15%
CO-2	Understand the layout and architecture of Electric Vehicles, including the powertrain design.	1	15%
CO-3	Evaluate the impact of electric vehicle design on performance, efficiency, and safety	1	15%
CO-4	Understand the layout and architecture of Hybrid Vehicles, including the powertrain design.	3	15%
CO-5	Evaluate the impact of hybrid vehicle design on performance, efficiency, and safety	3	15%
CO-6	Understand the construction of Inverter, Rectifier and Converter.	4	10%
CO-7	Demonstrate the working of Inverter, Rectifier and Converter.	4	5%

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (Total Course Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
45	0	60	5	100	0	0	0	100



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE05IAA011

Course / Subject Name : Introduction to Electric & Hybrid Vehicles

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Introduction to Electric Vehicles Basic electrical circuits and components, Technology comparison with ICE. Different layouts of drivetrains in EV.	27	26
2	Motors used in Electric Vehicles Types of Motors, Working Principles, Performance Characteristics and Applications of Motors in Electric & Hybrid Vehicles	26	24
3	Power Electronics Working, Construction and Demonstration of rectifiers and inverter and Power Converters used in Electric Vehicles.	25	24
4	Hybrid Vehicle Technology Hybrid Vehicle – Safety, Design, Architecture & Efficiency, Different layouts of the drivetrain in Hybrid Vehicles	27	26
	Total	105	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
5	30	20	20	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze E: Evaluate and C: Create and above Levels (Revised Bloom's Taxonomy)



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE06IAA011

Course / Subject Name : Electric & Hybrid Vehicle Systems

w. e. f. Academic Year:	A.Y. 2024-25
Semester:	6th
Category of the Course:	Core Course

Prerequisite:	Basics of Electrical Engineering and Introduction to Electric & Hybrid Vehicles
Rationale:	The course content has been designed to equip learners with the knowledge and skills about various systems equipped in the Electric & Hybrid Vehicles. The course covers various topics such as Batteries of Electric & Hybrid Vehicles, Charging Stations & Regenerative Braking Systems along with Advanced Driver Assistance Systems.

Course Outcome:

Sr. No.	CO Statement	Topics Mapped	% weightage
CO-1	Understand the chemical composition of batteries, their construction and application.	1	15%
CO-2	Evaluate various types of Batteries used in Electric & Hybrid Vehicles based on their composition, energy density and arrangement.	1	15%
CO-3	Understand the working of Regeneration during braking application and various modes of regeneration.	2	10%
CO-4	Identify various types of Charging Sockets used for charging an Electric and Hybrid vehicle.	3	5%
CO-5	Understand the workings of different types of charging stations. Evaluate the effect of each station on the health of the battery.	3	10%
CO-6	Understand the working of various types of sensors used in ADAS system.	4	15%
CO-7	Describe the operation and function of sensors used in ADAS.	4	20%
CO-8	Perform the recalibration of sensors used in ADAS enabled vehicle.	4	10%

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (Total Course Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
30	0	60	4	100	0	0	0	100



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Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE06IAA011

Course / Subject Name : Electric & Hybrid Vehicle Systems

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Battery and Battery Management System Types of batteries, their comparison, applications and causes of failures. Battery Management Systems (BMS), its types and applications.	23	26
2	Regenerative Braking System Conversion of Kinetic Energy to Electrical Energy, Modes of Regeneration, Efficiency and Applications.	22	24
3	Charger and Charging Stations Introduction to different Chargers and Sockets, their classification, and applications. Different types of Charging Stations and their applications.	23	26
4	Advance Driver Assistance System Introduction to ADAS, its sensors, various features in ADAS like ACC, Lane Assist, etc. Application of various sensors in ADAS and connected cars. Recalibration of sensors used in ADAS enabled vehicle.	22	24
Total		90	100

Suggested Specification table (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	10	10	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze E: Evaluate and C: Create and above Levels (Revised Bloom's Taxonomy)



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE07IAA011

Course / Subject Name : Working on various Electric and Hybrid Vehicles

w. e. f. Academic Year:	A.Y. 2024-25
Semester:	7th
Category of the Course:	Core Course

Prerequisite:	Introduction to Electric & Hybrid Vehicles.
Rationale:	The course content outlined has been designed to equip learners with the knowledge, skills, and practical experience necessary to work safely and effectively in an automotive repair and maintenance setting. The course covers a range of topics, from safe working practices to troubleshooting procedures, ensuring that learners are equipped with a broad set of skills and knowledge to succeed in the industry.

Course Outcome:

Sr. No.	CO Statement	Topics Mapped	% weightage
CO-1	Understand the systems and sub-systems of a two-wheeler electric vehicle.	1	5%
CO-2	Perform the dismantling and assembly of a two-wheeler electric vehicle.	1	10%
CO-3	Understand the systems and sub-systems of a three-wheeler electric vehicle.	2	5%
CO-4	Perform the dismantling and assembly of a three-wheeler electric vehicle.	2	15%
CO-5	Understand the systems and sub-systems of a four-wheeler electric vehicle.	3	5%
CO-6	Perform various sorts of practicals on a four-wheeler electric vehicle.	3	15%
CO-7	Understand the systems and sub-systems of a four-wheeler hybrid vehicle.	3	5%
CO-8	Perform various sorts of practicals on a four-wheeler hybrid vehicle.	3	20%
CO-9	Understand the working of an On-Board Diagnostic Tool and usage of the same to identify the faults in an electric and hybrid vehicle.	4	10%
CO-10	Troubleshoot various problems occurring in an electric and hybrid vehicle by identifying the fault codes using diagnostic tool.	4	10%

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Program Name: Bachelor of Engineering

Level: BE-Minor/Hons.

Branch: IAA

Course / Subject Code : BE07IAA011

Course / Subject Name : Working on various Electric and Hybrid Vehicles

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
30	0	90	5	100	0	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Working on a Two-Wheeler Electric Vehicle Design of two-wheeler EV, brief on systems, subsystems, hands-on exposure in dismantling and assembling two-wheeler EVs.	25	21
2	Working on a Three-Wheeler Electric Vehicle Design of three-wheeler EV, brief on systems, subsystems, hands-on exposure in dismantling and assembling three-wheeler EV.	35	29
3	Working on a Four-Wheeler Electric and Hybrid Vehicle Design of four-wheeler EV and HV, brief on systems, subsystems, hands-on exposure to four-wheeler EV and HV.	35	29
4	Diagnostics & Troubleshooting of an Electric Vehicle Use the On-Board Diagnostic (OBD) Tool to identify faults in an electric and hybrid vehicle. Troubleshoot the faults occurring in an electric and hybrid vehicle.	25	21
Total		120	100

Suggested Specification table (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	10	20	20	20

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze E: Evaluate and C: Create and above Levels (Revised Bloom's Taxonomy)
