ICTQual AB

Qualification Specification

Level 4 Diploma in Automotive Engineering
120 Credits – One Year

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Qualification Specifications about

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About ICTQual AB

ICTQual AB UK Ltd. is a distinguished awarding body based in the United Kingdom, dedicated to fostering excellence in education, training, and skills development. Committed to global standards, ICTQual AB provides internationally recognized qualifications that empower individuals and organizations to thrive in an increasingly competitive world. Their offerings span diverse industries, including technical fields, health and safety, management, and more, ensuring relevance and adaptability to modern workforce needs.

The organization prides itself on delivering high-quality educational solutions through a network of Approved Training Centres worldwide. Their robust curriculum and innovative teaching methodologies are designed to equip learners with practical knowledge and skills for personal and professional growth. With a mission to inspire lifelong learning and drive positive change, ICTQual AB continuously evolves its programs to stay ahead of industry trends and technological advancements.

ICTQual AB's vision is to set benchmarks for educational excellence while promoting inclusivity and integrity. Their unwavering focus on quality and accessibility makes them a trusted partner in shaping future-ready professionals and advancing societal progress globally.

Course Overview

The ICTQual Level 4 Diploma in Automotive Engineering is a comprehensive one-year program designed to equip students with advanced skills and knowledge essential for a successful career in the automotive sector. This 120-credit course delves into critical areas such as vehicle design, diagnostics, electrical systems, and manufacturing processes, blending theoretical learning with practical, hands-on training. Students will explore both traditional automotive engineering aspects and emerging technologies, including hybrid and electric vehicle systems, autonomous driving, and telematics, preparing them to address real-world challenges in this dynamic field.

Graduates of this diploma are well-positioned to pursue various roles within the automotive industry, such as vehicle technician, service engineer, vehicle design engineer, and automotive systems engineer. With the global demand for skilled automotive professionals on the rise, this qualification offers promising career prospects. By completing the program, students gain in-depth knowledge of current automotive technologies and develop essential hands-on skills, making it a robust pathway for those looking to start or advance their careers in automotive engineering.

Certification Framework

Qualification title	**ICTQual Level 4 Diploma in Automotive Engineering 120 Credits – One Year**
Course ID	AE0003
Qualification Credits	120 Credits
Course Duration	1 Year
Grading Type	Pass / Fail
Competency Evaluation	Coursework / Assignments / Verifiable Experience
Assessment	The assessment and verification process for ICTQual qualifications involves two key stages: **Internal Assessment and Verification:** ✓ Conducted by the staff at the Approved Training Centre (ATC). Ensures learners meet the required standards through continuous assessments. ✓ Internal quality assurance (IQA) is carried out by the centre's IQA staff to validate the assessment processes. **External Quality Assurance:** ✓ Managed by ICTQual AB verifiers, who periodically review the centre's assessment and IQA processes. ✓ Verifies that assessments are conducted to the required standards and ensures consistency across centres

Entry Requirements

To enrol in the ICTQual Level 4 Diploma in Automotive Engineering 120 Credits – One Year, candidates must meet the following entry requirements:

- ✓ A minimum of a Level 3 qualification (e.g., A-Levels, BTEC National Diploma, NVQ Level 3, or equivalent). A background in subjects such as mathematics, physics, information technology, or engineering is highly recommended, as the course involves technical concepts, vehicle systems, diagnostics, and engineering principles.
- ✓ Minimum age of 16 years to enrol in the course.
- ✓ Proficiency in English, as the program involves technical terminology, written reports, and effective communication within automotive engineering contexts. This ensures that students can fully engage with the curriculum and communicate technical concepts clearly.
- ✓ Basic computer skills, as the course requires students to complete assignments, work with automotive engineering software, and engage in simulations or analysis tasks related to vehicle systems and diagnostics.
- ✓ While not mandatory, prior exposure to automotive engineering, mechanics, or a related technical field can provide a solid foundation and enhance the practical learning experience. This could include basic knowledge of vehicle maintenance, automotive systems, or previous hands-on experience with automotive repair.

Qualification Structure

This qualification comprises 12 mandatory units, totalling 120 credits. Candidates must successfully complete all mandatory units to achieve the qualification.

Mandatory Units		
Unit Ref#	**Unit Title**	**Credits**
AE0003 - 1	Vehicle Systems and Components	10
AE0003 - 2	Automotive Electrical and Electronic Systems	10
AE0003 - 3	Vehicle Diagnostics and Fault Finding	10
AE0003 - 4	Hybrid and Electric Vehicle Technologies	10
AE0003 - 5	Automotive Engine Design and Performance	10
AE0003 - 6	Automotive Materials and Manufacturing Processes	10
AE0003 - 7	Vehicle Safety and Crash Testing	10
AE0003 - 8	Automotive Fuel Systems and Emissions Control	10
AE0003 - 9	Automotive Air Conditioning and Climate Control Systems	10
AE0003 - 10	Automotive Project Management	10
AE0003 - 11	Advanced Vehicle Technology and Autonomous Systems	10
AE0003 - 12	Automotive Industry Regulations and Standards	10

Centre Requirements

Even if a centre is already registered with ICTQual AB, it must meet specific requirements to deliver the ICTQual Level 4 Diploma in Automotive Engineering 120 Credits – One Year. These standards ensure the quality and consistency of training, assessment, and learner support.

1. Approval to Deliver the Qualification

- ✓ Centres must obtain formal approval from ICTQual AB to deliver this specific qualification, even if they are already registered.
- ✓ The approval process includes a review of resources, staff qualifications, and policies relevant to the program.

2. Qualified Staff

- ✓ **Tutors:** Must have relevant qualifications in Automotive Engineering at Level 4 or higher, alongside teaching/training experience.
- ✓ **Assessors:** Must hold a recognized assessor qualification and demonstrate expertise in Automotive Engineering
- ✓ **Internal Quality Assurers (IQAs):** Must be appropriately qualified and experienced to monitor the quality of assessments.

3. Learning Facilities

Centres must have access to appropriate learning facilities, which include:

- ✓ **Classrooms:** Modern classrooms equipped with multimedia tools for in-depth theoretical learning on automotive systems, vehicle dynamics, and cutting-edge automotive technologies.

- ✓ **Practical Areas**: Fully equipped workshops featuring advanced automotive tools and diagnostic equipment, including engines, transmission systems, braking systems, and electrical components for hands-on training and skill assessments.
- ✓ **Technology Access:** High-performance computers with industry-standard software (e.g., CAD for vehicle design, diagnostic software, simulation tools) and internet access for research, analysis, and project work.

4. Health and Safety Compliance

- ✓ Centres must ensure that practical training environments comply with relevant health and safety regulations.
- ✓ Risk assessments must be conducted regularly to maintain a safe learning environment.

5. Resource Requirements

- ✓ Learning Materials: Approved course manuals, textbooks, and study guides aligned with the curriculum.
- ✓ Assessment Tools: Templates, guidelines, and resources for conducting and recording assessments.
- ✓ E-Learning Systems: If offering online or hybrid learning, centres must provide a robust Learning Management System (LMS) to facilitate remote delivery.

6. Assessment and Quality Assurance

- ✓ Centres must adhere to ICTQual's assessment standards, ensuring that all assessments are fair, valid, and reliable.
- ✓ Internal quality assurance (IQA) processes must be in place to monitor assessments and provide feedback to assessors.
- ✓ External verification visits from ICTQual will ensure compliance with awarding body standards.

7. Learner Support

- ✓ Centres must provide learners with access to guidance and support throughout the program, including:
- ✓ Academic support for coursework.
- ✓ Career guidance for future progression.
- ✓ Additional support for learners with specific needs (e.g., disabilities or language barriers).

8. Policies and Procedures

Centres must maintain and implement the following policies, as required by ICTQual:

- ✓ Equal Opportunities Policy.
- ✓ Health and Safety Policy.
- ✓ Safeguarding Policies and Procedures.
- ✓ Complaints and Appeals Procedure.
- ✓ Data Protection and Confidentiality Policy.

9. Regular Reporting to ICTQual

- ✓ Centres must provide regular updates to ICTQual AB on learner enrolment, progress, and completion rates.
- ✓ Centres are required to maintain records of assessments and learner achievements for external auditing purposes.

Support for Candidates

Centres should ensure that materials developed to support candidates:

- ✓ Facilitate tracking of achievements as candidates progress through the learning outcomes and assessment criteria.
- ✓ Include information on how and where ICTQual's policies and procedures can be accessed.
- ✓ Provide mechanisms for Internal and External Quality Assurance staff to verify and authenticate evidence effectively.

This approach ensures transparency, supports candidates' learning journeys, and upholds quality assurance standards.

Assessment

This qualification is competence-based, requiring candidates to demonstrate proficiency as defined in the qualification units. The assessment evaluates the candidate's skills, knowledge, and understanding against the set standards. Key details include:

1. **Assessment Process:**

   - ✓ Must be conducted by an experienced and qualified assessor.
   - ✓ Candidates compile a portfolio of evidence that satisfies all learning outcomes and assessment criteria for each unit.

2. **Types of Evidence:**

   - ✓ Observation reports by the assessor.
   - ✓ Assignments, projects, or reports.
   - ✓ Professional discussions.
   - ✓ Witness testimonies.
   - ✓ Candidate-produced work.
   - ✓ Worksheets.
   - ✓ Records of oral and written questioning.
   - ✓ Recognition of Prior Learning (RPL).

3. **Learning Outcomes and Assessment Criteria:**

   - ✓ **Learning Outcomes:** Define what candidates should know, understand, or accomplish upon completing the unit.
   - ✓ **Assessment Criteria:** Detail the standards candidates must meet to demonstrate that the learning outcomes have been achieved.

This framework ensures rigorous and consistent evaluation of candidates' competence in line with the qualification's objectives.

Unit Descriptors

AE0003 - 1. Vehicle Systems and Components

The aim of this study unit is to provide students with a thorough understanding of the fundamental components of automotive systems, including the engine, transmission, suspension, braking systems, and steering. Students will learn how each system functions both individually and in conjunction with other systems to contribute to overall vehicle operation. The unit will focus on analysing the interdependencies between vehicle systems, highlighting their collective impact on vehicle performance, safety, and efficiency. This comprehensive understanding will enable students to assess and optimize the integration of various systems for improved vehicle functionality.

Learning Outcome:	Assessment Criteria:
1. Understand the fundamental components of automotive systems, such as the engine, transmission, suspension, braking systems, and steering.	1.1. Accurately identify and describe the key components of automotive systems, including the engine, transmission, suspension, braking systems, and steering. 1.2. Demonstrate a clear understanding of the functional role each system plays in the overall operation of a vehicle. 1.3. Explain the interrelationship between various automotive systems and their impact on vehicle performance and safety. 1.4. Assess the importance of maintenance and regular servicing for the optimal functioning of each system. 1.5. Identify common faults within each system and outline the potential consequences of neglecting maintenance. 1.6. Apply knowledge of automotive systems to support diagnostic processes and troubleshooting techniques.
2. Explain how each vehicle system functions individually and as part of the overall vehicle operation.	2.1. Describe the individual function of each vehicle system, including engine, transmission, suspension, braking systems, and steering. 2.2. Analyse how each system interacts with others to ensure smooth and efficient vehicle operation. 2.3. Identify the role of the engine in converting fuel into mechanical energy and driving the vehicle. 2.4. Explain how the transmission system manages power distribution to the wheels, affecting

	speed and torque. 2.5. Detail how the suspension system enhances vehicle stability, comfort, and handling. 2.6. Illustrate the critical role of braking and steering systems in ensuring safety, control, and effective vehicle manoeuvrability.
3. Analyse the interdependencies of various vehicle systems and their impact on vehicle performance, safety, and efficiency.	3.1. Evaluate the interdependence between the engine and transmission systems in determining vehicle speed, acceleration, and fuel efficiency. 3.2. Assess how the suspension system interacts with braking and steering systems to ensure vehicle stability, safety, and comfort during operation. 3.3. Analyse the effect of braking system performance on vehicle stopping distance and its relationship with the suspension and steering systems. 3.4. Examine how efficient power transmission impacts fuel economy and engine load. 3.5. Investigate the impact of improper maintenance or failure in one system on the performance and safety of other vehicle systems. 3.6. Discuss the role of advanced vehicle technologies in optimising system interdependencies to improve overall vehicle performance and reduce emissions.

AE0003 - 2. Automotive Electrical and Electronic Systems

The aim of this study unit is to provide students with a comprehensive understanding of automotive electrical circuits, including wiring, battery systems, and control units. Students will explore the critical role of electronics in vehicle control systems, including the integration of sensors, actuators, and safety features that enhance vehicle performance and safety. The unit will also equip students with the skills to apply diagnostic tools for identifying faults in electrical and electronic systems, focusing on wiring issues and component-level troubleshooting. This will enable students to accurately diagnose and resolve electrical and electronic issues in modern vehicles.

Learning Outcome:	Assessment Criteria:
1. Demonstrate an understanding of automotive electrical circuits, including wiring, battery systems, and control units.	1.1. Identify and describe the key components of automotive electrical circuits, including wiring, battery systems, and control units. 1.2. Explain the function and operation of battery systems in providing electrical power to the vehicle. 1.3. Demonstrate how automotive wiring systems transmit electrical signals and power to various vehicle components. 1.4. Illustrate the role of control units in regulating and managing vehicle electrical systems, including diagnostics and fault detection. 1.5. Analyse the importance of proper wiring and battery maintenance in ensuring vehicle electrical reliability and performance. 1.6. Apply knowledge of electrical circuits to troubleshoot and identify potential issues within the system.
2. Assess the role of electronics in vehicle control systems, including sensors, actuators, and safety features.	2.1. Identify and describe the key components of automotive electrical circuits, including wiring, battery systems, and control units. 2.2. Explain the function and operation of battery systems in providing electrical power to the vehicle. 2.3. Demonstrate how automotive wiring systems transmit electrical signals and power to various vehicle components. 2.4. Illustrate the role of control units in regulating and managing vehicle electrical systems, including diagnostics and fault detection. 2.5. Analyse the importance of proper wiring and battery maintenance in ensuring vehicle electrical reliability and performance. 2.6. Apply knowledge of electrical circuits to

	troubleshoot and identify potential issues within the system.
3. Apply diagnostic tools to identify faults in electrical and electronic systems, including wiring and component-level troubleshooting.	3.1. Identify and describe the key components of automotive electrical circuits, including wiring, battery systems, and control units. 3.2. Explain the function and operation of battery systems in providing electrical power to the vehicle. 3.3. Demonstrate how automotive wiring systems transmit electrical signals and power to various vehicle components. 3.4. Illustrate the role of control units in regulating and managing vehicle electrical systems, including diagnostics and fault detection. 3.5. Analyse the importance of proper wiring and battery maintenance in ensuring vehicle electrical reliability and performance. 3.6. Apply knowledge of electrical circuits to troubleshoot and identify potential issues within the system.

AE0003 - 3. Vehicle Diagnostics and Fault Finding

The aim of this study unit is to provide students with the knowledge and practical skills needed to identify and diagnose common faults in vehicle systems, including engine management, electrical, and mechanical components. Students will learn to use a variety of automotive diagnostic tools and techniques to accurately perform fault diagnosis and recommend appropriate repair actions. The unit will also focus on the interpretation and evaluation of diagnostic reports, enabling students to identify the underlying issues affecting vehicle performance and safety, and apply effective solutions to optimize vehicle operation and reliability.

Learning Outcome:	Assessment Criteria:
1. Identify common faults in vehicle systems, including engine management, electrical, and mechanical components.	1.1. Identify common faults in engine management systems, such as misfires, poor fuel efficiency, and irregular idling, and explain their potential causes. 1.2. Recognise electrical system faults, including issues with the battery, alternator, wiring, and fuses, and describe how they affect vehicle performance. 1.3. Diagnose mechanical faults in vehicle components like the transmission, suspension, and braking systems, and understand their impact on vehicle handling and safety. 1.4. Detect sensor malfunctions, such as inaccurate readings from oxygen or temperature sensors, and discuss their effect on overall system performance. 1.5. Examine the symptoms of faults in the steering system, such as difficulty turning or noise, and identify potential mechanical or hydraulic causes. 1.6. Outline the procedures for safely diagnosing and addressing common faults in vehicle systems, using appropriate tools and methods.
2. Utilize automotive diagnostic tools and techniques to perform fault diagnosis and recommend appropriate repairs.	2.1. Identify common faults in engine management systems, such as misfires, poor fuel efficiency, and irregular idling, and explain their potential causes. 2.2. Recognise electrical system faults, including issues with the battery, alternator, wiring, and fuses, and describe how they affect vehicle performance. 2.3. Diagnose mechanical faults in vehicle

	components like the transmission, suspension, and braking systems, and understand their impact on vehicle handling and safety. 2.4. Detect sensor malfunctions, such as inaccurate readings from oxygen or temperature sensors, and discuss their effect on overall system performance. 2.5. Examine the symptoms of faults in the steering system, such as difficulty turning or noise, and identify potential mechanical or hydraulic causes. 2.6. Outline the procedures for safely diagnosing and addressing common faults in vehicle systems, using appropriate tools and methods.
3. Evaluate diagnostic reports to determine the underlying issues affecting vehicle performance and safety.	3.1. Identify common faults in engine management systems, such as misfires, poor fuel efficiency, and irregular idling, and explain their potential causes. 3.2. Recognise electrical system faults, including issues with the battery, alternator, wiring, and fuses, and describe how they affect vehicle performance. 3.3. Diagnose mechanical faults in vehicle components like the transmission, suspension, and braking systems, and understand their impact on vehicle handling and safety. 3.4. Detect sensor malfunctions, such as inaccurate readings from oxygen or temperature sensors, and discuss their effect on overall system performance. 3.5. Examine the symptoms of faults in the steering system, such as difficulty turning or noise, and identify potential mechanical or hydraulic causes. 3.6. Outline the procedures for safely diagnosing and addressing common faults in vehicle systems, using appropriate tools and methods.

AE0003 - 4. Hybrid and Electric Vehicle Technologies

The aim of this study unit is to provide students with a comprehensive understanding of the design, operation, and key components of hybrid and electric vehicles, including batteries, drivetrains, and electric motors. Students will compare and contrast the technologies behind hybrid and electric vehicles with traditional internal combustion engine vehicles, highlighting the differences in performance, efficiency, and environmental impact. The unit will also address the specific maintenance and servicing requirements of hybrid and electric vehicles, focusing on battery management systems, charging infrastructure, and the unique challenges these vehicles present for technicians in terms of diagnostics and repair.

Learning Outcome:	Assessment Criteria:
1. Understand the design, operation, and components of hybrid and electric vehicles, including batteries, drivetrains, and electric motors.	1.1. Identify and describe the key components of hybrid and electric vehicles, including batteries, electric motors, and drivetrains. 1.2. Explain the operation of hybrid and electric powertrains, outlining how they differ from traditional internal combustion engine vehicles. 1.3. Assess the function and importance of battery systems in storing and supplying energy to electric motors and other vehicle components. 1.4. Understand the role of regenerative braking in hybrid and electric vehicles and how it contributes to energy efficiency. 1.5. Evaluate the performance characteristics of electric motors, including torque delivery, efficiency, and their integration with the vehicle's control systems. 1.6. Analyse the challenges and advantages of hybrid and electric vehicle designs, including range, charging infrastructure, and environmental impact.
2. Compare and contrast the technologies behind electric and hybrid vehicles versus traditional internal combustion engine vehicles.	2.1. Identify and describe the key components of hybrid and electric vehicles, including batteries, electric motors, and drivetrains. 2.2. Explain the operation of hybrid and electric powertrains, outlining how they differ from traditional internal combustion engine vehicles. 2.3. Assess the function and importance of battery systems in storing and supplying energy to electric motors and other vehicle components.

	2.4. Understand the role of regenerative braking in hybrid and electric vehicles and how it contributes to energy efficiency. 2.5. Evaluate the performance characteristics of electric motors, including torque delivery, efficiency, and their integration with the vehicle's control systems. 2.6. Analyse the challenges and advantages of hybrid and electric vehicle designs, including range, charging infrastructure, and environmental impact.
3. Assess the maintenance and servicing needs of hybrid and electric vehicles, including battery management systems and charging infrastructure.	3.1. Evaluate the specific maintenance requirements of hybrid and electric vehicles, focusing on battery health, electrical components, and drivetrain systems. 3.2. Analyse the importance of regular battery management system (BMS) checks to monitor battery charge, health, and capacity, ensuring optimal performance and longevity. 3.3. Assess the servicing needs of the charging infrastructure, including regular inspections of charging stations, cables, and connectors for safe and efficient operation. 3.4. Identify common issues in hybrid and electric vehicles, such as battery degradation, electric motor faults, and issues with power electronics, and their impact on performance. 3.5. Compare the maintenance schedules of hybrid and electric vehicles to those of traditional internal combustion engine vehicles, noting the differences in complexity and frequency. 3.6. Recommend strategies for improving the lifespan and efficiency of hybrid and electric vehicles through proactive maintenance, including software updates and component checks.

AE0003 - 5. Automotive Engine Design and Performance

The aim of this study unit is to provide students with an in-depth understanding of the design principles behind internal combustion engines, focusing on performance characteristics, fuel systems, and exhaust systems. Students will learn to evaluate engine performance through key metrics such as power output, fuel efficiency, and emissions, gaining the ability to assess an engine's overall effectiveness. Additionally, the unit will cover tuning techniques that optimize engine performance while ensuring compliance with industry standards for efficiency and emissions. This will prepare students to apply their knowledge in enhancing engine performance while meeting environmental and regulatory requirements.

Learning Outcome:	Assessment Criteria:
1. Analyse the design principles behind internal combustion engines, including performance characteristics, fuel systems, and exhaust systems.	1.1. Demonstrate a comprehensive understanding of the fundamental design principles of internal combustion engines. 1.2. Critically evaluate the performance characteristics of various internal combustion engine configurations. 1.3. Analyse the influence of different fuel systems on engine efficiency and performance. 1.4. Assess the impact of exhaust systems on engine operation and environmental considerations. 1.5. Apply theoretical knowledge to evaluate the interaction between engine components and their overall contribution to performance. 1.6. Examine the technological advancements in fuel and exhaust systems and their effect on modern engine design.
2. Evaluate engine performance through key metrics such as power output, fuel efficiency, and emissions.	2.1. Demonstrate a comprehensive understanding of the fundamental design principles of internal combustion engines. 2.2. Critically evaluate the performance characteristics of various internal combustion engine configurations. 2.3. Analyse the influence of different fuel systems on engine efficiency and performance. 2.4. Assess the impact of exhaust systems on engine operation and environmental considerations. 2.5. Apply theoretical knowledge to evaluate the interaction between engine components and their overall contribution to performance. 2.6. Examine the technological advancements in fuel and exhaust systems and their effect on

	modern engine design.
3. Apply tuning techniques to optimize engine performance, ensuring compliance with industry standards for efficiency and emissions.	3.1. Demonstrate a comprehensive understanding of the fundamental design principles of internal combustion engines. 3.2. Critically evaluate the performance characteristics of various internal combustion engine configurations. 3.3. Analyse the influence of different fuel systems on engine efficiency and performance. 3.4. Assess the impact of exhaust systems on engine operation and environmental considerations. 3.5. Apply theoretical knowledge to evaluate the interaction between engine components and their overall contribution to performance. 3.6. Examine the technological advancements in fuel and exhaust systems and their effect on modern engine design.

AE0003 - 6. Automotive Materials and Manufacturing Processes

The aim of this study unit is to provide students with a comprehensive understanding of the materials and manufacturing processes integral to the automotive industry. It seeks to equip learners with the knowledge and skills to analyse and evaluate the selection of materials such as metals, composites, and polymers and their impact on vehicle design, safety, performance, and cost-efficiency. Additionally, the unit aims to develop a critical understanding of manufacturing techniques, including casting, welding, and assembly, fostering the ability to make informed decisions in automotive engineering and production contexts.

Learning Outcome:	Assessment Criteria:
1. Identify and describe the materials used in vehicle construction, such as metals, composites, and polymers.	1.1. Identify the primary materials used in vehicle construction, including metals, composites, and polymers. 1.2. Describe the properties of various metals commonly used in automotive manufacturing, such as steel, aluminium, and alloys. 1.3. Analyse the role of composite materials in enhancing vehicle strength, weight reduction, and performance. 1.4. Explain the types of polymers used in automotive applications and their impact on durability and safety. 1.5. Evaluate the advantages and limitations of using different materials in terms of cost, manufacturing processes, and sustainability. 1.6. Investigate the emerging trends in material science and their potential influence on future vehicle design.
2. Understand the manufacturing processes involved in vehicle production, including casting, welding, and assembly.	2.1. Identify the primary materials used in vehicle construction, including metals, composites, and polymers. 2.2. Describe the properties of various metals commonly used in automotive manufacturing, such as steel, aluminium, and alloys. 2.3. Analyse the role of composite materials in enhancing vehicle strength, weight reduction, and performance. 2.4. Explain the types of polymers used in automotive applications and their impact on durability and safety. 2.5. Evaluate the advantages and limitations of using different materials in terms of cost, manufacturing processes, and sustainability. 2.6. Investigate the emerging trends in material

	science and their potential influence on future vehicle design.
3. Evaluate the role of material selection in vehicle safety, performance, and cost-effectiveness.	3.1. Identify the primary materials used in vehicle construction, including metals, composites, and polymers. 3.2. Describe the properties of various metals commonly used in automotive manufacturing, such as steel, aluminium, and alloys. 3.3. Analyse the role of composite materials in enhancing vehicle strength, weight reduction, and performance. 3.4. Explain the types of polymers used in automotive applications and their impact on durability and safety. 3.5. Evaluate the advantages and limitations of using different materials in terms of cost, manufacturing processes, and sustainability. 3.6. Investigate the emerging trends in material science and their potential influence on future vehicle design.

AE0003 - 7. Vehicle Safety and Crash Testing

The aim of this study unit is to provide students with an in-depth understanding of vehicle safety design principles and the technologies that enhance passenger protection. This includes both passive and active safety features such as airbags, seatbelts, and stability control systems. The unit also aims to develop critical knowledge of crash testing procedures and their importance in advancing vehicle safety standards. Furthermore, students will learn to assess the real-world performance of safety systems and ensure their compliance with regulatory requirements, fostering expertise in creating safer and more reliable vehicles.

Learning Outcome:	Assessment Criteria:
1. Understand the principles of vehicle safety design, including passive and active safety features like airbags, seatbelts, and stability control systems.	1.1. Demonstrate understanding of the principles behind vehicle safety design, focusing on passive and active safety systems. 1.2. Explain the function and design considerations of passive safety features such as airbags and seatbelts in protecting occupants during collisions. 1.3. Analyse the role of active safety systems, including stability control, traction control, and collision avoidance technologies, in preventing accidents. 1.4. Evaluate the integration of passive and active safety features to enhance overall vehicle safety. 1.5. Assess the impact of safety regulations and industry standards on vehicle design and the implementation of safety technologies. 1.6. Investigate the advancements in vehicle safety systems and their role in reducing fatalities and injuries on the road.
2. Analyse crash testing procedures and their role in improving vehicle safety standards.	2.1. Describe the various types of crash testing procedures used to evaluate vehicle safety, such as frontal, side, and rollover tests. 2.2. Analyse the data collected from crash tests and how it informs vehicle design improvements for safety. 2.3. Evaluate the role of crash testing in meeting regulatory safety standards and the impact of these standards on vehicle production. 2.4. Investigate the relationship between crash test results and the development of safety features like airbags, crumple zones, and reinforced structures.

	2.5. Assess the effectiveness of crash testing in reducing injury risk and improving occupant protection in real-world collisions. 2.6. Examine the advancements in crash testing technology and its potential to enhance future vehicle safety standards.
3. Assess the performance of safety systems in real-world accident scenarios and their regulatory compliance.	3.1. Evaluate the effectiveness of safety systems in real-world accident scenarios, focusing on their ability to reduce injury and fatality rates. 3.2. Analyse the performance of active safety systems, such as automatic emergency braking and stability control, in preventing or mitigating accidents. 3.3. Assess the effectiveness of passive safety features, including airbags and seatbelts, in providing occupant protection during various types of collisions. 3.4. Investigate the role of regulatory compliance in ensuring the reliability and performance of safety systems in real-world conditions. 3.5. Examine case studies and accident data to assess how well safety systems perform under different crash scenarios and conditions. 3.6. Critically assess the role of ongoing safety system testing and improvements in meeting evolving regulatory and safety standards.

AE0003 - 8. Automotive Fuel Systems and Emissions Control

The aim of this study unit is to equip students with a thorough understanding of automotive fuel systems, including their components and operation, such as carburettors, fuel injectors, and fuel pumps. The unit emphasizes the evaluation of vehicle emissions, their environmental impact, and the technologies designed to control them, such as catalytic converters and exhaust gas recirculation systems. Students will develop the ability to apply this knowledge to ensure compliance with emissions regulations and contribute to the development of sustainable and environmentally friendly automotive technologies.

Learning Outcome:	Assessment Criteria:
1. Understand the operation and components of automotive fuel systems, including carburettors, fuel injectors, and fuel pumps.	1.1. Describe the key components of automotive fuel systems, including carburettors, fuel injectors, and fuel pumps. 1.2. Explain the operation of carburettors and their role in mixing air and fuel for combustion in older vehicle engines. 1.3. Analyse the function of fuel injectors in modern engines, focusing on their precision in delivering fuel directly into the combustion chamber. 1.4. Assess the role of fuel pumps in ensuring consistent fuel flow and pressure to the engine, and their impact on overall engine performance. 1.5. Compare the advantages and limitations of carburettors versus fuel injection systems in terms of fuel efficiency, emissions, and power delivery. 1.6. Investigate advancements in fuel system technologies and their role in improving engine efficiency and reducing environmental impact.
2. Examine the environmental impact of vehicle emissions and evaluate the technologies used for emissions control, such as catalytic converters and exhaust gas recirculation.	2.1. Analyse the environmental impact of vehicle emissions, focusing on pollutants such as carbon monoxide, nitrogen oxides, and particulate matter. 2.2. Evaluate the role of catalytic converters in reducing harmful emissions by converting toxic gases into less harmful substances. 2.3. Examine the function of exhaust gas recirculation (EGR) systems in reducing nitrogen oxide emissions and improving fuel efficiency. 2.4. Assess the effectiveness of other emissions

	control technologies, such as selective catalytic reduction (SCR) and diesel particulate filters (DPF). 2.5. Investigate the regulatory standards governing vehicle emissions and the role of emissions control technologies in meeting these requirements. 2.6. Explore emerging technologies and their potential to further reduce vehicle emissions and mitigate environmental impact.
3. Apply knowledge of fuel systems and emissions control to ensure compliance with regulatory standards and reduce environmental impact.	3.1. Analyse the relationship between fuel system design, emissions production, and environmental impact, focusing on reducing harmful emissions. 3.2. Evaluate the effectiveness of emissions control technologies, such as catalytic converters and exhaust gas recirculation, in meeting regulatory standards. 3.3. Assess the role of fuel system tuning in optimising emissions control and improving engine efficiency while reducing pollutants. 3.4. Investigate the impact of modern fuel systems, including direct injection and alternative fuels, on emissions reduction and compliance with environmental regulations. 3.5. Apply knowledge of industry standards, such as Euro 6 or EPA regulations, to ensure vehicle fuel systems and emissions control technologies comply with environmental requirements. 3.6. Critically assess the potential for future emissions control innovations and their role in reducing the environmental footprint of vehicle production and operation.

AE0003 - 9. Automotive Air Conditioning and Climate Control Systems

The aim of this study unit is to provide students with a comprehensive understanding of the principles and components of automotive air conditioning and climate control systems, including refrigerants, compressors, condensers, and evaporators. The unit aims to develop practical skills in diagnosing faults and performing maintenance on these systems. Additionally, it focuses on evaluating energy-efficient technologies, such as eco-friendly refrigerants and alternative cooling methods, enabling students to contribute to sustainable advancements in automotive HVAC systems.

Learning Outcome:	Assessment Criteria:
1. Understand the principles of automotive air conditioning systems, including refrigerants, compressors, condensers, and evaporators.	1.1. Describe the key components of automotive air conditioning systems, including refrigerants, compressors, condensers, and evaporators, and their functions. 1.2. Explain the principles behind refrigeration cycles and how automotive air conditioning systems regulate cabin temperature. 1.3. Analyse the role of compressors in circulating refrigerant through the system and maintaining pressure and flow. 1.4. Examine the function of condensers in releasing heat from the refrigerant and the importance of heat exchange in the cooling process. 1.5. Assess the role of evaporators in absorbing heat from the vehicle interior to cool the cabin air. 1.6. Investigate the environmental impact of refrigerants used in automotive air conditioning and the industry's shift towards more sustainable alternatives.
2. Demonstrate the ability to diagnose faults and perform maintenance on air conditioning and climate control systems.	2.1. Describe the key components of automotive air conditioning systems, including refrigerants, compressors, condensers, and evaporators, and their functions. 2.2. Explain the principles behind refrigeration cycles and how automotive air conditioning systems regulate cabin temperature. 2.3. Analyse the role of compressors in circulating refrigerant through the system and maintaining pressure and flow. 2.4. Examine the function of condensers in releasing heat from the refrigerant and the importance of heat exchange in the cooling

	process. 2.5. Assess the role of evaporators in absorbing heat from the vehicle interior to cool the cabin air. 2.6. Investigate the environmental impact of refrigerants used in automotive air conditioning and the industry's shift towards more sustainable alternatives.
3. Evaluate energy-efficient technologies in automotive HVAC systems, including eco-friendly refrigerants and alternative cooling methods.	3.1. Describe the key components of automotive air conditioning systems, including refrigerants, compressors, condensers, and evaporators, and their functions. 3.2. Explain the principles behind refrigeration cycles and how automotive air conditioning systems regulate cabin temperature. 3.3. Analyse the role of compressors in circulating refrigerant through the system and maintaining pressure and flow. 3.4. Examine the function of condensers in releasing heat from the refrigerant and the importance of heat exchange in the cooling process. 3.5. Assess the role of evaporators in absorbing heat from the vehicle interior to cool the cabin air. 3.6. Investigate the environmental impact of refrigerants used in automotive air conditioning and the industry's shift towards more sustainable alternatives.

AE0003 - 10. Automotive Project Management

The aim of this study unit is to develop students' ability to apply project management principles specifically to automotive engineering projects. This includes mastering key areas such as scheduling, resource allocation, and cost estimation. The unit emphasizes the evaluation and utilization of project management tools and software to track progress and ensure quality control. Additionally, it aims to equip students with the skills to manage automotive projects effectively, ensuring timely delivery, budget adherence, and the achievement of high-quality outcomes.

Learning Outcome:	Assessment Criteria:
1. Apply project management principles to automotive engineering projects, including scheduling, resource allocation, and cost estimation.	1.1. Demonstrate the ability to develop a detailed project schedule, incorporating realistic timelines, milestones, and deliverables. 1.2. Effectively allocate resources, ensuring that personnel, materials, and equipment are utilised optimally throughout the project lifecycle. 1.3. Accurately estimate project costs, considering all variables such as labour, materials, and overheads. 1.4. Apply appropriate project management tools and techniques to monitor project progress and adjust plans as necessary. 1.5. Assess and mitigate potential risks that may affect project timelines, resources, or costs, ensuring minimal disruption. 1.6. Ensure adherence to industry standards and regulations, maintaining quality control and compliance throughout the project.
2. Evaluate the role of project management tools and software in tracking project progress and ensuring quality control.	2.1. Analyse the effectiveness of various project management tools and software in tracking key project metrics such as time, cost, and resource utilisation. 2.2. Evaluate the role of software in improving communication and collaboration among project teams, ensuring transparency and accountability. 2.3. Assess the capacity of project management tools to identify and mitigate risks that may impact project quality or progress. 2.4. Demonstrate how software can streamline reporting and documentation, facilitating timely decision-making and ensuring compliance with quality standards.

	2.5. Analyse the impact of project management tools on monitoring quality control measures, ensuring that the project meets specified quality requirements. 2.6. Evaluate how real-time data provided by software can aid in adaptive project management, allowing for prompt adjustments to ensure successful project completion.
3. Manage automotive engineering projects effectively, meeting deadlines and staying within budget while maintaining high standards of quality.	3.1. Analyse the effectiveness of various project management tools and software in tracking key project metrics such as time, cost, and resource utilisation. 3.2. Evaluate the role of software in improving communication and collaboration among project teams, ensuring transparency and accountability. 3.3. Assess the capacity of project management tools to identify and mitigate risks that may impact project quality or progress. 3.4. Demonstrate how software can streamline reporting and documentation, facilitating timely decision-making and ensuring compliance with quality standards. 3.5. Analyse the impact of project management tools on monitoring quality control measures, ensuring that the project meets specified quality requirements. 3.6. Evaluate how real-time data provided by software can aid in adaptive project management, allowing for prompt adjustments to ensure successful project completion.

AE0003 - 11. Advanced Vehicle Technology and Autonomous Systems

The aim of this study unit is to provide students with an advanced understanding of autonomous driving technologies, focusing on key principles such as sensors, machine learning, and data processing. The unit explores the various levels of vehicle autonomy, highlighting their benefits and challenges. Furthermore, it aims to enable students to critically assess the impact of advanced vehicle technologies on safety, regulatory frameworks, and industry standards, preparing them to contribute to the evolving landscape of intelligent transportation systems.

Learning Outcome:	Assessment Criteria:
1. Understand the principles behind autonomous driving technologies, including sensors, machine learning, and data processing.	1.1. Demonstrate a comprehensive understanding of the various types of sensors used in autonomous vehicles, including LIDAR, radar, cameras, and ultrasonic sensors, and their functions. 1.2. Evaluate the role of machine learning algorithms in enabling autonomous vehicles to make real-time decisions based on sensor data. 1.3. Assess the significance of data processing in autonomous driving systems, ensuring the accurate integration and analysis of large datasets for decision-making. 1.4. Apply knowledge of the principles of sensor fusion to improve the accuracy and reliability of autonomous driving systems. 1.5. Explain the interaction between hardware and software in autonomous vehicles, ensuring effective communication between sensors, processors, and control systems. 1.6. Analyse the ethical and safety considerations of autonomous driving technologies, ensuring that they comply with industry standards and regulations.
2. Examine the different levels of autonomy in vehicles and the associated benefits and challenges.	2.1. Analyse the various levels of vehicle autonomy, from driver assistance systems to fully autonomous technologies, in accordance with internationally recognised classification frameworks. 2.2. Evaluate the technological advancements underpinning each level of autonomy, considering the integration of artificial intelligence, sensor systems, and vehicle-to-infrastructure communication. 2.3. Assess the benefits of autonomous vehicles,

	including improvements in safety, efficiency, and accessibility, with reference to empirical research and industry case studies. 2.4. Identify and critically examine the challenges associated with autonomous vehicle implementation, including ethical considerations, cybersecurity risks, and regulatory compliance. 2.5. Compare the impact of different levels of autonomy on transportation systems, urban mobility, and environmental sustainability, demonstrating a comprehensive understanding of their societal implications. 2.6. Formulate evidence-based conclusions on the future of autonomous vehicles, considering emerging trends, legislative developments, and potential barriers to widespread adoption.
3. Assess the impact of advanced vehicle technologies on safety, regulations, and industry standards.	3.1. Analyse how advanced vehicle technologies enhance road safety through collision prevention, driver assistance, and automated response systems. 3.2. Evaluate the regulatory frameworks governing the adoption of emerging vehicle technologies across different jurisdictions. 3.3. Examine the role of industry standards in ensuring the reliability, security, and interoperability of advanced automotive systems. 3.4. Assess the challenges of integrating new technologies while maintaining compliance with evolving safety and environmental regulations. 3.5. Investigate the impact of autonomous and electric vehicle advancements on existing transportation policies and legal requirements. 3.6. Provide evidence-based insights into the future implications of advanced vehicle technologies on global automotive safety and compliance.

AE0003 - 12. Automotive Industry Regulations and Standards

The aim of this study unit is to equip students with a comprehensive understanding of the legal and regulatory frameworks that govern the automotive industry, including safety standards, emissions regulations, and homologation requirements. The unit emphasizes the role of industry standards, such as ISO certifications, in shaping vehicle design, manufacturing processes, and safety practices.

Learning Outcome:	Assessment Criteria:
1. Understand the legal and regulatory frameworks that govern the automotive industry, including safety standards, emissions regulations, and homologation requirements.	1.1. Identify key legal and regulatory frameworks governing the automotive industry at national and international levels. 1.2. Analyse safety standards and their role in ensuring vehicle reliability, occupant protection, and crashworthiness. 1.3. Examine emissions regulations and their impact on vehicle design, manufacturing, and environmental sustainability. 1.4. Assess homologation requirements for vehicle compliance across different markets and jurisdictions. 1.5. Evaluate the challenges of adapting to evolving automotive regulations and industry best practices. 1.6. Provide evidence-based insights into future regulatory trends shaping the global automotive sector.
2. Evaluate how industry standards, such as ISO certifications, influence vehicle design, manufacturing, and safety.	2.1. Identify key legal and regulatory frameworks governing the automotive industry at national and international levels. 2.2. Analyse safety standards and their role in ensuring vehicle reliability, occupant protection, and crashworthiness. 2.3. Examine emissions regulations and their impact on vehicle design, manufacturing, and environmental sustainability. 2.4. Assess homologation requirements for vehicle compliance across different markets and jurisdictions. 2.5. Evaluate the challenges of adapting to evolving automotive regulations and industry best practices. 2.6. Provide evidence-based insights into future regulatory trends shaping the global

	automotive sector.
3. Assess the importance of compliance with regulatory bodies in ensuring the safety, environmental sustainability, and marketability of vehicles.	3.1. Identify key legal and regulatory frameworks governing the automotive industry at national and international levels. 3.2. Analyse safety standards and their role in ensuring vehicle reliability, occupant protection, and crashworthiness. 3.3. Examine emissions regulations and their impact on vehicle design, manufacturing, and environmental sustainability. 3.4. Assess homologation requirements for vehicle compliance across different markets and jurisdictions. 3.5. Evaluate the challenges of adapting to evolving automotive regulations and industry best practices. 3.6. Provide evidence-based insights into future regulatory trends shaping the global automotive sector.

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