

DAY 1: Workshop Safety & Tools

Introduction

The first day of our workshop was focused on one of the most important aspects of working in a technical or hands-on environment: **safety**. Before using any equipment or tools, it's crucial to understand and follow workshop safety rules, know the different types of tools, and use the correct Personal Protective Equipment (PPE). During this session, we also worked in teams to create safety posters that summarized everything we learned.

Workshop Safety Rules

Safety rules in a workshop are designed to protect everyone from potential hazards. Here are some key safety rules we researched and discussed:

1. **Always wear appropriate PPE** – Safety glasses, gloves, ear protection, and steel-toe boots when necessary.
2. **Keep the workspace clean and organized** – Tools and materials should be returned to their proper places.
3. **Never use a tool you haven't been trained to use** – Always ask for help if you're unsure.
4. **Report damaged tools or unsafe conditions immediately** – Don't take risks.
5. **No loose clothing or jewelry** – These can get caught in machines.

These rules are basic but essential. Ignoring them can lead to serious injuries.

Types of Tools

We also learned how to identify different types of tools and their purposes. Tools are generally divided into several categories:

- **Hand Tools** – Hammers, screwdrivers, pliers, wrenches.
- **Power Tools** – Drills, angle grinders, jigsaws.
- **Measuring Tools** – Tape measures, rulers, calipers.
- **Cutting Tools** – Handsaws, box cutters, utility knives.

Each tool has a specific use, and knowing how to handle it safely is part of being a responsible worker in the shop.

Personal Protective Equipment (PPE)

PPE protects us from injury or harm in the workshop. Here's a breakdown of commonly used PPE:

- **Safety goggles** – Protect eyes from dust, sparks, and debris.
- **Gloves** – Prevent cuts and exposure to harmful materials.
- **Ear protection** – Reduces the risk of hearing damage from loud tools.
- **Masks/respirators** – Used when working with chemicals or fine dust.
- **Protective clothing** – Like overalls or flame-resistant jackets.

Choosing the right PPE depends on the task and the tools being used.

Team Activity: Safety Poster

In teams, we created a **digital safety poster** that summarized the key rules, tool types, and PPE requirements. Our goal was to design something clear, informative, and visually appealing that could be displayed in any workshop. We used diagrams of tools, labeled safety gear, and included safety rule checklists.

Working in a team helped us learn from each other and improve our understanding through discussion and collaboration.

Conclusion

By the end of Day 1, we understood the importance of workshop safety and how to apply it. We became more confident in identifying tools and using PPE correctly. This foundation will help us stay safe and effective throughout the rest of the workshop sessions.

Day 2: Measuring Instruments

Introduction

On Day 2 of our workshop, we focused on developing one of the most important skills in engineering and manufacturing: **precision measurement**. Accurate measurements ensure that parts fit correctly and function as intended. During this session, we researched key measuring instruments—**calipers**, **micrometers**, and **gauges**—and practiced using them to measure different components with guidance from our instructor.

Research: Measuring Instruments

1. Calipers

Calipers are versatile instruments used to measure both internal and external dimensions. The three main types are:

- **Vernier calipers**
- **Dial calipers**
- **Digital calipers**

Each has jaws to measure external size, smaller jaws for internal size, and a depth rod. They are commonly used to measure objects with an accuracy of ± 0.02 mm. We learned to read a vernier scale manually and how to use digital calipers for faster, more precise readings.

2. Micrometers

Micrometers are more precise than calipers and are used for measuring small distances with high accuracy (up to ± 0.01 mm). Types include:

- **Outside micrometers** (for rods, wires, and flat surfaces)
- **Inside micrometers** (for hole diameters)
- **Depth micrometers** (for recesses and slots)

We practiced holding the micrometer correctly and using the ratchet mechanism to avoid over-tightening, which could affect the measurement.

3. Gauges

Gauges are used more for checking dimensions than for reading exact values. Examples we studied include:

- **Feeler gauges** – used to check gap width or clearance.
- **Thread gauges** – for checking screw thread sizes.
- **Plug and ring gauges** – to quickly verify if parts are within tolerance.

Gauges are commonly used in production for quality control.

Practical Activity

We worked in pairs to practice using these instruments on real parts. With guidance from the instructor, we measured:

- A metal rod's **diameter** with a **vernier caliper**
- A small disc's **thickness** using a **micrometer**
- A gap between two surfaces using **feeler gauges**

Each measurement was recorded in our notebooks. We double-checked readings and discussed errors or inconsistencies as a group. The focus was on **handling tools correctly, ensuring repeatable measurements, and interpreting values accurately.**

Results & Learning

We successfully measured each component and recorded the values clearly in a results table. We realized the importance of careful alignment, steady hands, and clean surfaces when taking precise measurements. The feedback helped us improve our technique and confidence.

Conclusion

Measuring instruments like calipers, micrometers, and gauges are essential tools in any workshop. On Day 2, we not only studied how they work but also learned how to use them in practice. By the end of the session, we were able to **measure parts accurately** and **record our results reliably**, which will be crucial in future projects.

Day 3: Fasteners & Torque

Introduction

On Day 3 of our technical workshop, we explored the essential components that hold machines and structures together: **fasteners**. We focused on different types of **nuts, bolts, threads**, and how **torque tools** are used to apply the correct amount of force when tightening them. Understanding and using the right fasteners, along with applying the proper torque, is critical to building safe, reliable mechanical assemblies.

Types of Fasteners

Fasteners are hardware devices used to mechanically join or affix two or more objects together. The most common types we studied include:

- **Bolts** – Threaded fasteners used with nuts to hold components together.
- **Nuts** – Paired with bolts to secure joints.
- **Screws** – Fasten directly into materials.
- **Washers** – Distribute the load and protect surfaces from damage.
- **Threaded rods** – Long bolts used in structural applications.

We also learned that fasteners can have **different thread types**, such as:

- **Coarse threads** – For quick assembly and stronger grip in softer materials.
 - **Fine threads** – For more precise torque applications and vibration resistance.
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Torque Tools and Their Purpose

Torque is the rotational force applied to a fastener. Applying the correct torque is vital to avoid over-tightening (which can damage parts or strip threads) or under-tightening (which can lead to loosening or failure).

Torque Tools We Studied:

- **Click-Type Torque Wrench** – Emits a click when the set torque is reached.
- **Beam-Type Torque Wrench** – Uses a pointer and scale to show torque.
- **Digital Torque Wrench** – Displays exact torque value on a screen.

These tools allow precise control and consistency, especially in automotive, aerospace, and mechanical industries.

Practical Activity: Using a Torque Wrench

In the practical session, we used a **click-type torque wrench** to tighten bolts to specific torque values. We:

1. Selected the correct bolt and nut combination.
2. Set the torque wrench to the required torque value.
3. Practiced tightening until the wrench “clicked” to signal that the desired torque was reached.
4. Compared torque settings and fastener types with classmates.

This helped us understand how different materials and bolt sizes require different torque levels.

Key Takeaways

- Proper use of **fasteners** ensures structural integrity.
 - **Torque tools** help avoid damage and ensure safety.
 - **Thread type** and material matter when choosing bolts and nuts.
 - Hands-on practice gave us a better understanding of how much force is needed and why accuracy matters.
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Conclusion

Day 3 helped us build confidence in identifying and using fasteners correctly. By practicing with torque wrenches, we learned the importance of applying the correct amount of force. These skills are essential for anyone working with machinery, vehicles, or structural components, where even a small mistake can lead to big problems.

Day 4: Engine Types

Introduction

On Day 4 of our technical workshop, we explored one of the most important components in the world of mechanics: the **internal combustion engine**. Working in pairs, we researched and compared two major engine types—**2-stroke** and **4-stroke** engines. Our goal was to understand how each engine works, where it's used, and what makes them different. We created comparison charts to highlight the key differences in structure, operation, and efficiency.

Research: 2-Stroke vs 4-Stroke Engines

What is a 2-Stroke Engine?

A 2-stroke engine completes a power cycle in just two piston strokes (one revolution of the crankshaft). This type of engine is:

- Simpler in design
- Lightweight and compact
- Often used in motorcycles, chainsaws, and small garden tools

However, 2-stroke engines are **less fuel-efficient**, produce **more pollution**, and typically **wear out faster** due to lack of a dedicated lubrication system.

What is a 4-Stroke Engine?

A 4-stroke engine completes the power cycle in four strokes (two revolutions of the crankshaft):

1. Intake
2. Compression
3. Power
4. Exhaust

This type is commonly found in cars, trucks, lawnmowers, and generators. Advantages include:

- **Greater fuel efficiency**
- **Lower emissions**
- **Longer lifespan**

They are more complex, heavier, and typically require more maintenance.

Comparison Chart

Feature	2-Stroke Engine	4-Stroke Engine
Power Strokes	1 per revolution	1 every 2 revolutions
Efficiency	Lower fuel efficiency	Higher fuel efficiency
Emissions	Higher pollution	Cleaner combustion
Weight & Size	Lightweight, compact	Heavier, more complex
Lubrication	Mixed with fuel	Separate oil system
Maintenance	Wears out faster	More durable, longer service life
Common Uses	Small tools, scooters	Cars, generators, motorcycles

Hands-On Activity

After creating our comparison charts, we looked at real-life models and images of both types of engines. Some groups even had plastic engine models that showed how pistons and valves move inside. With the help of our instructor, we were able to:

- **Identify key engine parts**
- **Recognize whether an engine was 2-stroke or 4-stroke**
- **Explain the basic working cycle of each**

Conclusion

By the end of Day 4, we were able to confidently **identify engine types** and explain the **main differences** between them. Working in pairs made the learning experience more interactive and fun. Understanding how engines work is essential for anyone interested in mechanics, automotive engineering, or machinery.

Day 5: Engine Parts

Introduction

On Day 5 of our workshop, we focused on learning about the **internal parts of an engine**. Understanding each part and how it works is essential to diagnosing problems, performing maintenance, or even rebuilding an engine. We used videos, books, and physical engine models to explore the most important components inside a typical internal combustion engine. At the end of the session, we labeled engine diagrams and explained the function of each part.

Research: Internal Engine Components

During our research, we identified the main parts of a 4-stroke engine and studied how they work together during the engine cycle. The most important internal components include:

1. Cylinder

The cylinder is the space where the piston moves up and down. Most engines have multiple cylinders.

2. Piston

The piston is a moving part that transfers force from the combustion process to the crankshaft. It moves up and down inside the cylinder.

3. Crankshaft

The crankshaft converts the up-and-down motion of the pistons into rotational motion, which powers the vehicle.

4. Connecting Rod

This connects the piston to the crankshaft and transfers the force between them.

5. Camshaft

The camshaft controls the opening and closing of the intake and exhaust valves. It is synchronized with the crankshaft.

6. Valves

There are two main types:

- **Intake valve** – allows fuel-air mixture into the cylinder.
- **Exhaust valve** – releases burned gases after combustion.

7. Spark Plug

The spark plug ignites the fuel-air mixture in the combustion chamber (only in petrol engines).

8. Combustion Chamber

The area at the top of the cylinder where fuel is burned to produce energy.

Practical Activity: Labeling and Explanation

We watched an animated video that showed the engine cycle and highlighted each part in motion. Using printed engine diagrams and 3D models, we labeled every part we had researched. Then, in small groups, we explained the function of each part using simple terms and examples. This helped reinforce our understanding and improve our technical vocabulary.

Summary of Functions (Quick Reference Table)

Engine Part	Function
Cylinder	Guides piston motion
Piston	Moves to compress and transfer energy
Crankshaft	Converts piston movement to rotation
Connecting Rod	Links piston and crankshaft
Camshaft	Opens/closes valves at correct timing
Valves	Allow air/fuel in and exhaust out
Spark Plug	Ignites fuel-air mixture
Combustion Chamber	Area where fuel combustion takes place

Conclusion

Day 5 helped us gain a deep understanding of the internal parts of an engine and how each one contributes to its operation. Through diagrams, videos, and hands-on models, we learned to **identify**, **label**, and **explain** the function of every key component. This knowledge is fundamental for anyone planning to work with engines or pursue a career in automotive or mechanical engineering.

DAY 6: Lubrication Systems

Introduction

On Day 6 of our technical workshop, we focused on one of the most important systems that keep an engine running smoothly: the **lubrication system**. A good lubrication system protects engine parts from wear and overheating by reducing friction and removing heat and dirt. In this session, we researched **engine oils**, **oil pumps**, and **filters**, and we observed or took part in an **engine oil change**. We also learned how oil flows through the engine and the differences between various oil types.

Research: Key Components of the Lubrication System

1. Engine Oils

Engine oil is the lifeblood of the engine. It performs multiple roles:

- **Reduces friction** between moving metal parts
- **Cools** hot engine components
- **Cleans** by collecting dirt and particles
- **Protects** by forming a thin layer between parts

Types of Engine Oil:

- **Mineral Oil** – Natural, less expensive, suitable for older engines.
- **Synthetic Oil** – Man-made, provides better performance, lasts longer, more stable in extreme temperatures.
- **Semi-Synthetic Oil** – A blend of mineral and synthetic, offering balanced performance and cost.

2. Oil Pump

The oil pump moves oil under pressure through the engine. It draws oil from the **oil sump (pan)** and pushes it through the **oil filter**, then to parts such as:

- Crankshaft and camshaft bearings
- Pistons
- Valve train

This keeps all critical parts lubricated and cool.

3. Oil Filter

The oil filter removes impurities such as metal shavings, carbon particles, and dirt. Without it, dirty oil would damage engine parts. There are:

- **Spin-on filters** – Most common, easy to replace
 - **Cartridge filters** – Eco-friendly, used in many modern vehicles
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Oil System Flow – How It Works

1. **Oil is stored** in the oil pan at the bottom of the engine.
2. The **oil pump** pulls oil from the pan and pressurizes it.
3. Oil flows through the **oil filter**, where it is cleaned.
4. Clean oil is sent through oil channels to **bearings, cylinder walls, valve lifters**, and other parts.
5. After lubricating, the oil **returns to the pan** and the cycle continues.

Understanding this flow helps us see why clean, high-quality oil and a working pump and filter are critical.

Practical Activity: Oil Change

We either observed or performed a basic **engine oil change**. The process involved:

- **Draining old oil** from the oil pan
- **Replacing the oil filter**
- **Refilling with fresh oil**, using the right type and amount
- **Checking the oil level** with a dipstick

We also discussed signs of bad oil, such as dark color, burnt smell, or low level on the dipstick.

Conclusion

On Day 6, we learned how important the lubrication system is for engine health. We explored how oil flows, what each part does, and how different types of oil affect engine performance. Performing or observing an oil change gave us hands-on experience and showed us how proper

maintenance can extend engine life. Knowing how the system works helps us understand what happens inside the engine and how to keep it running safely and efficiently.

Day 7: Cooling Systems

Introduction

On Day 7 of our workshop, we explored the **cooling system**—a vital part of any internal combustion engine. This system prevents engines from **overheating**, which can lead to serious damage or total failure. In teams, we investigated the roles of **radiators**, **coolant**, and **water pumps**, and we created diagrams showing how the cooling system works. By the end of the session, we understood how cooling flow works and what causes engines to overheat.

Investigation: Key Cooling System Components

1. Radiator

The radiator is a key part of the cooling system. Its main role is to **remove heat** from the coolant. Hot coolant from the engine enters the radiator and releases heat as air passes through thin metal fins. It is usually located at the front of the vehicle to maximize airflow.

2. Coolant

Coolant (or antifreeze) is a special liquid that:

- **Absorbs engine heat**
- **Prevents freezing** in cold weather
- **Prevents boiling** in high temperatures

Coolant is usually a mix of water and chemicals like ethylene glycol. It flows in a closed loop from the engine to the radiator and back.

3. Water Pump

The water pump is responsible for **circulating coolant** through the engine and radiator. It is usually belt-driven and ensures that coolant is constantly moving. If the pump fails, coolant stops flowing and the engine can overheat very quickly.

Understanding Cooling Flow

We created team diagrams that showed how coolant flows through the system. The basic cooling cycle looks like this:

1. **Coolant is pushed** from the radiator into the engine by the water pump.

2. Inside the **engine block**, the coolant **absorbs heat** from the cylinders.
3. The hot coolant flows to the **radiator**, where it releases heat into the air.
4. A **cooling fan** helps move air through the radiator, especially at low speeds.
5. **Cooled coolant** returns to the engine and the cycle repeats.

We labeled parts like the **thermostat**, **hoses**, and **fan**, and discussed how each one contributes to cooling performance.

Causes of Overheating

We also studied common reasons why engines overheat. These include:

- **Low coolant levels** (due to leaks or evaporation)
- **Clogged radiator** (poor airflow or blocked passages)
- **Broken water pump**
- **Stuck thermostat** (not allowing coolant to circulate)
- **Cooling fan failure**

Recognizing these causes helps prevent breakdowns and damage.

Conclusion

By the end of Day 7, we had a clear understanding of how the engine cooling system works. Working in teams helped us visualize the **cooling flow** and identify the **functions of key components**. Most importantly, we learned how to detect early signs of overheating and how proper maintenance of the radiator, water pump, and coolant can protect an engine from failure.

Day 8: Fuel System

Introduction

On Day 8 of our technical workshop, we focused on understanding the **fuel system**—the part of the engine responsible for delivering fuel in the right amount and at the right time. We researched key components such as **carburetors**, **fuel injectors**, and **fuel filters**. In teams, we also observed or took part in a **fuel filter replacement** and discussed the **fuel delivery process** step by step.

Research: Key Fuel System Components

1. Carburetor

The carburetor is a mechanical device used mainly in older vehicles. It mixes air and fuel before sending it into the combustion chamber. It works based on pressure differences and vacuum created by the moving pistons.

- Simple design, but less efficient
- Requires manual tuning and regular cleaning
- Replaced in modern engines by fuel injectors

2. Fuel Injectors

Fuel injectors are used in modern vehicles to spray a precise amount of fuel into each cylinder. Controlled electronically, they:

- Improve fuel economy
- Lower emissions
- Provide better performance and smoother operation

Each injector is connected to a fuel rail that delivers pressurized fuel from the pump.

3. Fuel Filter

The fuel filter is essential for removing dirt, rust, and debris from fuel before it reaches the injectors or carburetor. A dirty filter can:

- Reduce fuel flow
- Cause engine misfires
- Lead to poor performance or damage to injectors

Fuel filters should be checked and replaced regularly to maintain engine health.

Practical Activity: Fuel Filter Replacement

During the practical session, students either observed or helped perform a **fuel filter replacement**. The steps included:

1. Locating the fuel filter (under the car or near the engine).
2. Depressurizing the fuel system for safety.
3. Disconnecting fuel lines and removing the old filter.
4. Installing the new filter in the correct flow direction.
5. Checking for leaks and testing the engine.

This activity taught us how essential clean fuel is for proper engine operation and gave us hands-on experience with vehicle maintenance.

Fuel Delivery Process

We learned how fuel flows from the tank to the engine:

1. **Fuel is pumped** from the fuel tank by an electric fuel pump.
2. It passes through the **fuel filter**, which removes contaminants.
3. Clean fuel reaches the **injectors** or **carburetor**, where it is mixed with air.
4. The fuel-air mixture enters the **combustion chamber**, where it is ignited to produce power.

This cycle repeats continuously while the engine runs. Electronic control units (ECUs) monitor and adjust fuel delivery based on engine load, temperature, and speed.

Conclusion

Day 8 gave us a deeper understanding of how fuel reaches the engine and why clean, well-regulated delivery is so important. We explored the differences between **carburetors and fuel injectors**, learned the role of the **fuel filter**, and participated in a real maintenance task. With this knowledge, we can better recognize fuel system problems and understand how modern engines operate efficiently.

Day 9: Electrical Systems I

Introduction

On Day 9 of our workshop, we focused on the **Electrical System I**, the foundation of any vehicle's power and control. The goal of this session was to understand the basic components that generate and distribute electrical energy: the **battery**, the **starter motor**, and the **alternator**. We explored these components through research, video tutorials, and by **inspecting a real electrical system**. We also **tested a battery** using a multimeter and identified various components in a working vehicle.

Key Components of the Electrical System

1. Battery

The battery stores electrical energy and supplies power to the vehicle's systems when the engine is off. It is also responsible for starting the engine. Most automotive batteries are 12V lead-acid types.

- Function: Provides initial power to the starter motor and ignition system.
- Symptoms of failure: Weak engine start, dim lights, no power when turning the key.

2. Starter Motor

The starter motor is a powerful electric motor that turns the engine over to start it. It operates only during engine start-up and requires a high amount of current from the battery.

- Located near the bottom of the engine.
- Connected to the battery and ignition switch.

3. Alternator

The alternator is driven by the engine and recharges the battery while providing continuous electrical power to the vehicle while the engine is running.

- Converts mechanical energy into electrical energy.
 - Contains a built-in voltage regulator.
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Practical Observation

We watched tutorial videos explaining:

- How a starter motor works
- How to test a car battery with a **digital multimeter**
- Signs of alternator problems

Afterward, we worked in pairs to **inspect an actual vehicle electrical system**. We located:

- The **battery terminals**
- The **starter motor** connection
- The **alternator** and its belt

We also observed **wiring** and **ground points**, which are essential for completing electrical circuits.

Battery Testing Activity

Using a multimeter, we tested the voltage of a 12V car battery:

1. **Multimeter set to DC volts**
2. Red lead to the positive terminal (+), black to negative (-)
3. A healthy battery showed between **12.4V and 12.7V** (engine off)
4. With the engine running, voltage increased to **13.8V – 14.4V**, confirming alternator function

This hands-on activity helped us understand how to check battery health and charging performance.

Conclusion

Day 9 helped us build a strong foundation in automotive electrical systems. We learned about the battery, starter, and alternator — the key components that bring a vehicle to life. By watching tutorials, inspecting a real system, and testing a battery ourselves, we gained both technical knowledge and practical skills. These are essential for diagnosing electrical issues and ensuring reliable engine starting and power supply.

Day 10: Electrical Systems II

Introduction

On Day 10 of our workshop, we continued our journey into automotive electrical systems with a focus on the practical aspects of **fuses**, **lights**, and **relays**. Today's session aimed to help students understand how circuits are protected by fuses, how to test bulbs and fuses, and how to safely replace components such as **light bulbs** and **fuses** in vehicles or on a demo board. By the end of this session, students had gained practical experience in diagnosing basic electrical faults and had a better understanding of the role of **fuses and relays** in protecting circuits.

Key Concepts: Fuses, Lights, and Relays

1. Fuses

Fuses are safety devices designed to protect electrical circuits from damage caused by **overcurrent**. When an electrical current exceeds the safe limit, the fuse "blows," cutting off the power and preventing damage to wiring and components.

- **Types of Fuses:** Blade fuses (commonly used in vehicles), glass fuses, and ceramic fuses.
- **Ratings:** Each fuse has an amperage rating that should match the circuit it protects. Replacing a blown fuse with one of the wrong rating can lead to more serious electrical damage.

2. Lights

In this session, we focused on the various **lighting systems** in a vehicle, such as headlights, tail lights, turn signals, and interior lights. Each light is part of a larger **electrical circuit** that can be affected by a blown fuse, faulty relay, or a burned-out bulb.

- **Headlights and Tail Lights:** Essential for visibility and safety.
- **Turn Signals:** Indicate the driver's intent to change lanes or make turns.
- **Interior Lights:** Illuminate the vehicle's cabin, especially in low-light conditions.

3. Relays

Relays are used to control high-power circuits with low-power signals. They act as switches that use an electromagnet to open or close a circuit. For example, a small current from the switch can activate a relay that allows a much larger current to flow to the headlights or the air conditioning system.

- **Function:** Protects switches from carrying too much current.

- **Common Uses:** Headlights, fuel pump, horns, and windshield wipers.
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Practical Activity: Testing and Replacing Bulbs/Fuses

1. Testing Bulbs

Using a **demo board**, we tested various bulbs (headlights, brake lights, etc.) to determine if they were functional. We connected the bulbs to a **power source** and observed whether they lit up. If the bulb did not light, we knew that it needed to be replaced.

- **What we learned:** If a bulb is burned out, replacing it with a new one is simple, but we must ensure the new bulb has the correct **wattage** and fits the socket properly.

2. Testing Fuses

We tested several **fuses** using a **multimeter** set to continuity mode. If the multimeter beeped, the fuse was intact. If there was no beep, the fuse was blown and required replacement.

- **Fuses in Action:** A blown fuse usually indicates an issue, such as a short circuit, that needs to be fixed before replacing the fuse.

3. Replacing Fuses and Bulbs Safely

After testing the components, we replaced any blown fuses or burned-out bulbs. **Safety precautions** included:

- **Disconnecting the battery** before working on electrical components in the vehicle.
- Using **proper-rated fuses** to ensure that we didn't overload the circuit.
- Wearing **insulated gloves** to prevent any accidental shocks.

We also reviewed the **correct way to insert a fuse** into the fuse box, ensuring that it was oriented correctly and that the metal prongs were making a secure connection.

Understanding Circuits and Troubleshooting

By the end of the day, students had a deeper understanding of how **electric circuits** work in vehicles and the importance of components like fuses and relays in maintaining safe operation. We also learned how to **troubleshoot simple electrical faults**—such as a headlight not turning on or a power window failing to operate—by systematically checking the fuse, relay, and the bulb itself.

Conclusion

Day 10 provided practical, hands-on experience with basic **electrical diagnostics** in vehicles. We explored the roles of fuses, lights, and relays in the electrical system, and we learned how to **safely test and replace bulbs and fuses**. This session was essential for developing the skills needed to work with automotive electrical systems and to ensure that all components operate efficiently and safely.

Day 11: Brake System

Introduction

On Day 11 of our technical workshop, we focused on understanding the **brake system**, one of the most crucial safety features in any vehicle. This session aimed to teach us about the different types of brake systems, specifically **disc and drum brakes**, as well as the modern safety system **ABS (Anti-lock Braking System)**. We also had the opportunity to **inspect a real braking system** in small groups, identify the various components, and understand how the system operates to ensure safe vehicle stopping.

Key Components of the Brake System

1. Disc Brakes

Disc brakes are one of the most common types of braking systems in modern vehicles. The key components of disc brakes include:

- **Brake rotor (disc):** A metal disc that rotates with the wheel. The brake pads press against the rotor to create friction and slow down or stop the vehicle.
- **Brake caliper:** A housing that holds the brake pads and applies pressure to them when the brake pedal is pressed.
- **Brake pads:** Friction material that presses against the rotor to slow the vehicle down. As the pads wear, they need to be replaced to maintain braking efficiency.

Advantages of Disc Brakes:

- More effective at dissipating heat.
- Less prone to fading (loss of braking power).
- More reliable in wet conditions.

2. Drum Brakes

Drum brakes were commonly used in older vehicles but are still found in some vehicles today, especially in the rear wheels. The key components of drum brakes include:

- **Brake drum:** A cylindrical drum that rotates with the wheel.
- **Brake shoes:** Curved pieces of friction material that press against the inside of the drum to slow the vehicle down.

- **Wheel cylinder:** A hydraulic piston that pushes the brake shoes outward against the drum.

Advantages of Drum Brakes:

- Simple design.
- Can be less expensive to maintain in some cases.

However, drum brakes tend to overheat more easily, reducing their effectiveness, especially in heavy braking situations.

3. ABS (Anti-lock Braking System)

ABS is an advanced safety feature found in most modern vehicles. It prevents the wheels from locking up during hard braking, helping the driver maintain steering control while stopping. ABS works by rapidly pulsing the brakes to prevent skidding.

- **Components:** ABS uses sensors to monitor wheel speed, a hydraulic control unit, and a pump to adjust brake pressure.
 - **Advantages of ABS:**
 - Reduces the risk of skidding in slippery conditions.
 - Helps maintain vehicle control during emergency braking.
 - Shortens stopping distances on dry pavement.
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Practical Activity: Inspecting a Real Braking System

In groups, we had the opportunity to inspect an actual vehicle's braking system. The tasks included:

- Locating and identifying **disc brakes** and **drum brakes** on the vehicle.
- Checking the **condition of the brake pads** and **rotors** for wear.
- Inspecting the **brake lines** and **hoses** for signs of leaks or damage.
- Looking for any **ABS components** such as the **sensors**, **hydraulic control unit**, and **wiring**.

We observed the **rotor surface** for any scoring or grooving, which could indicate worn pads or other issues that may affect braking performance. We also checked the **brake fluid** level and its condition, as low or contaminated fluid can lead to brake failure.

Basic Operation of the Brake System

The brake system works by converting the kinetic energy of the vehicle into heat through friction. Here's how it works in basic terms:

1. **Pressing the Brake Pedal:** When the driver presses the brake pedal, hydraulic fluid is sent through the brake lines to the brake calipers or brake shoes.
2. **Friction Applied:** The brake pads or shoes press against the rotors or drums, creating friction that slows the rotation of the wheels.
3. **ABS Intervention (if equipped):** In case of hard braking, ABS sensors detect if a wheel is about to lock. The system automatically modulates brake pressure to allow the wheel to continue rotating and avoid skidding.

The brake system is designed to provide the vehicle with maximum stopping power while ensuring safety and control.

Conclusion

Day 11 gave us a comprehensive understanding of the **brake system**, its essential components, and how it operates to ensure vehicle safety. We learned the differences between **disc and drum brakes**, as well as the functionality of **ABS**. Through hands-on experience inspecting a real braking system, we were able to identify various brake components and understand their role in the overall braking process. This knowledge is essential for diagnosing brake-related issues and maintaining a safe and efficient braking system.

Day 12: Transmission

Introduction

On Day 12 of our workshop, we focused on understanding the **transmission system** in vehicles, an essential part that allows the engine's power to be transferred to the wheels. We studied both **manual** and **automatic transmission systems**, looking at how they work, the key components, and the process of **gear shifting**. As part of the practical activity, our teams built a **basic model** of a transmission system and created diagrams to visualize its functions. This session provided us with a deeper understanding of how vehicles change gears and how the transmission parts work together to ensure smooth operation.

Manual vs. Automatic Transmission

1. Manual Transmission

In a manual transmission system, the driver controls the shifting of gears using the **gear lever** and **clutch pedal**. The key components of a manual transmission are:

- **Clutch:** A mechanism that disengages the engine from the transmission, allowing the driver to change gears.
- **Gear Lever:** The lever the driver uses to select the appropriate gear.
- **Gears and Gearbox:** A set of gears that provide different speed ratios for the vehicle, allowing the engine to operate at an optimal speed while the wheels rotate at the desired speed.
- **Flywheel:** A rotating disk that helps smooth out the power transfer between the engine and transmission.

How it Works:

- When the driver presses the **clutch pedal**, it disconnects the engine from the transmission, allowing the driver to change gears.
- Once the driver selects a new gear using the **gear lever**, they release the clutch pedal, re-engaging the engine and allowing power to flow to the wheels at the appropriate gear ratio.

2. Automatic Transmission

In an automatic transmission, the vehicle automatically selects the appropriate gear based on factors like speed, engine load, and throttle position. The components of an automatic transmission include:

- **Torque Converter:** A fluid coupling that connects the engine to the transmission, allowing for smooth power transfer without the need for a clutch.
- **Planetary Gear Set:** A system of gears that allows for automatic gear shifting.
- **Transmission Fluid:** A special fluid that lubricates and cools the internal parts of the transmission while also providing hydraulic pressure to shift gears.
- **Shifter:** The gear lever in an automatic vehicle that allows the driver to select Park, Reverse, Neutral, or Drive.

How it Works:

- The **torque converter** automatically adjusts the power flow from the engine to the transmission. When the vehicle needs to shift gears (based on speed and acceleration), the **planetary gear set** adjusts the gear ratio.
 - The system uses **hydraulic pressure** from the transmission fluid to control the gear shifts, eliminating the need for manual intervention.
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Practical Activity: Building a Model & Drawing Diagrams

During the workshop, our teams had the opportunity to either **build a basic model** of a manual or automatic transmission or create **diagrams** to represent the components and their functions.

- **Model Building:** Some teams used a combination of **plastic gears, wires, and small motors** to create a simple working model of a **manual transmission**, showing how gears shift when the clutch is pressed.
 - **Diagrams:** Other teams drew detailed **schematic diagrams** of both **manual and automatic transmission systems**, labeling key components such as the **clutch, flywheel, torque converter, gearbox, and shifter**. These diagrams helped to visualize how each part interacts within the system.
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Explanation of Gear Shifting and Transmission Parts

1. Manual Transmission Gear Shifting

In a manual transmission, gear shifting requires the driver to:

- **Press the clutch pedal** to disengage the engine from the transmission.
- **Move the gear lever** to select the appropriate gear.
- **Release the clutch** to engage the new gear and transfer power from the engine to the wheels.

Each gear provides a different ratio of engine power to wheel speed. Low gears (like 1st and 2nd) provide more power for acceleration, while higher gears (like 4th and 5th) provide less power but allow the vehicle to maintain higher speeds with lower engine RPMs.

2. Automatic Transmission Gear Shifting

In an automatic transmission, gear shifting is handled by the vehicle's computer and hydraulic system. The process is automatic, but it still follows basic principles:

- **Torque converter** provides smooth power transfer from the engine to the transmission.
 - The **planetary gear set** adjusts the gear ratio based on speed and load.
 - The **transmission fluid** is essential for hydraulic pressure, allowing the vehicle to shift gears smoothly.
-

Conclusion

Day 12 provided an in-depth exploration of **manual and automatic transmissions** and how they function within a vehicle. We gained hands-on experience building models and drawing diagrams to understand the components and gear-shifting processes better. Whether it's **manually shifting gears** with a clutch or letting the vehicle handle the changes automatically, understanding the transmission system is essential for both maintaining and driving modern vehicles. By the end of the session, we were able to identify key parts of both systems and explain their roles in transferring power from the engine to the wheels.

Day 13: Suspension & Steering

Introduction

On Day 13 of our workshop, we explored two critical systems in any vehicle: **suspension** and **steering**. These systems play a vital role in vehicle stability, comfort, and safety. Suspension systems, including **shock absorbers**, ensure that the vehicle remains stable while driving over bumps or rough terrain, while the steering system allows the driver to control the direction of the vehicle. We had the opportunity to **inspect these systems on a real car or model** and learned how to **recognize worn-out parts**. Additionally, we gained an understanding of the **purpose of both systems** and how they work together to ensure smooth and safe driving.

Key Components of Suspension and Steering

1. Suspension System

The **suspension system** connects the vehicle to its wheels and allows relative motion between the two. The primary goal of the suspension system is to absorb shocks from the road and maintain tire contact for better handling.

Main Components:

- **Shock Absorbers (Shocks):** These components control the impact and rebound movement of the springs. They prevent the car from bouncing excessively after hitting bumps, ensuring a smooth ride.
- **Springs:** Springs absorb the initial impact from bumps or road imperfections. They come in various forms, including coil springs, leaf springs, and air springs.
- **Struts:** Similar to shock absorbers, struts are a combination of shock absorbers and structural components that support the suspension system.
- **Control Arms:** These link the suspension components to the vehicle frame and allow the wheels to move up and down while maintaining proper alignment.
- **Bushings:** These rubber components provide flexibility and reduce noise and vibrations in the suspension system.

Purpose: The suspension system's primary purpose is to ensure comfort and safety. It helps in **reducing the impact** from rough roads, maintaining **traction** between the tires and the road, and improving overall vehicle stability.

2. Steering System

The **steering system** is responsible for controlling the direction of the vehicle. It allows the driver to turn the vehicle's wheels and navigate around corners or obstacles. The most common steering system in modern vehicles is the **rack-and-pinion** system.

Main Components:

- **Steering Wheel:** The device the driver uses to steer the vehicle. It is connected to the steering column and allows for the rotation of the wheels.
- **Steering Column:** A shaft that transmits the movement of the steering wheel to the steering mechanism.
- **Rack and Pinion:** The most common steering mechanism. The pinion (a small gear) is attached to the steering wheel column and engages with the rack (a long, toothed bar). Turning the wheel rotates the pinion, which moves the rack left or right, turning the vehicle's wheels.
- **Tie Rods:** These link the steering rack to the wheels and transfer the motion from the rack to the tires.
- **Power Steering Pump:** In vehicles with power steering, this pump provides hydraulic pressure to assist with turning the steering wheel, making it easier to maneuver the vehicle.

Purpose: The purpose of the steering system is to provide precise control over the direction of the vehicle, making it easy to turn the wheels and change the vehicle's path. Power steering systems make steering less strenuous, especially at low speeds.

Practical Activity: Inspecting Suspension and Steering Systems

In today's session, we had the opportunity to inspect the **suspension and steering systems** of a real car or a model vehicle. In groups, we:

- **Checked shock absorbers** for signs of wear, including oil leaks or damage to the rubber seals. Worn-out shock absorbers may cause excessive bouncing, poor handling, or tire wear.
- **Tested the springs** to ensure they were not cracked or damaged. We also examined the control arms and bushings for any signs of wear or cracking, which could lead to poor handling or noise while driving.

- **Inspected the steering system** by turning the steering wheel and checking for smooth movement. We also looked for any unusual noises or difficulty in steering, which could indicate problems with the **steering rack, tie rods, or power steering pump**.
- **Tested the suspension's ability to absorb shocks** by pressing down on the car and releasing it to check if it bounces excessively or stays stable. This is an indicator of whether the shock absorbers are functioning properly.

Through these activities, we learned to **recognize worn-out parts**, such as leaking shock absorbers, worn-out bushings, or damaged steering components, which can affect the overall performance of the vehicle.

Recognizing Worn-Out Parts and System Purpose

Suspension System:

- **Worn Shock Absorbers:** If the shock absorbers are leaking oil or making a knocking sound, they are no longer performing effectively. This can lead to an uncomfortable ride and poor handling.
- **Worn Springs:** Springs that are cracked or broken can cause the vehicle to sit unevenly and impact the overall suspension system's ability to absorb bumps.
- **Worn Control Arms or Bushings:** Control arms that are bent or bushings that are cracked can result in uneven tire wear and a lack of control over the vehicle.

Steering System:

- **Loose Steering:** If the steering wheel feels loose or unresponsive, it could indicate issues with the steering rack, tie rods, or power steering pump.
 - **Difficulty Steering:** If the vehicle is hard to steer, it could be a sign of low power steering fluid or a failing power steering pump.
 - **Unusual Noises:** Squeaking or grinding noises when turning the wheel could point to worn-out steering components such as the rack-and-pinion or tie rods.
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Conclusion

Day 13 provided valuable hands-on experience in understanding the critical role of the **suspension** and **steering systems** in vehicle safety and performance. We learned how these systems work together to ensure a smooth ride and precise handling. By inspecting the **shock**

absorbers, springs, steering mechanisms, and identifying common signs of wear, we now have the knowledge to diagnose potential issues and understand the importance of maintaining these systems for the safety and comfort of the driver and passengers. Recognizing and replacing worn-out parts is crucial for ensuring the vehicle's performance and safety.

Day 14: Diagnostics

Introduction

On **Day 14** of our automotive workshop, we focused on an essential modern skill: **vehicle diagnostics**. As cars have become more complex and reliant on electronics, it's critical for technicians and mechanics to understand how to read and interpret diagnostic information using **OBD (On-Board Diagnostics) scanners**. In this session, we learned about **error codes**, practiced using an OBD scanner, and began to understand how to **identify faults** and resolve basic vehicle issues.

What is OBD?

OBD stands for **On-Board Diagnostics**, a system built into modern vehicles that monitors and reports the condition of various systems, especially those related to **engine performance and emissions**.

There are two main versions:

- **OBD-I**: An older system used before 1996, with limited compatibility.
- **OBD-II**: A standardized system used in all cars sold in the U.S. and Europe since 1996. It features a **universal port** and a set of **standardized error codes**.

OBD-II connects to sensors throughout the vehicle and reports any abnormal readings by triggering the **“Check Engine” light**. Technicians can plug in a **scanner** to read the specific fault codes and identify what part of the vehicle is having trouble.

Common Diagnostic Trouble Codes (DTCs)

OBD-II codes are categorized by letter and number:

- **Pxxxx** – Powertrain (engine/transmission)
- **Bxxxx** – Body (airbags, lights, climate)
- **Cxxxx** – Chassis (brakes, suspension)
- **Uxxxx** – Network (communication between modules)

Examples:

- **P0301** – Cylinder 1 Misfire Detected

- **P0171** – System Too Lean (Bank 1)
- **P0420** – Catalyst System Efficiency Below Threshold

Each code includes:

1. A letter (system)
 2. A digit (generic or manufacturer-specific)
 3. Three more digits (the specific fault)
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Hands-On Activity: Using an OBD Scanner

During the workshop, we used an **OBD-II scanner** to connect to a training vehicle or demo module. Here's what we practiced:

1. **Locating the OBD Port** – Usually found under the dashboard, near the steering wheel.
2. **Connecting the Scanner** – Plugging in the tool and powering it on.
3. **Reading Codes** – Accessing stored or pending trouble codes.
4. **Interpreting Codes** – Looking up code meanings using manuals or apps.
5. **Clearing Codes** – Erasing fault codes after the issue has been repaired.

Some groups used **Bluetooth OBD-II adapters** and connected them to a phone or tablet using diagnostic apps. This method makes it easier to view live data such as **engine RPM, fuel trim, and oxygen sensor readings**.

Understanding Fault Finding and Error Reading

Why Codes Appear:

- A code appears when a sensor detects something abnormal (e.g., low voltage, no signal, or incorrect data).
- Codes do **not always mean a part is broken**—sometimes the issue is with wiring, connectors, or temporary conditions.

How to Interpret Them:

1. **Read the code** (e.g., P0301).
2. **Understand the meaning** (e.g., Misfire on Cylinder 1).

3. **Check related components** (spark plug, injector, ignition coil).
4. **Use live data** to confirm the issue.
5. **Fix the cause** and then clear the code.

We also discussed the **importance of not guessing** when diagnosing. Accurate diagnostics saves time, money, and prevents replacing parts that still work.

Conclusion

Day 14 taught us the basics of **vehicle diagnostics** and how to use an **OBD scanner** to read and understand fault codes. We learned that reading error codes is just the first step—real diagnostics also involves **thinking critically, analyzing data, and understanding how vehicle systems work together**. Whether working in a shop or diagnosing your own car, knowing how to use diagnostic tools is a must-have skill in the modern automotive world.

Day 15: Project & Presentation

Introduction

Day 15 marked the final day of our technical workshop—a chance to bring everything we’ve learned together in a meaningful way. Each group was given the opportunity to **present their learning** through a **demo, poster, or slide show**. The goal of this final session was not only to share knowledge but also to develop valuable **presentation and teamwork skills**. Additionally, some students participated in a **short written quiz** to reflect on and reinforce their understanding of key topics covered over the past two weeks.

Presentation Preparation

In the days leading up to Day 15, each group selected one of the major topics from the workshop, such as:

- Workshop Safety & Tools
- Measuring Instruments
- Engine Parts and Types
- Fuel and Cooling Systems
- Electrical Systems
- Brake System
- Suspension & Steering
- Transmission
- Diagnostics

Each group worked collaboratively to create a visual and/or interactive presentation. Students used a variety of tools including:

- **Posters** showing labeled diagrams and explanations
- **Slide shows** with photos, videos, and animations
- **Live demos** using real car parts or models (e.g., measuring with calipers, using an OBD scanner, or explaining how a clutch works)

Group members practiced their speaking parts to ensure smooth delivery and confidence during the final presentation.

Presentation Day Activities

During the session:

- Each group had **5–10 minutes** to explain their topic, demonstrate tools or concepts, and answer questions from the audience (classmates and instructors).
- Presentations were evaluated based on:
 - **Clarity and accuracy of content**
 - **Team collaboration**
 - **Creativity and engagement**
 - **Ability to answer questions**

The atmosphere was **supportive and collaborative**, with students encouraging each other and celebrating what they had learned. It was inspiring to see everyone take pride in their work and apply their knowledge in creative ways.

Reflection and Learning Outcomes

After the presentations, students reflected on the experience by discussing the following:

- **What was the most interesting thing you learned during the workshop?**
- **What was the most challenging activity or concept, and how did you overcome it?**
- **How did working in a team help you learn more effectively?**
- **What skills will be useful in real-life situations or future careers?**

Some students also completed a **short written quiz**, which tested their understanding of workshop safety, tool usage, engine components, diagnostics, and other core topics. This helped reinforce important lessons and highlighted areas for future learning.

Skills Gained

By the end of the day, students had developed a wide range of important skills:

- ✓ **Technical knowledge** of automotive systems
- ✓ **Communication and public speaking**

- ✓ **Team collaboration and problem solving**
- ✓ **Confidence in using tools and diagnostic equipment**
- ✓ **Critical thinking and reflection**

These skills will be extremely valuable not only in future automotive training but also in any career that requires teamwork, technical understanding, and clear communication.

Conclusion

Day 15: Project & Presentation was a perfect way to conclude our workshop. It celebrated everything we had accomplished, from learning how to safely handle tools to diagnosing engine issues. It also reminded us that learning is more powerful when shared, and that teamwork, curiosity, and hands-on practice are the keys to success in any technical field. We left the classroom with greater confidence, knowledge, and the satisfaction of having built something together.