



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Automobile Engineering

Subject Code: BE05002051

Subject Name: Powertrain and Hybrid Vehicles

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Elective Course - 02

Prerequisite:	Basics of Automobile Systems
Rationale:	This course introduces the fundamentals of conventional, hybrid, and electric powertrain systems used in modern vehicles. It focuses on components, system operation, and design considerations affecting performance, efficiency, and emissions. The course also covers hybrid vehicle technologies, energy management, and optimization techniques. It prepares students to analyze and design sustainable and efficient automotive powertrain systems.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Explain the types, components, and working of conventional, hybrid, and electric powertrain systems, and their design considerations with respect to performance, efficiency, and cost.	17
CO-2	Describe the types, components, architecture, advantages, and challenges of hybrid vehicles.	27
CO-3	Analyze power train components, power electronics, and control systems in conventional and hybrid vehicles to optimize performance, efficiency, and reliability	22
CO-4	Analyze energy management strategies, regenerative braking systems, performance, and efficiency of hybrid vehicles for optimized operation.	23
CO-5	Design power train systems considering performance, efficiency, cost, weight, and integration using appropriate component selection and optimization techniques.	11

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA (I)	PBL (I)	ESE (V)	
45	00	30	15	90	03	70	30	20	30	50	200

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Power Train Systems: Types of Power Train Systems Conventional power train systems, Hybrid power train systems, Electric power train systems,	08



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	<p>Comparison of power train systems</p> <p>Components of Power Train Systems</p> <p>Engine: types, configurations, and characteristics</p> <p>Transmission: types (manual, automatic, CVT), gear ratios, and shifting mechanisms</p> <p>Drivetrain: shafts, gears, differentials, and axles</p> <p>Other components: clutch, torque converter, and propeller shaft</p> <p>Power Train System Design Considerations</p> <p>Vehicle performance requirements: acceleration, top speed, and gradeability, Fuel efficiency and emissions regulations, Power train system efficiency and losses, Design trade-offs: performance vs. efficiency vs. cost</p> <p>Case Study: Conventional Power Train System</p> <p>Example: Front-engine, rear-wheel drive (FR) power train system</p> <p>Components: engine, manual transmission, propeller shaft, differential, and axles</p> <p>System operation: power flow, gear shifting, and torque transmission</p> <p>Design considerations: gear ratios, clutch sizing, and system efficiency</p>	
2	<p>Hybrid Vehicle Fundamentals:</p> <p>Types of Hybrid Vehicles</p> <p>Hybrid Electric Vehicles (HEV): ICE + electric motor, no external charging</p> <p>Plug-in Hybrid Electric Vehicles (PHEV): ICE + electric motor, external charging</p> <p>Electric Vehicles (EV): battery-powered electric motors only</p> <p>Comparison: HEV, PHEV, EV - efficiency, emissions, range, cost</p> <p>Components of Hybrid Vehicles</p> <p>Electric motor: types (AC, DC, induction, permanent magnet), characteristics</p> <p>Battery: types (lead-acid, lithium-ion, nickel-metal hydride), sizing, management</p> <p>Engine: ICE types, downsizing, optimization for hybrid operation</p> <p>Power electronics: motor controllers, inverters, converters</p> <p>Other components: regenerative braking, energy recovery systems</p> <p>Hybrid Vehicle Architectures</p> <p>Series hybrid: electric motor drives wheels, ICE generates electricity</p> <p>Parallel hybrid: ICE and Electric motor both drive wheels</p> <p>Series-parallel hybrid: combination of series and parallel architectures</p> <p>Examples: Toyota Prius (series-parallel), Honda Civic Hybrid (parallel)</p> <p>Advantages and Challenges of Hybrid Vehicles</p> <p>Advantages: with respect to fuel efficiency, emission and energy recovery</p> <p>Challenges: with respect to cost, weight, battery and infrastructure</p>	12
3	<p>Power Train Components:</p> <p>Clutch and Transmission Systems</p> <p>Clutch: Types (friction, hydraulic, electromagnetic), operation, and design</p> <p>Manual transmission: Gear ratios, Shifting mechanisms, Synchronization</p> <p>Automatic transmission: Types (torque converter, dual clutch), Operation, and Control</p> <p>Continuously Variable Transmission (CVT): types, operation, and advantages</p> <p>Drivetrain Components</p> <p>Shafts: Types (propeller, half-shaft), Design, and Materials</p> <p>Gears: Types (spur, helical, bevel), Gear ratios, and Tooth</p> <p>Differentials: Types (open, limited slip, locking), Operation,</p> <p>Axles: Types (live, dead, hybrid), and Materials</p> <p>Power Electronics and Control Systems</p> <p>Power electronics: Motor controllers, Inverters, Converters, and Switching devices</p>	10



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	<p>Control systems: Engine management, Transmission control, and Hybrid control units</p> <p>Sensors and actuators: Types, Operation, and Integration with control systems</p> <p>Communication protocols: CAN bus, LIN bus, and Flex Ray</p> <p>Case Study: Power Train Components in Hybrid Vehicles</p> <p>Example: Toyota hydride powertrain components</p> <p>Components: Electric motor, Battery, Engine, Transmission, and Power electronics</p> <p>System operation: Power flow, Energy management, and Regenerative braking</p> <p>Design considerations: Component sizing, Efficiency, and Packaging</p>	
4	<p>Hybrid Vehicle Operation:</p> <p>Energy Management Strategies</p> <p>Overview of energy management in hybrid vehicles</p> <p>Strategies:</p> <p>Rule-based approaches (e.g., thermostat control), Optimization-based approaches (e.g., dynamic programming), Real-time optimization techniques (e.g., model predictive control)</p> <p>Energy management system components</p> <p>Battery state-of-charge (SOC) management, Engine operating point optimization, Electric motor torque management</p> <p>Regenerative Braking and Energy Recovery</p> <p>Regenerative braking: Principles, Benefits, Types of regenerative braking (Series regenerative braking Parallel regenerative braking)</p> <p>Energy recovery systems: Battery charging, Supercapacitor charging, Regenerative braking control strategies</p> <p>Hybrid Vehicle Performance and Efficiency</p> <p>Hybrid vehicle performance metrics: Acceleration, Top speed, Gradeability</p> <p>Efficiency analysis: Well-to-wheel efficiency, Tank-to-wheel efficiency</p> <p>Factors affecting hybrid vehicle efficiency: Engine efficiency, Electric motor efficiency, Battery efficiency, Regenerative braking effectiveness</p> <p>Comparison of hybrid vehicle efficiency with conventional vehicles</p> <p>Case Study: Hybrid Vehicle Operation</p> <p>Example: Toyota hydrides hybrid vehicle operation</p> <p>Analysis of energy flow and management:</p> <p>Low-speed operation (electric motor), Medium-speed operation (engine + electric motor), High-speed operation (engine), Regenerative braking and energy recovery</p> <p>Evaluation of performance and efficiency: Fuel economy, Emissions reduction</p>	10
5	<p>Power Train Design and Analysis:</p> <p>Power Train System Design Considerations</p> <p>Design objectives: Design based on Performance (acceleration, top speed, gradeability), Efficiency (fuel economy, emissions), Cost and weight, Packaging and Integration.</p> <p>Design parameters: Engine selection (type, size, configuration), Transmission selection (type, gear ratios), Electric motor selection (type, power rating), Battery selection (type, capacity, chemistry).</p> <p>Design trade-offs and optimization: Performance vs. efficiency, Cost vs. weight, Packaging vs. integration</p> <p>Performance Analysis of Power Train Systems</p> <p>Performance metrics: Acceleration, Top speed, Gradeability (maximum grade, sustained grade)</p> <p>Analysis techniques: Experimental testing (e.g., chassis dynamometer, road testing)</p>	5



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Performance optimization: Gear ratio optimization, Engine calibration, Electric motor control strategy	
Total	45

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	35	10	35	00	10

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

The syllabus of Powertrain and Hybrid Vehicles directly contributes to

Chapter / Topic	SDG No.	Sustainable Development Goals
Chapter-2	SDG-7 SDG-9	Ensure access to affordable, reliable, sustainable and modern energy: Application of hybrid vehicle technology in an automobile vehicle. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation: by knowledge of efficient hybrid components, hybrid vehicle architectures and challenges in the hybrid automobile industry and infrastructure.
Chapter-3	SDG-7 SDG-12	Ensure access to affordable, reliable, sustainable and modern energy: by knowledge of energy-efficient drivetrain systems and the use of power electronics and control systems. It supports the development of clean automotive technologies. Ensure sustainable consumption and production patterns: It can be achieved by optimization of component sizing and system integration, reducing energy losses in transmission and powertrain systems.
Chapter-4	SDG-7 SDG-11 SDG-13	Ensure access to affordable, reliable, sustainable and modern energy: Students can find affordable, reliable, sustainable and modern energy management components in hybrid systems and can use regenerative braking, which promotes reduction in fossil fuel dependency. It supports development of clean automotive technologies Make cities and human settlements inclusive, safe, resilient and sustainable: Reduction of urban air pollution via hybrid vehicles, improved fuel economy, and reduced emissions. It supports clean transportation



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		systems Take urgent action to combat climate change and its impacts: Emission reduction via hybrid operation.
Chapter-5	SDG-9 SDG-13	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation: Students are able to achieve sustainable industrialization and foster innovation by innovative engineering design by considering various design parameters and performance analysis of powertrain systems. Take urgent action to combat climate change and its impacts: Students can design a climate-conscious vehicle.

Reference Books:

Fundamentals of Power Train & Automotive Systems

1. Automotive Engineering Fundamentals by Richard Stone and Jeffrey K. Bal, SAE International (2004).
2. Automotive Technology: A Systems Approach by Jack Erjavec and Rob Thompson, 7th edition, Cengage Learning, 2020.

Transmission, Drivetrain & Components

3. Manual Transmission and Drivetrain Systems by Chris Johanson, 1st edition, Cengage Learning, 2016.
4. Automotive Transmissions: Fundamentals, Selection, Design and Application by Harald Naunheimer et al., Bernd Bertsche, Springer-Verlag, 2010

Hybrid & Electric Vehicles

5. Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives by Chris Mi et al., 2nd edition, Wiley, 2017.
6. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles by Mehrdad Ehsani et al., 3rd edition, CRC Press / Taylor & Francis, 2018.

Vehicle Performance & Design

7. Vehicle Powertrain Systems by Wei Liu, John Wiley & Sons, 2017
8. Fundamentals of Vehicle Dynamics by Thomas D. Gillespie, SAE International (Society of Automotive Engineers)

Indian Edition

9. Automobile Engineering (Vol. 1 & 2) by Kirpal Singh, Standard Publishers Distributors
10. Automobile Engineering by V. A. W. Hillier and Peter Coombes, Indian adaptation, Indian edition
11. E-Mobility: A New Era in Automotive Technology by Kathiresan M
12. Electric And Hybrid Vehicle (Green and Sustainable Transportation) by Dr. Nitesh Tiwari and Dr. Shekhar Yadav, S.K. Kataria & Sons
13. Electric & Hybrid Vehicles by A.K. Babu, Khanna Publishing House

List of Experiments: (At least ten experiments from the following list should be performed)

1. To compare the different hybrid vehicle architectures (series, parallel, series-parallel) and their components.
2. To analyze the performance characteristics of an electric motor used in hybrid vehicles.



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3. To evaluate the efficiency of regenerative braking systems in hybrid vehicles.
4. To compare different energy management strategies (rule-based, optimization-based) in hybrid vehicles.
5. Demonstrate the working and implementation of battery management systems in hybrid vehicles.
6. To evaluate the fuel economy and emissions of a hybrid vehicle under different driving cycles.
7. To analyze the performance of a hybrid vehicle powertrain using software tools (e.g., MATLAB, Simulink).
8. Demonstrate the working and application of power electronics components (motor controllers, inverters, converters) in hybrid vehicles.
9. To analyze the working and performance of different transmission systems (manual, automatic, CVT) in hybrid vehicles.
10. To evaluate the performance (acceleration, top speed, gradeability) of a hybrid vehicle under different operating conditions.
11. Examine the components of Battery Electric Vehicles (BEV) and Hybrid Electric Vehicles (HEV).
12. Analysis of battery state of charge (SOC) variation.

Major Equipment:

- 1 Hybrid Electric Vehicle Powertrain Training Setup
- 2 Data acquisition system
- 3 Simulation software (e.g., MATLAB, Simulink)
- 4 Electric motor test bench for EV or HEV
- 5 Regenerative braking system test bench
- 6 Battery management system equipment
- 7 Power electronics test rig (motor controllers, inverters, converters)

Minor Equipment: Hybrid vehicle prototypes/models (series, parallel, series-parallel), Battery pack and Battery tester. Energy management system controller, Regenerative braking system education model, BEV and HEV prototypes/models, Component cutaways (e.g., battery, motor, inverter)

List of Open-Source Software/learning website:

1. https://onlinecourses.nptel.ac.in/noc26_de12/preview
2. <https://nptel.ac.in/courses/108103009>
3. <https://nptel.ac.in/courses/121106014>
4. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed83
5. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed15
6. Autonomie (by Argonne National Laboratory): A MATLAB/Simulink-based platform for simulating and analyzing hybrid and electric vehicles.
7. ADVISOR (by National Renewable Energy Laboratory): A MATLAB/Simulink-based tool for simulating and analyzing hybrid and electric vehicles.
8. PSAT (by Argonne National Laboratory): A MATLAB/Simulink-based tool for simulating and analyzing hybrid and electric vehicles.
9. QSS Toolbox (by ETH Zurich): A MATLAB/Simulink-based tool for simulating and analyzing hybrid and electric vehicles.
10. OpenModelica: An open-source modeling and simulation environment for complex systems, including



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hybrid vehicles.

11. PyBAMM: A Python-based open-source tool for simulating and analyzing hybrid and electric vehicles.

List of course-related Indian standards: Faculty members are required to give an introduction about various Automotive Industry Standards (AIS) related to the course during theory and/or practical sessions. Students may be asked to prepare a report on one or more related Automotive Industry Standards (AIS).

1. AIS-024 and AIS-028 (Rev.1) (Part C): Safety and Procedural Requirements for Type Approval of Gaseous Fuel Vehicles - Part C (CEV's Application) and Code of Practice for Use of Gaseous Fuels in Internal Combustion Engine Construction Equipment Vehicles (CEV's) - Part C (CEV's Application).
2. AIS-038 (Rev.1):2015 and Amd.1: Electric Power Train Vehicles- Construction and Functional Safety Requirements
3. AIS-038 (Rev. 2) and Amd. 1 to 4: Specific Requirements for Electric Power Train of Vehicles Part I: Requirements of a Vehicle with Regard to Specific Requirements for the Electric Power Train Part II: Requirements of a Rechargeable Electrical Energy Storage System (REESS) with Regard to its Safety
4. AIS-039: Battery Operated Vehicles - Measurement of Electrical Energy Consumption
5. AIS-039 (Rev.1) & Corri. 1 and Amd. 1 & 2: Electric Power Train Vehicles - Measurement of Electrical Energy Consumption
6. AIS-040: Battery Operated Vehicles - Method of Measuring the Range
7. AIS-040 (Rev.1):2015 and Amd.1 to 3: Electric Power Train Vehicles - Method of Measuring the Range
8. AIS-041: Battery Operated Vehicles -Measurement of Net Power and the Maximum 30 Minute Power and speed
9. AIS-041 (Rev.1):2015 and Amd. 1: Electric Power Train Vehicles Measurement of Net Power and The Maximum 30 Minute Power
10. AIS-048 & Amd. 1 and Amd 2: Battery Operated Vehicles - Safety Requirements of Traction Batteries
11. AIS-049 and Amd. 1 & 2: Battery Operated Vehicles - CMVR Type Approval for Battery Operated Vehicles
12. AIS-049 (Rev. 1): 2016 and Amd. 1: Electric Power Train Vehicles - CMVR Type Approval for Electric Power Train Vehicles
13. AIS-102 (Part 1) and Amd. 1 to 3: CMVR Type Approval for Hybrid Electric Vehicles of M and N Category with GVW - 3500 kg and L category vehicles
14. AIS-102 (Part 2) & Amd. 1: CMVR Type Approval for Hybrid Electric Vehicles of M and N Category with GVW > 3500 kg
15. AIS-123(Part 1) & Amds. 1 to 5: CMVR Type Approval of Hybrid Electric System Intended for Retrofitment on Vehicles of M and N Category having GVW - 3500 kg
16. AIS-123(Part 2) and Amd. 1 & 2: CMVR Type Approval of Hybrid Electric System Intended for Retrofitment on Vehicles of M and N Category having GVW exceeding 3500 kg
17. AIS-131: Type Approval Procedure for Electric and Hybrid Electric Vehicles introduced in market for Pilot / Demonstration Projects intended for Government Scheme
18. AIS-137 (Part 1) and Amd.1 to 4: Test Method, Testing Equipment and Related Procedures for Type Approval and Conformity of Production (COP) Testing of L2 category Vehicles for Bharat Stage VI emission norms as per CMV Rules 115, 116 and 126
19. AIS-137(Part 3) with Amendments 1 to 9: Test Method, Testing Equipment and Related Procedures for Type Approval and Conformity of Production (COP) Testing of M and N Category Vehicles having GVW not exceeding 3500 kg for Bharat Stage VI (BS VI) Emission Norms as per CMV Rules 115, 116 and 126



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20. AIS-137 (Part 5) and Amd 1: Test Method, Testing Equipment and Related Procedures for Internal Combustion Engines and Electric Drive Trains intended for the Propulsion of Motor Vehicles of Categories L, M and N with regard to the Measurement of Net Power and the Maximum 30 Minutes Power of Electric Drive Trains and Emission of Visible Pollutants of Motor Vehicles of Categories L, M and N equipped with Compression-Ignition Engines
21. AIS-138 (Part 1): Electric Vehicle Conductive AC Charging System
22. AIS-138 (Part 2): Electric vehicle conductive DC charging system
23. AIS-156 and Amd. 1 to 4: Specific Requirements for L Category Electric Power Train Vehicles Part I: Requirements of a Vehicle with Regard to its Electrical Safety Part II: Requirements of a Rechargeable Electrical Energy Storage System (REESS) with Regard to its Safety
24. AIS-157 & Amd. 1 and 2: Safety and Procedural Requirements for Type Approval of Compressed Gaseous Hydrogen Fuel Cell Vehicles
25. AIS-157 A: Safety and Procedural Requirements for Type Approval of Hydrogen Powered Construction Equipment Vehicles (Liquid / Compressed Gaseous Hydrogen)

List of suggested activities for Problem-based Learning (PBL):

Sr. No	PBL category	Name of the activity	No. of hours	Evaluation Criteria
1.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Mini Project	15h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, report quality and presentation
2.	Case Study Analysis / Seminar	Seminar	15h (need to be changed as per total PBL hours)	Based on the quality of report and presentation, technical understanding
3.	Micro project	Micro project	8h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, quality of report and demonstration
4.	Industry/Research laboratory visit	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
5.	Video Based Learning	Technical video-based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
6.	Assignment / Technical Writing / Research Writing	Assignment writing. Numerical based assignment is preferable.	5 assignments of 4 h each Total = 20h	Based on the correctness of submitted assignment
7.	Group Discussion /	Problem	5 small coding-based	Based on the coding



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	Quiz / Simulation	solving/Coding using C, C++, MATLAB, Python, SCILAB, modeling and Analysis software or any other software	assignment of 2h each Total = 10h	solution submitted.
8.	Video Based Learning	Self-learning online course	Minimum duration of the course should be 10h	Examination based assessment at the end of course. Based on the certificate produced.
9.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Identification and solution of Complex problem	Maximum 2 problems. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
10.	Video Based Learning	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
11.	Research Paper Review / Analysis	Technical paper reading and summarization of research papers based on relevant subject	5 research papers = 20h	Summarize research paper and evaluation critical parameters
12.	Poster / Chart / PowerPoint presentation	Poster/chart/power point preparation on technical topics	Duration = 6h	Based on poster/chart preparation and presentation skills
13.	Industry/Research laboratory visit	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/sustainability/any other issue	Duration = 15h for industrial exposure Problem identification and tentative solution = 10h Total = 20h	Based on evaluation of critical problems and solutions
14.	Group Discussion / Quiz / Simulation	Group Discussion on emerging/trending technical topics based on subject	Duration = 1h – 3h per topic	Based on performance in group discussion, technical depth, knowledge etc.
15.	Case Study Analysis / Seminar	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
16.	Group Discussion / Quiz / Simulation	Application/Software development	Duration = 10h	Depending on the complexity of the Application/Software
17.	Assignment /	Research paper	Duration = 10h	Based on submission of



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	Technical Writing / Research Writing	publication		proof of publication
18.	Micro project	Upgradation/Reverse engineering studies of existing equipment of the laboratory	Duration 10h	Based on the performance of the equipment
19.	Industry/Research laboratory visit	Expert lecture/session	Duration 3h For attending the lecture/session– 2h and for report writing 1h	Based on the proof of attendance and report submitted
20.	Video Based Learning	Annotated Video Explanation of Concept/Problem	10h (Preparation + Recording + Submission)	Based on accuracy of explanation, clarity, and presentation style.
21.	Assignment / Technical Writing / Research Writing	Patent Search and Innovation Gap Identification	10h (Search + Report)	Based on number of relevant patents analyzed and identification of innovation scope.
22.	Assignment / Technical Writing / Research Writing	Preparation of a report on Indian Standard(s)	10h (study of Indian Standard(s) + report	Based on report quality and understanding of the relevant Indian Standard(s).

Note:

1. In alignment with Outcome-Based Education (OBE) and NBA accreditation requirements, the subject **Powertrain and Hybrid Vehicles compulsorily incorporates Micro Project and 5 marks as PBL activities for PEC and Seminar and Mini Project for PCC.** These activities are incorporated as integral Project-Based Learning (PBL) components. These activities are designed to foster experiential learning, encourage innovation, and strengthen problem-solving skills by engaging students in practical applications of power converter design, simulation, and analysis. The inclusion of PBL ensures that learners develop higher-order cognitive abilities mapped to Bloom's taxonomy, while simultaneously enhancing teamwork, communication, and research competencies essential for professional engineering practice.
2. The hours allocated to specific activities should be proportionate to the total no. of PBL hours and marks.
3. All the suggested activity should be related to the subject.
4. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
5. Rubrics for the evaluation can be prepared by the faculty.
6. Subject teacher can add the relevant activities other than those listed above, with the consent of head of the department and DQAC.
