



Government of Karnataka

AUTOMOTIVE

Job Role : Four wheeler Service Assistant

TEXT BOOK



9th Standard



**National Skill Qualification Framework
NSQF LEVEL 1**

**Samagra Shikshana Karnataka
and
Karnataka Text Book Society (R.)**

FOREWORD

All Education commissions recommend bringing work and education into the domain of the curricular, infusing it in all areas of learning while giving it an identity of its own at relevant stages. It explains that work, transforms knowledge into experience and generates important personal and social values such as self-reliance, creativity and cooperation. Through work one learns to find one's place in the society. Work involves interaction with material or other people (mostly both), thus creating a deeper comprehension and increased practical knowledge of natural substances and social relationships.

Through work and education, school knowledge can be easily linked to learners' life outside the school. All the previous Education commissions emphasized on Vocational Education and Training (VET) for all those children who wish to acquire additional skills and/or seek livelihood through vocational education after either discontinuing or completing their school education. VET is expected to provide a 'preferred and dignified' choice rather than a terminal or 'last-resort' option. NCERT has attempted to infuse work across the subject areas and also contributed in the development of the National Skill Qualification Framework (NSQF) for the country, which was notified on 27 December 2013.

It is a quality assurance framework that organizes all qualifications according to levels of knowledge, skills and attitude. These levels, graded from one to ten, are defined in terms of learning outcomes, which the learner must possess regardless of whether they are obtained through formal, non-formal or informal learning. The NSQF sets common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, Colleges and Universities. It is under this backdrop that Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE), Bhopal, a constituent of NCERT has developed learning outcomes based modular curricula for the vocational subjects from Classes IX to XII. This has been developed under the Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education of the Ministry of Education

This textbook has been developed as per the learning outcomes based curriculum, keeping in view the National Occupational Standards (NOS) for the job role and to promote experiential learning related to the vocation. This will enable the students to acquire necessary skills, knowledge and attitude.

These text books from PSSCIVE were vetted by a team of subject experts and resource persons in the context of setting a state specific content to ensure more relevancy to the world outside the school.

CHAIRMAN NOTE:

In a rapidly evolving world, the importance of vocational education has never been more pronounced. As industries adapt to new technologies and changing market demands, the need for skilled professionals who are equipped with practical knowledge and hands on experience becomes critical. The series of vocational text books aims to bridge the gap between theoretical concepts and real world application, providing learners with the tools they need to succeed in their chosen fields.

Each text book in this series has been meticulously crafted to align with industry standards and best practices. By combining foundational knowledge with practical skills we aim to empower among students to not only understand their disciplines but also to excel in them. Our contributors are experienced educators, Industry professions and subject matter experts have collaborated to ensure that the content is both relevant and engaging.

The structure of each book is designed to facilitate effective learning among students. All Key points are presented in a clear and concise manner, complemented by real life case studies, practical exercises and assessments that encourage critical thinking and problem-solving. We believe that learning is most effective when students can see the direct application of their studies in Professional settings.

We also recognize the diverse backgrounds and learning styles of our students. To that end, we have included a variety of teaching tools, including visual aids, Interactive elements, and online resources, to support a more personalized learning experience. Our goal is to make vocational education accessible and engaging for all learners, regardless of their starting point.

As you embark on this educational journey we encourage you to approach these text books with an open mind and a willingness to explore new ideas. The skills and knowledge you gain will not only prepare you for immediate employment but will also serve as a foundation for lifelong learning and professional development.

We extend our gratitude to all those who contributed to this text books, and we hope that these textbooks will inspire and equip the next generation of skilled professionals.

Welcome to the future of Vocational Education.

ABOUT THE BOOK

Our country has been witnessing growth in the automotive sector with new developments taking place in all components of automobiles. The automotive manufacturing industry comprises the production of commercial vehicles, passenger cars, three and two - wheelers, etc. We need trained manpower to carry out the various activities in sales, service and production of automotive products.

Class 9th and 10th has job role “Four wheeler service assistant” is an important job role involving repairing and servicing of automobile vehicle and accessories. A Four wheeler service assistant is responsible for installation, minor repair, maintenance and servicing of vehicles. The person should be able to work independently, perform laborious tasks, should be a good listener, good at taking and following instructions, a good team player and result oriented, with a positive attitude. Four wheeler service assistant is a beginner-level course. On completion of this course, a student can take up an intermediate-level course for a job role in the automotive sector, such as four wheeler service technician in Class XI and Class XII.

This textbook for the job role of “Four wheeler service assistant” has been developed to impart knowledge skills through hands-on learning experience, which forms a part of the experimental learning. The textbook has been developed with the contribution from the subject experts, vocational teachers and industry experts and academicians for making it a useful and inspiring teaching-learning resource material for the vocational students. Adequate care has been taken to align the contents of the textbook with the National Occupational Standards (NOS) for the job role so that the student acquires the necessary knowledge and skills as per performance criteria mentioned in the respective NOS of the Qualification Pack (QP).

Unit 1 of the textbook gives the history and evolution of automobiles.

Unit 2 focuses on various types of automobiles used in the automobile sector.

Unit 3 covers the major systems and components of automobiles.

Unit 4 deals with road safety,

Unit 5 deals with automobiles and the environment.

Unit 6 gives an introduction to vehicle maintenance and servicing and

Unit 7 deals with innovation and development in automobiles.

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UNIT INFORMATION

Unit name: History and Evolution of Automobiles

Unit code: Auto L1U1-NQ2012.

Unit descriptor: This unit provides the knowledge & skills covering invention of the wheel, wheel cart, horse cart and invention of Automobiles and its evolution till date.

Resource implications:

- Notebooks, Pen, Pencil, Eraser.
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs.
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours: 10 hours.

Name of the sessions

Sl. No	History and Evolution of Automobiles	Duration (In Hours)
1	Invention of Wheel	2
2	Invention of the Wheel cart and animal powered horse cart.	2
3	Invention of Automobile and Evolution	3
4	Invention of Automobile and Evolution (post world war II)	3
	Total Duration in Hours	10

Elements and Performance Criteria

Element	Performance Criteria
• History of wheel and its applications	• Able to describe the Invention of wheel • Able to explain use of wheel cart
• Invention of Automobile and its Evolution till date	• Able to describe Invention of Automobile. • Able to describe stages of the evolution of Automobiles till date

UNIT-1



HISTORY AND EVOLUTION OF AUTOMOBILES

UNIT OVERVIEW:

This unit covers the history and development of transportation, focusing on key innovations. It begins with the invention of the wheel, which led to the creation of the wheel cart and horse-drawn carts. The unit then explores the invention of automobiles and traces their evolution over time, highlighting major advancements in design, technology, and functionality up to the present day.

INTRODUCTION

The meaning of automobile can be an auto car, motor car or car. It is a wheeled motor vehicle used for transporting goods or passengers, which also carries its own engine or motor.

Definition for Automobile:

"An automobile is a self-propelled vehicle designed for the transportation of passengers or goods from one location to another.

Ex: Car, Bus, Truck, Jeep etc.



The word automobile comes from the ancient Greek word αὐτός (autós, meaning 'self') and the Latin word mobiles (movable); therefore automobile means a vehicle that moves itself.

Automobiles are designed to run primarily on roads, have seating for one or more people, typically have four wheels and are constructed principally for the transport of people and goods.

SESSION 1: INVENTION OF WHEEL

Session-1 Overview: Students will gain and understanding of the invention of the wheel and its significance, as well as learn about various types of wheels and applications throughout history.

INTRODUCTION

In this unit, you will explore the concept of the wheel and its importance in shaping transportation and technology. You will also learn about the various types of wheels that were developed over several centuries, which played a crucial role in the invention and evolution of the wheel.

LEARNING OUTCOME:

1. Students understand the invention of the wheel, its historical development, and the different types of wheels.
2. Students to identify the various types of wheels and explore the different materials used in their construction.

The wheel is considered as one of the most important mechanical inventions of all times. The wheel has been used by man since the beginning of civilization.

Most primitive technologies since the invention of the wheel have been based on its principles.

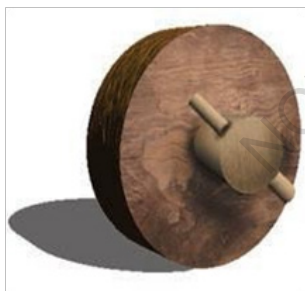


FIG.1.1 WOODEN WHEEL

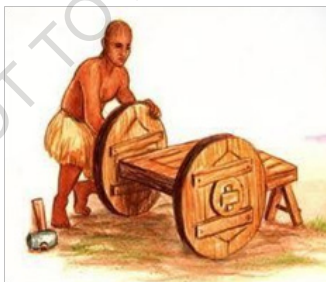


FIG.1.2 WHEEL WITH SPOKES



‘Wheel is a circular component and it rotates on its center’.

History tells us that wheel was most likely invented in Mesopotamia (modern day Iraq) around 3500 BC. This means that the wheel (Fig.1.1) is about 5500 years old! The first use of the wheel for transportation was in Mesopotamian chariots in 3200 BC.

There are many references to wheeled chariots in Indian mythology also, dating to around 3000 BC. It is interesting to note that wheels may have been used in industrial or manufacturing applications before they were used on vehicles.

Egyptians started using wheel with spokes, first in chariots around 2000 BC and use of wheels is believed to have started in Europe by 1400 BC.

Wheel and Its Structure:

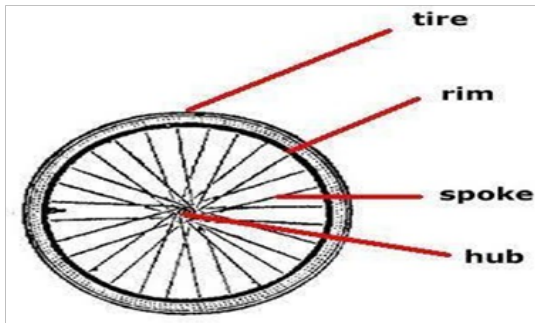


FIG.1.3: WHEEL

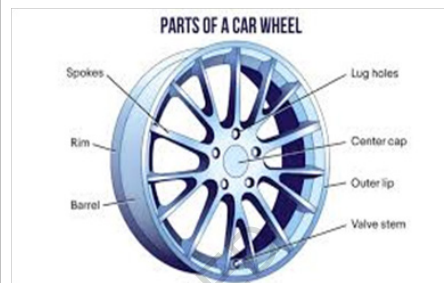


FIG.1.3a. MODREN WHEEL

The Spoked Wheel (Fig. 1.2) was invented much recently, and allowed the construction of lighter and swifter vehicles. Some noteworthy arte facts belonging to the Harappa civilization of the Indus Valley and North Western India are toy-cart wheels made of clay with spokes painted or in relief, and the symbol of the spoked wheel in the script of the seals.



FIG.1.4 CELTIC CHARIOT



FIG.1.41 PNEUMATIC WHEEL

The invention of the wheel has also been important for application in the water wheel, the cogwheel, the spinning wheel.

Therefore, we see that a wheel is a circular component (Fig.1.3) that can rotate on its center.

Wheels, in conjunction with axles, allow moving heavy objects with ease.

The wheel is a Key component of the wheel and axle assembly.

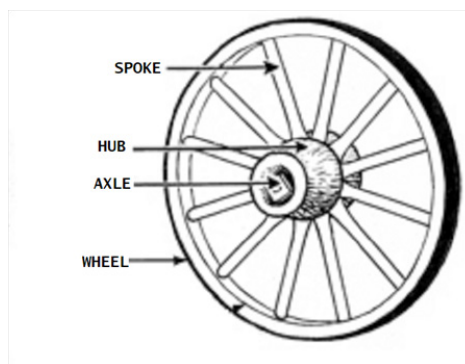


Fig:1.4.2 Wheel and its components

"The wheel is a device that enables the efficient movement of an object across a surface where a force presses the object against the surface."



Fig: 1.4.3 The evolution of wheel

Suggested Activity:

ACTIVITY

1. List the important of wheels.
2. Draw different types of wheels saw by you in your surroundings. .
3. List the items where wheels have been used in machinery.
4. Make models of different wheels by using clay, wood, mud and different materials.
5. Draw a chart to show the different types of wheels and colour it.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of wheel.
02	Able to understand about invention of the wheel.
03	Able to list out different types of wheels.
04	Able to know the history of wheel and its type.
05	Able to understand importance of wheels and different materials to be used for making wheels.

A. Fill in the blanks:

- is considered as one of the most important mechanical inventions of all times.
- Wheel was invented in..... in around 3500BC that is 5500 years ago.
- Wheel is a component that can rotate on its center.

B. Multiple choice questions:

- How many years ago was the wheel invented?
(a) 2500years (b) 3500years (c) 5500years (d) 6000years
- Spoked wheel is used for which category of vehicle?
(a) Light (b) Medium
(c) Heavy (d)None of the above
- Axle of wheel is fitted in the wheel in the .
(a) Top (b) Bottom (c) Centre (d) Side

C. Answer the following questions:

- What is a Wheel?
- Write the different components of a wheel.
- Write the different types of materials used to make wheel.
- List the different types of wheel used in transport.
- What are the main components of wheel?
- Draw the neat diagram of wheel and label its parts.

SESSION-2: WHEEL CART

Session-1 Overview: Students will learn about the invention of the wheel cart and its significance in transportation history. They will also explore the different types of wheel carts.

LEARNING OUTCOME:

1. Understand the invention and history of the wheel cart.
2. Be able to identify and distinguish between different types of wheel carts.
3. Learn about the various materials used in the construction of wheel carts.
4. Understand the practical reasons why wheel carts are essential in daily life and how they have been used throughout history.

INTRODUCTION

This unit provides the knowledge & skills covering invention of the wheel carts and there uses. And also, we are going to learn that animals instead of men were used for pulling the cart.

‘Wheel cart is a vehicle designed for transport, using two wheels’

TYPES OF CARTS:

Carts have been in continuous use since the invention of the wheel in 3500 BC. Carts may be named after the animal that pulls them, such as ox-cart, horse-cart, buffalo-cart, camel-cart & donkey-cart. In present times, horse- cart are used in competitions.



FIG:1.51: TYPESS OF CARTS

HAND CART: A handcart is pulled or pushed by one or more people.



FIG.1.52: HAND CART PULLED BY MEN

However, history tells us that animals, instead of men, were used for pulling the carts, as they were more powerful.

Normally, a cart was pulled by a pair of draught animals. The draught animals used for carts could be horses or ponies, mules, oxen, water buffalo or donkeys, or even smaller animals, such as goats or large dogs.



FIG1.53 HORSE CART-TANGA

Carts have been mentioned in literature as far back as the 2nd millennium BC. The Indian epic Mahabharata, Lord Krishna as the saarathi (the charioteer of the rath) and the chariot (Fig.1.61) carrying Pandava prince Arjuna in the battlefield of Kurukshetra are some of the examples.

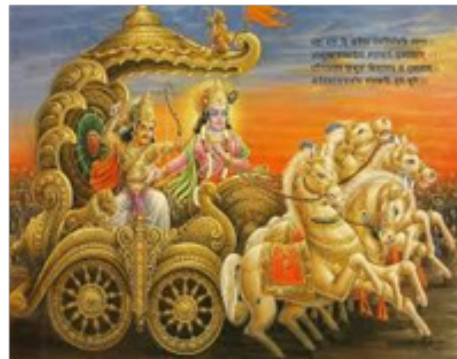


FIG 1.61 HORSE CHARIOT



FIG1.62 DOG CART

A dog-cart, however, is usually a cart designed to carry hunting dogs. It is an open cart with two cross-seats back to back; the dogs can be penned between the rear-facing seat and the back end

A bullock-cart or ox-cart is a two-wheeled vehicle pulled by oxen (draught cattle). It is a means of transportation used since ancient times in many parts of the world. They are used even today in places where modern vehicles are too expensive or the infrastructure does not favor them.



FIG1.62 OX CART

Carts are used especially for carrying goods. Bullock-cart is pulled by one or two bullocks. The cart is attached to a bullock team by a special chain attached to yokes, but a rope may also be used for one or two animals. The driver and any other passenger can sit on the front of the cart, while the load is placed at the back.

Horse Power:

How many men would be needed to equal the power of a horse? After conducting some experiments, it was found that, on an average 10–12 men were needed to equal the power of one horse. This is the reason why mankind thought of using horses for pulling carts. This led to the development of a horse carriage.

Did you know..?

The concept of horsepower was originally developed as a way to measure the power of engines and mechanical devices, particularly when steam engines were first introduced. The term horsepower was coined by the Scottish engineer James Watt in the late 18th century.

1 horsepower (hp) is traditionally defined as the ability to do 550 foot-pounds of work per second (or 745.7 watts).

Suggested Activity:

ACTIVITY

1. Draw the charts of different types of wheel cart .
2. Make the models of different types of wheel cart by using clay, wood, mud and different materials.
3. Visit nearby Tanga or horse cart stand and observe the activities.(With help of teacher)
4. Conducts a tug-of-war game understand about the meaning of horse power.



Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of wheel cart and invention of wheel carts.
02	Able to list out different types of wheel cart.
03	Able to understand why animals instead of men were used for pulling the cart.
04	Able to understand importance of wheel carts and different materials to be used for making wheel carts.

A. Fill in the blanks

1. Carts are driven by..... .
2. In Mahabharata, the chariot was pulled by.....

B. Answer the following questions:

1. What is wheel cart?
2. List the different types of carts.
3. Define horsepower.

SESSION-3: INVENTION OF AUTOMOBILES

Session-1 Overview: Understand the invention of automobiles, Identify the key inventor(s) of the automobile, Learn about various automobile manufacturers.

LEARNING OUTCOME:

1. Understand the invention of the automobile, including how it transformed transportation and shaped modern society.
2. Learn about the inventors of the automobile, focusing on key figures like Karl Benz and other pioneers who contributed to its development.
3. Explore various automobile manufacturers, understanding the role of different companies in the evolution of the automobile industry and their impact on car design and production.

INTRODUCTION:

Till now, we have learnt how the wheel was used in carts and about horse carriages for transportation of goods and people. Engineers kept improving the horse carriage design bit by bit. At the same time, people were working on a system that could be self-propelled, meaning that the system could be run without any man or animal force required for moving it.

In the year 1672, the very first such model was developed in the form of a toy. This was actually a steam engine, in which the power of steam was used to provide momentum to the toy. Further improvements continued in various parts of the world. Then in the year 1806, the first car powered by an internal combustion engine appeared. The fuel used for running this was 'fuel gases instead of 'steam'.



Fig.1.10: Cugnot Steam Trolley



Fig.1.11: First Practical Car Model

The process of using fuel gas is different from that of steam. Steam engine requires ‘external combustion’, whereas fuel gas uses the principle of ‘internal combustion’. We shall study this in detail later.

Meanwhile, engineers continued to improve designs till the year 1885 when the first modern gasoline-or petrol- fueled engine was developed in Europe. It is important to note that inventions in science and technology cannot often be used immediately by general public.

Karl Benz, a German engineer designed and patented the first practical model (Fig.1.8) in 1885. This model used internal combustion engine and was called Motorwagen. Although several other German engineers (including Gottlieb Daimler, Wilhelm Maybach and Siegfried Marcus) were working on the problem at about the same time, Karl Benz generally is acknowledged as the “inventor of the modern automobile”.

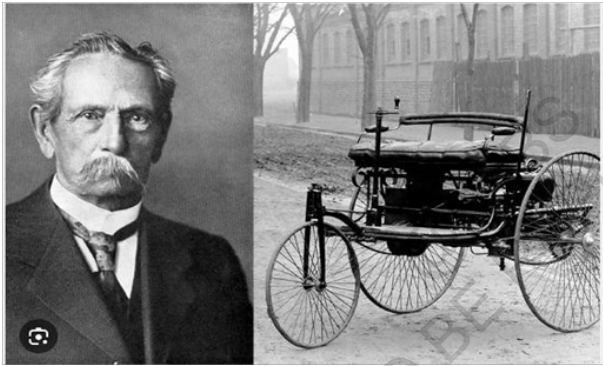


FIG 1.8: ORIGINAL KARL BENZ AND BENZ



FIG.1.9: BERTHA BENZ

PATENT MOTORWAGEN FIRST BUILT IN 1815.

Karl Benz built an automobile powered by his own four-stroke cycle gasoline engine in Mannheim, Germany in 1885 and was granted a patent in January of the following year, under the auspices of his major company, Benz & Cie., which was founded in 1883. It was an integral design, without the adaptation of other existing components and included several new technological elements to create a new concept. Benz began to sell his production vehicles in 1888. In 1879, Benz was granted a patent for his first engine, designed in 1878. His first motor wagon was built in 1885, and he was awarded the patent for this invention, based on his application on 29 January 1886.

In August 1888, Bertha Benz, (Fig. 1.9) wife of Karl Benz, undertook the first road trip by car, to prove the road-worthiness of her husband’s invention

(Fig. 1.9.1). During the last years of the nineteenth century, Benz was the largest automobile company in the world with 572 units produced in 1899.



Fig: 1.9.1 Bertha benz

The assembly line style of mass production and interchangeable parts had been pioneered in the U.S. by Thomas Blanchard in 1821, at the Springfield Armory in Springfield, Massachusetts. This concept was greatly expanded by Henry Ford, beginning in 1914. With the introduction of this new manufacturing process, Ford Motor Company launched the first large-scale production of their Model T. (Fig.1.10). In 1914, an assembly line worker could buy a Model T with four months' pay.



FIG.1.10: CAR FORD MODEL-T



FIG.1.11: 1926 AUSTIN 7 BOX

In 1926, Austin 7 Box was an economy car produced by Austin company. Between the World Wars I and II, a lot of attention of the automobile industry went towards development of defense vehicles. As a result, several new vehicles like battle tanks and jeeps were developed. The tank (Fig. 1.12) became very popular

in the war field. Its a very versatile vehicle which can run in any road conditions, i.e., in cross-country terrain, hills, deserts, trenches, etc.



Fig.1.12: Mark V Tank



Fig.1.13: Jeweled One-Millionth



Fig.1.14: Volkswagen Mo

However, during this period, there were some very interesting designs in the passenger segment also. Volkswagen in Germany developed a car in 1930s, which looked like a crawling creature and was therefore called 'Beetle' (Fig. 1.13). This model had the engine at the back and the front bonnet was used as the luggage compartment. The car was very convenient to drive and looked stylish. It became popular in Europe.

Suggested Activity:

ACTIVITY	
1.	Draw a neat diagram of first practical model of car.
2.	Collect some Karl Benz and Bertha Benz photograph and also old models of car from internet or newspaper.
3.	Make a different type of vehicles using Battery, wood, and different materials in the form of toy.
4.	Make a chart of different types of vintage cars and compare with new era cars.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about invention of automobile.
02	Able to understand about first invention of Motorwagen.
03	Able to understand the aspect of history of invention of automobile and its type.
04	Able to understand about various manufacture of automobile.

A. Fill in the blanks.

- 1) In the year _____ the very first model of a self-propelled system was developed in the form of a toy.
- 2) In year 1806, the first cars powered by appeared.
- 3) _____ a German Engineer designed and patented the first practical model of an engine in 1885.
- 4) _____ Volkswagen developed a car in the 1930s which looked like a crawling creature and was therefore called
- 5) Father of automobile is _____

B. Multiple choice questions:

- 1) In which year was the first vehicle invented?
(a) 1885 (b) 1650 (c) 1806 (d) 1997
- 2) Who was the inventor of the first patented car?
(a) Karl Benz (b) Ratan Tata (c) Mohandas Singh (d) Henry ford

C. ANSWER THE FOLLOWING.

- 1) Who is called inventor of modern automobiles in the world?
- 2) Who is the first rider of patented car?
- 3) Make a list of automobiles and their model vehicles developed in the past.
- 4) Make a list of the important manufacturers of cars in India.

SESSION4: INVENTION OF AUTOMOBILES (POSTWORLDWAR-II)

Session-1 Overview: Student will be able to understand the invention of Automobiles during (Post World War II) and Rising of many manufacturers automobile industry, Indian Automotive Industry, Manufacturers of Indian Cars, and Development of Automobiles in India.

LEARNING OUTCOME :

1. The students will learn about the invention of the automobile and gain an understanding of the automobile industry.
2. They will also explore the Indian automobile industry, focusing on its development and evolution within the country.

INTRODUCTION

This unit provides the knowledge & skills covering invention of Automobiles. Till now you have gone through the development in the Automobile sector before World War II, now we will concentrate on post-World War II. And also, the Indian Automobile Scenario



In the U.S., road network was built after the World War II. This road network was quite modern with long high ways stretching cross the length and breadth of the country. It is not worthy that U.S. has a large land mass and vast geography, which allows open and wide roads to be built. On these roads models like the Beetle do appear very tiny!

The Big Three of the car industries, namely General Motors, Ford and Chrysler set about to be design fast-moving cars for the American roads. Edsel, Firebird, Chevrolet Impala, etc., were some of the big cars that came on American highways in the 1950s & 60s



FIG1.20-GENERAL MOTORS COMPANY LOGO FIG1.21-.HENRY FORD AND COMPANY LOGO

It may also be noted that these models used large amounts of petrol or gasoline. But petrol consumption was not a grave concern in those days. So, each car maker competed with the others in making bigger and better designs with more luxuries added for comfort. All this made buying and maintaining a car quite costly. However, more and more Americans bought these models. One very popular model from Ford was named 'Mustang'.

However, things changed after 1973. This was the year of the first 'Oil Crisis'. Petrol started becoming costlier as all the Arab nations got together in an alliance. Now, suddenly even Americans started looking for more economical designs.

Meanwhile, quietly but with determination, Japan was developing cars for marketing worldwide, mainly in the U.S. Actually, after the devastation of their country during World War II, several Japanese companies came into existence like Toyota, Mazda, Mitsubishi, Suzuki, etc. Some of these like Mazda, were using American technology.

Since then, companies like Toyota, Honda have been steadily increasing their market presence worldwide. There are some technical and design aspects that differentiate modern cars from antiques. The modern era has been one of increasing standardization, platform sharing and computer-aided design.

- Toyota Corolla (1966–present) — a simple small Japanese sedan that has come to be the best-selling car of all time.

-
- Range Rover (1970–present) — the first take on the combination of luxury and four-wheeled drive utility, the original ‘SUV’. Such was the popularity of the original Range Rover Classic that a new model was not brought out until 1994.
 - Mercedes-Benz S-Class (1973–present) — features like electronic anti-lock braking system, supplemental restraint airbags, seat belt pretensioners and electronic traction control systems made their debut in the S-Class. These features later became standard throughout the car industry.
 - BMW 3 Series (1975–present) — Making it the longest running entry in the list.
 - Honda Accord (1977–present) — this Japanese sedan became the most popular car in the U.S. in the 1990s, pushing the Ford Taurus aside, and setting the stage for today’s upscale Asian sedans.
 - Dodge Aries and Plymouth Reliant (1981–89) — the ‘K-cars’ These models were some of the first successful American front-wheel drive, fuel- efficient cars.
 - Chrysler minivans (1983–present) — the two- box minivan design nearly pushed the station wagon out of the market.
 - Renault Espace (1984–present) — first mass one-volume car of non-commercial MPV class.
 - Ford Taurus (1986–present) — this mid-sized front-wheel drive sedan with modern computer- assisted design dominated the American market in the late 1980s.
 - Ford Focus (1998–present) — one of the most popular hatchbacks across the globe, which is also one of Ford’s best-selling world cars.
 - Tata Nano (2008-present) — it is an inexpensive (₹ 1, 00,000), rear-engine, four-passenger city car built by an Indian company, Tata Motors, and is aimed primarily at the Indian domestic market.
 - Nissan Leaf and Chevrolet Volt (2010–present) —all these electric cars were launched in the American and Japanese markets in December 2010, thereby becoming the first mass production vehicles of their kind.



FIG.1.22–CAR COMPANIES AND THEIR LOGOS

Indian Automobile Scenario:

The automotive industry in India started with the import of cars for royal families, which perhaps started in 1920s. For many years, India did not have any manufacturing capability of its own. Hindustan Motors is one of the initial car manufacturers in India, founded in 1942 by B.M. Birla. It was a leader in car sales until the 1980s, when the industry was opened up from protection. Hindustan Motors was the producer of the Ambassador car (Fig.1.15), widely used as a taxi cab and as a government limousine. This car was based on the Morris Oxford, a British car that dates back to 1954. The production of Ambassador stopped in 2014.



FIG.1.23: AMBASSADOR CAR



FIG.1.24: PREMIUM PADMINI CAR



FIG.1.25: MARUTI 800 CAR

Another Indian company, Premier Automobiles was founded in 1944. The company first launched production of vehicles in 1951; they began producing

versions of Fiat 500 for the Indian market. This was followed by Fiat 1100 in 1954. In 1973, Premier renamed the Fiat 1100 as the 'Premier Padmini' (Fig.1.24). Ambassador and Fiat/Padmini were the two dominant models of cars on the Indian roads till 1983

In 1983, the Government of India started Maruti Udyog in collaboration with Suzuki of Japan. Maruti's first model called Maruti 800 (Fig. 1.25) became a huge success. Within 5–6 years the company reached an annual production of nearly 1,00,000 cars. They launched various models like 800, Gypsy, Omni van, Esteem, Zen, Boleno, etc.

As a result of this, Nano model was developed by Tata Motors, which is the cheapest car in the world with all convenient and quality features. India also exports nearly 12 per cent of manufactured cars to Europe, U.S. and elsewhere in the world. The automotive industry in India is one of the largest in the world and one of the fastest growing globally.

The majority of India's car manufacturing industry (Fig. 1.26) is based around three clusters in the south, west and north.

- **The southern cluster near Chennai is the biggest with 40 per cent of the revenue share.** Chennai is also referred to as the 'Detroit of India' with the Indian operations of Ford, Hyundai, Renault and Nissan headquartered in the city and BMW having an assembly plant on the outskirts. It exports nearly 60% annually.
- **The western hub near Pune is 33 per cent of the market.** The Chakan corridor near Pune, Maharashtra is the western cluster with companies like General Motors, Mahindra, Tata Motors, Mercedes Benz, Land Rover, Fiat and Force Motors having assembly plants in the area. Aurangabad with Audi, ŠKODA and Volkswagen also forms part of the western cluster
- **The northern cluster is primarily Haryana with 32 per cent.** Gurugram and Manesar in Haryana form the northern cluster where the country's largest car manufacturer Maruti Suzuki is based.
- **Present Indian automobile sectors grow up with all states of the nation:** Another emerging cluster is in the state of Gujarat with manufacturing facility of General Motors in Halol and further planned for Tata Nano at

Sanand. Ford, Maruti Suzuki and Peugeot-Citroen plants are also set to come up in Gujarat. Kolkata with Hindustan Motors. Noida with Honda. Bengaluru with Toyota are some of the other automotive manufacturing regions around the country.



FIG. 1.26: INDIA'S CAR MANUFACTURING INDUSTRY

Suggested Activity:

ACTIVITY

1. Draw a neat diagram of car.
2. Collect some photograph of old models of car for internet or newspaper.
3. Make a list of different car manufacturer industries around the world.
4. Make a chart of different types of car manufacturer in India during 1980's.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about different car manufacturer around the world.
02	Able to understand about different car manufacturer in India during 1980's.
03	Able to understand about why Chennai is called 'DETROIT OF INDIA'.
04	Able to understand the different Cluster of automobiles in India.

A. Fill in the blanks.

- 1) A very popular model from Ford was named _____
- 2) The Big Three of the car industries, namely General Motors, Ford and Chrysler set out to design big fast, moving cars for the _____ roads.
- 3) The first cars imported in India were in _____
- 4) In 1983, the government of India started Maruti Udyog in collaboration with _____ of Japan.
- 5) The first Indian car which is cheapest in the world is _____

B. Multiple choice questions:

- 1) In which year was the first car imported in India?
(a) 1920 (b) 1942 (c) 1970 (d) 1947
- 2) Which of these is the first car manufactured in India?
(a) Ambassador (b) Fiat (c) Nano (d) Padmini
- 3) Which city is referred to as the “Detroit of India”?
(a) Pune (b) Gurugram (c) Chennai (d) Delhi
- 4) In which year was the India Company Premier Automobiles founded?
(a) 1940 (b) 1944 (c) 1960 (d) 1970
- 5) Maruthi Udyog is collaborated with the of Japan
(a) Toyota (b) Suzuki (c) Tata (d) Hyundai

C. Answer the following questions:

- 1) List any seven models of cars from different companies.
- 2) List out the Indian cluster zones related to Indian automobiles manufacturing.
- 3) Why Chennai is called as “Detroit of India”?
- 4) List out the Indian automobile manufacturers.

UNIT INFORMATION

Unit name: Various Types of Automobiles

Unit code: Auto L1U2-NQ2024.

Unit descriptor:

This unit provides comprehensive knowledge and skills related to various types of automobiles, including two-wheelers, three-wheelers, four-wheelers, passenger vehicles, commercial vehicles, agricultural vehicles, construction equipment vehicles, and special vehicles.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs,
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours: 35 hours.

Name of the sessions

Sl.No	Various Types of Automobiles	Duration (In Hours)
1	Two wheelers and Three wheelers	7
2	Passenger vehicles and Commercial Vehicles	7
3	Agricultural Vehicles	7
4	Construction Equipment Vehicles	7
5	Special Vehicles	7
	Total Duration In Hours	35

Elements and Performance Criteria

Element	Performance Criteria
• Use and Application of Two-wheelers, Three-wheeler model, and specifications.	• Able to identify two wheelers and three-wheeler. • Able to make sketches of two-wheeler/ three wheelers
• Use and Application of Passenger Vehicles	• Able to identify passenger vehicles • Able to make sketches of passenger vehicles
• Use and Application of Commercial Vehicles	• Able to identify various Commercial Vehicles like tempo, bus and truck. • Able to make sketch of various Commercial Vehicles
• Use and Application in Agriculture vehicles	• Able to identify Agricultural Vehicles like tractors, harvester combines. • Able to make sketches of tractor, Combine-harvester.
• Use and Application of Special Applications Vehicles	• Able to identify Dumper - Dozer - Tiller - Excavator - Road Roller - Crane - Fork Lift - Oil / water tankers - Trailers - Railway Train - Fire Tender.

UNIT-2

VARIOUS TYPES OF AUTOMOBILES



UNIT OVERVIEW:

This unit provides the broader knowledge & skills covering various types of automobiles like Two Wheelers, Three Wheelers, Four Wheelers, Passenger Vehicles, Commercial Vehicles, Agricultural Vehicles, Construction Equipment Vehicles and Special Vehicle.

INTRODUCTION

The Automotive industry in India is one of the largest in the world and one of the fastest growing globally.

In terms of the global ranking in manufacturing output, India is the second largest in two-wheelers, eighth largest in commercial vehicle, sixth largest in passenger cars and the largest in tractors.

India's Passenger Car and Commercial Vehicle manufacturing industry is the seventh largest in the world, with an annual production of more than million units in 2011.

The Automobile segment comprises of the following four broad categories of vehicles:

- Two-wheelers and three-wheelers
- Passenger vehicles
- Commercial vehicles
- Special application vehicles.

Two-Wheelers, being the most popular means of personal transport, account for about 75% of the total automobile production in India, while Passenger Vehicles account for nearly 16% of the production. As of 2010, India is home to 40 million Passenger Vehicles. More than 3.7 million Automotive Vehicles were produced in India in 2010, making the country the second fastest growing automobile market in the world.

According to the Society of Indian Automobile Manufacturers, annual vehicle sales are projected to increase to 5 million by 2015 and to more than 9 million by 2020. By 2050, the country is expected to be at the top the world in car manufacturing.

In this Unit, you will develop an understanding of the different types of vehicles used in our country like Two-Wheeler, Three-Wheeler, Passenger Vehicles, Commercial Vehicles, Agricultural Vehicles, Construction Equipment Vehicles and Special Application Vehicle

SESSION1: TWO-WHEELERS AND THREE-WHEELERS

Session-1 Overview: Student will be able to identify two and three wheelers.

LEARNIGNG OUTCOME:

The students,

1. Identify two-wheeler and three-wheeler vehicles.
2. Draw two-wheeler and three-wheeler vehicles.
3. Recognize different makes, models, and specifications of these vehicles.
4. Identify various parts and components of two-wheeler and three-wheeler vehicles.

Two wheelers:

As the name suggests, two-wheeler refers to vehicles that run on two wheels. Two-wheelers are used all over the world. In developed, rich countries, two-wheelers are used more for recreational purpose, whereas in our country it is an important means of transportation of passengers, both in urban as well as rural areas. India has the largest population of two-wheelers. More than 5.4 million two-wheelers are produced in our country every year.



FIG.2.1 MOTORCYCE, SCOOTER AND MOPED

Motorcycles, Scooters and Mopeds are the categories of Two-Wheelers used in our country. Motorcycles account for about 78 per cent in the Two-wheeler segment. Remaining 22 per cent comprise scooters and mopeds.

India is the second largest manufacturer of two-wheelers in the world. In the last few years, the Indian two-wheeler industry has seen massive growth. The country stands next to China and Japan in terms of production and sales, respectively.

Majority of Indians, especially the youngsters, prefer motorcycles over cars. Motorcycles and scooters cover major areas, in terms of usage. Large varieties of two-wheelers are available in the market that adopt latest technology and provide enhanced mileage.

Benefits of Two-wheelers

A motorcycle is a motor-powered two-wheeler, similar in construction to bicycles. Two-wheelers are the most popular and highly sought-after medium of transport in India, as they offer many benefits, like,

- Economical price
- Safety
- Fuel-efficiency.



Identification of Two-wheelers



FIG.2.2 PASSION PRO MOTOR BIKE

. You can identify the maker of the two-wheeler by the sticker or logo fixed on its body. Two-wheeler manufacturers produce different models each with different specifications. Popular brands of two-wheeler manufacturers are Hero, Honda, Bajaj, TVS and Suzuki. Some of their popular models include.

- Bajaj—Pulsar, Freedom125, Dominar, Discover, Platina, Bajaj CT 110X, Avenger street 160, & Avenger Cruise 220, Bajaj scooters- chetak, Bajaj electric Bikes.

- Hero—Glamour, PassionPlus, Splendor Plus, Super Splendor, HF Deluxe, CD dawn, Pleasure +, Destini125, Xtreme, Xpulse, Xoom,
- Honda—Shine, SP, Livo, Dream110, Unicorn, Hornet, Activa125, Activa5g, Dio, Aviator
- Suzuki—Access125, Burgman, Avenis, Gixxer150, Hayabusa, IntruderM800, Zeus
- TVS—Apache RTR, Raider, Sports, Radeon, Star City, Scotty pep, Jupiter, Ntorq, Streak, ScottyPep, TVS XL100.
- Electric bikes: TVS iQube, Ather, Ola, Hero VIDA.

These models vary in size, weight and dimension type and engine capacity.

Three-wheelers:

A three-wheeler is a vehicle with three wheels, either ‘human - or people-powered vehicles’ (HPV or PPV) or motored vehicles in the form of a tri-motorcycle, all-terrain vehicle (ATV) or automobile.

Auto-rickshaws (often called auto) are common all over India, and provide cheap and efficient transportation. Auto-rickshaws are found in villages, cities and in the countryside. The new auto-rickshaws operate on CNG (Compressed Natural Gas) and are environment-friendly.



FIG.2.3: AUTO RICKSHAW



FIG.2.4. BATTERY-POWERED THREE-WHEELER

The average mileage of an Indian-made auto rickshaw is around 35 kilometers per liter of petrol. Many major nationalized banks in India offer loans to self-employed individuals seeking to buy auto rickshaws. Important auto rickshaw manufacturers in India are Mahindra & Mahindra, Piaggio Ape, TVS Motors, Bajaj Auto, Kerala Auto Limited and Force Motors (previously Bajaj Tempo).

Mostly, two types of auto-rickshaws are used in India — the older versions in which the engine is fitted below the driver’s seat, and the newer versions in which

the engine is fitted in the rear portion. These auto-rickshaws run well on petrol, CNG and diesel

Suggested Activity:

ACTIVITY

1. Draw different types of Two-Wheeler & Three-Wheeler saw in your areas.
2. List the different makers of Two-wheeler.
3. Collect the picture of two and three wheelers from newspapers.
4. Visit nearest showroom of two or three wheeler showroom and identify the models.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of Two and Three-wheeler.
02	Able to list the different models of Two-wheeler.
03	Able to list the various manufacturers of two wheelers in India.
04	Able to list the auto rickshaw manufacturers in India.

A. Fill in the blanks

- 1) A two-wheeler refers to that run on two wheels.
- 2) A motor cycle is a motor-powered.....similar in construction to a bicycle.
- 3) Auto-rickshaws are.....all over India, and provide cheap and efficient
- 4) New auto-rickshaws run on and are environment-friendly.

B. Multiple choice questions

- 1) What is the typical mileage of an Indian-made auto-rickshaw per liter of petrol?
(a) 25km (b) 30km (c) 35km (d) 40km
- 2) Trikes-based machines are fitted in .
(a) 2-wheelers (b) 3-wheelers
(c) 4-wheelers (d)8- wheelers

-
- 3) Two-and three-wheelers are run by a common fuel known as .
- (a) Petrol (b) Diesel
- (c) CNG (d) All of these

C. Answer the following questions:

- 1) What are two-wheelers and three-wheelers?
- 2) List the uses of three-wheelers.
- 3) Which vehicle is known as back bone of city transport?
- 4) List the type of two-wheelers and three wheelers models used in your locality.

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SESSION 2: PASSENGER VEHICLES AND COMMERCIAL VEHICLES

Session-2 Overview: "Students will be able to identify different types of passengers, commercial vehicles, and the various makers of cars and buses."

LEARNING OUTCOME:

1. The students will be identifying types of passenger and commercial vehicles.
2. Identify the different makes, models, and specifications of passenger and commercial vehicles.

Passenger Vehicles:

A passenger vehicle refers to a machine that can carry a person or a group of persons. There are different types of passenger vehicles like cars, jeeps, tempos, etc. You must have seen various models of passenger vehicles in your village, town or city. You must have also travelled in these passenger vehicles. The details of some of the popular models of cars, buses, jeep and tempos have been illustrated below.



FIG.2.3 CAR



FIG.2.4 WILLYS OVER AND JEEP

Car:

A motor car or car is a vehicle used for transporting passengers, which also carries its own engine. Various popular cars companies in India are Maruti Suzuki, Tata Motors, Hyundai, Honda, Mahindra, KIA, Volkswagen, Renault, etc. Nowadays, various car manufacturers of international level have established in our country and have started production of cars here.

Jeep:

Jeep is the oldest vehicle used as an off-road vehicle. Willys Overland produced the first Jeep. It is the marque of the brand Chrysler. It has excellent off-road capabilities, and although it was designed primarily to aid military requirements, the company started producing civilian models too by changing the design.

Various changes under different leaderships were also made. The company celebrated its 70th anniversary in 2011.

Jeep is found in many countries around the world, and the popular models are Jeep Grand Cherokee, Jeep Patriot, Jeep Compass, Jeep Liberty, Jeep Commander and Jeep Thar.



FIG.2.4: MODERN JEEP

Commercial Vehicles:

A commercial vehicle is a type of motor vehicle that is generally used for transporting goods as well as passengers. Commercial vehicles support the trade, commerce and industry of a country in a major way.



FIG.2.5: COMMERCIALVEHICLE (BUS)



FIG.2.6: TRUCK.

Trucks:

Trucks (Fig.2.6) are used for carrying goods and material in bulk. As per size and functional use, trucks are classified into sub-categories — rigid trucks, tippers, delivery vans and trailers. The fuel efficiency of these vehicles has improved in the past few years.



The major truck manufacturers in India are Ashok Leyland, Tata Motors, Eicher, and Swaraj Mazda, Bharath Benz.

Bus:

A bus is a huge commercial vehicle, said to have originated in France in the year 1826 designed by Stanislaus Bawdry under the name of 'Omnibus'. The main purpose of this vehicle is to carry the passengers as it is a cost-effective medium of transportation. The major producers of buses in India are Ashok Leyland and Tata Motors, Swaraj Mazda, Volvo and Hindustan Motors. These companies have made a big name in manufacturing mini bus too.

The various sub-categories of buses like commuter buses, school buses and electric buses are also available. In India, CNG buses are more popular due to fuel efficiency and being environment-friendly vehicles.

Suggested Activity:

ACTIVITY

1. Make a list of Passenger vehicle.
2. Make a list of commercial vehicles.
3. Collect and make a poster of the various types of passenger vehicles.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of Passenger and commercial vehicle.
02	Able to list out Passenger and commercial vehicle manufacturers in India.

A. Fill in the blanks:

- 1) A passenger vehicle refers to a machine that runs on wheels.
- 2) Produced the first jeep.
- 3) A commercial vehicle is used for.....

B. Answer the following questions:

- 1) Who invented the jeep?
- 2) List the different makers of passenger vehicles.
- 3) List the different makers of commercial vehicles.

SESSION 3: AGRICULTURAL VEHICLES

Session-3 Overview: Students will be able to identify agricultural vehicles and their important.

LEARNING OUTCOME:

1. The students will be able to identify Meaning and Different types of Agricultural Vehicle.
2. Role of Tractor in different fields.
3. Able to identify the combine harvester with their uses.



Tractor:

FIG.2.8: TRACTOR

Agricultural vehicles are used for farming. They include tractors, harvesters, etc. A tractor (Fig. 2.8) is a motor vehicle with large back wheels and thick tyres and is used in farms for pulling machinery at a slow speed. Tractors are mostly used for carrying the trailer or machinery used in agriculture or construction.

It can be said that a tractor is a farm vehicle that provides the power and traction to mechanize agricultural tasks. Agricultural implements are mounted on the tractor. The tractor also provides power to stationary equipment like thresher, blower, etc. Tractors are heavy vehicles used for pulling or pushing agricultural machinery or trailers at an extremely low speed.

India is majorly an agricultural country and tractors are used on a large scale. Tractors are heavy vehicles and are used for carrying out agricultural operations in a systematic way to get more output.

Modern tractors usually employ large diesel engines which range in power output from 18 to 575 horsepower. The major producers of tractors in India are,

TAFE, Eicher, Mahindra, Ashok Leyland, Escorts, John Deer, Force Motors and Swaraj Enterprise.

‘**Tractor**’ is the most commonly used term for the vehicle used on farms. The farm tractor is used for plowing, tilling, disking, harrowing, planting and similar tasks. A variety of specialty farm tractors have been developed for different purposes. These include row crop tractors with adjustable tread width to allow the tractor to pass down rows of corn, tomatoes or other crops.

Combine Harvester:



FIG.2.9: HARVESTER

The combine harvester (Figs 2.9 and 2.10) is a machine that harvests grain crops. This machine combines three separate operations — reaping, threshing and winnowing into a single process. Among the crops harvested with a combine are wheat, oats, rye, barley, corn (maize), soybeans and flax (linseed). The waste straw left behind on the field is dried stems and leaves of the crop with low nutrients.



FIG. 2.10: COMBINE HARVESTER LOADING THE GRAININA TROLLEY

This left-over straw is either chopped and spread on the field or baled for feed and bedding for livestock. Combine harvesters are one of the most economically important labor-saving inventions, enabling a small fraction of the population to engage in agriculture.

Suggested Activity:

ACTIVITY

1. List the important of Agricultural vehicles.
2. Draw different types of Agricultural vehicles.
3. Make a different type of agricultural vehicles using clay, wood, mud and different materials.
4. Make a chart of different types of Combine Harvester and put in your class rooms.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of Agriculture vehicles.
02	Able to list out different models of Tractors.
03	Able to understand importance of Combine Harvester.
04	Able to list out Tractors manufacturers in India.

A. Fill in the blanks

1. Agricultural may be towed behind or mounted on the tractor.
2. Combines are used for and
3. Combines are one of the most economically important.....inventions.

B. Answer the following questions:

1. What are the uses of a tractor?
2. How an agricultural vehicles helped to the farmers.
3. Write a brief note on combine harvester.

SESSION 4: CONSTRUCTION EQUIPMENT VEHICLES

Session-4 Overview: Student will be able to identify Meaning, different types of Construction Vehicle and uses of them.

LEARNING OUTCOME:

1. The students will be identify Meaning and different types of Construction Vehicle.
2. To identify the different makes, models of construction vehicles
3. Understand the uses of construction vehicle.

INTRODUCTION

This unit provides the knowledge & skills covering able to identify Meaning, Different types of Construction Vehicle and uses of them i.e. Dumpers, Dozers and Tillers etc.

Lot of new roads, houses and industrial plants are being built these days. You must have seen big machines being used at the construction sites to dig earth. These are Special Purpose Automobiles and are sometimes called Earth Moving Equipment.

There are several types of Earth Moving or Construction Equipment such as;

- Bulldozers
- Road rollers
- Dumpers
- Excavators

As their names suggest, they are used for various types of work like digging earth and dumping it at a designated place. Road rollers are used for leveling roads.

Bulldozer:

It is a heavy vehicle with a large blade in the front, used for pushing the earth and stones away and for making the ground flat at the same time. A bulldozer is equipped with a heavy metal plate (blade) to push large quantities of soil, sand, rubble and other such material during construction or conversion work.

Bulldozers: are generally used at sites like mines and quarries, military bases, heavy industry factories, engineering projects and farms. Typically, bulldozers are large and powerful tracked heavy equipment. The tracks give them excellent ground hold. Bulldozers have great ground hold and a torque divider that is designed to convert the power of the engine into dragging

ability, which allows it to use its own weight to push heavy objects and even remove things from the ground.

Road Roller:



FIG.2.11: BULLDOZER



FIG.2.12: ROAD ROLLERS

Road Roller or soil compactor (Fig. 2.12) is a type of engineering vehicle used to compact soil, gravel, concrete or asphalt in the construction of roads and foundation. Similar rollers are used at landfills or in agriculture. A road roller is used for making roads.

Dumper:



FIG2.13: DUMPERS

It is a four-wheeled heavy machine vehicle (Fig. 2.13) designed for carrying bulk material or transporting loose material at construction sites. It is also known as a dump truck. Dumpers are operated by diesel engine. In a dumper truck, chassis with a dump body is mounted to the frame.

The bed is raised by a vertical hydraulic ram mounted under the front of the body, or a horizontal hydraulic ram and lever arrangement between the frame rails and the back of the bed is hinged at the back of the truck

Dumpers are also known as tippers. As per the need and requirement, various types of dumper are being manufactured in the country. The cost of these dumpers varies as per size.



FIG2.13.1: VARIOUS DUMPERS

Excavator:



FIG.2.14: EXCAVATOR (JCB)

Excavator (Fig. 2.14) is the machine that can excavate the soil of various types forcefully and then using hydraulic system a hydraulic force is generated and utilizing this force bucket is pulled back towards the machine. The bucket of excavator is replaceable. If the front bucket is exchanged with some other attachments, for example, pile diver, hydraulic jack hammer, etc., and then the excavator can be used for multiple purposes. Excavator comes in numerous sizes depending on bucket size, length of boom, length of arm and operation speed.

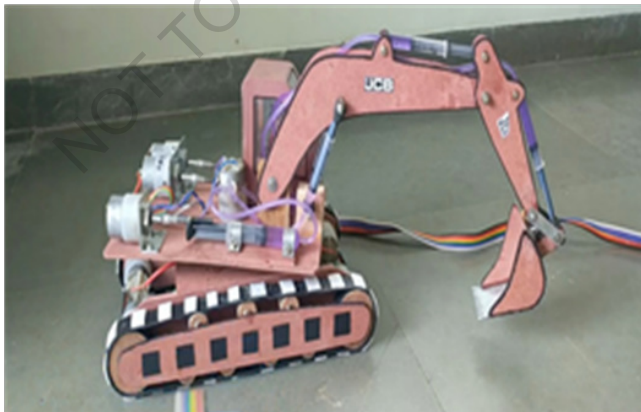


FIG2.14.1 CONSTRUCTION EQUIPMENT VEHICLES

Suggested Activity:

ACTIVITY

1. Make a model of JCB using clay, wood and Syringe material (With teacher).



2. Make a chart of construction vehicles.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of construction equipment vehicle
02	
03	Able to list out different models of construction equipment vehicle Able to understand importance of construction equipment vehicle

A. Fill in the blanks.

1. A road roller is a.....type engineering vehicle.
2. Dumper is a vehicle designed for carrying.....
3. Dumper is a vehicle.
4. Modern dumpers have pay loads of up to.....

B. Short answers questions.

1. List the different types of construction equipment vehicles.
2. Differentiate between road roller and dumper.

SESSION 5: SPECIAL VEHICLES

Session 5 -Overview: Student will be able to identify Special Vehicles.

LEARNING OUTCOME:

1. The students will be identifying importance of Special Vehicles i.e. Fork lift, Crane and its types, Railway Locomotive, Tankers.
2. To identify the different types of special vehicles.

INTRODUCTION

This unit provides the knowledge & skills covering able to identify importance of Special Vehicles i.e. Fork lift, Crane and its types, Railway Locomotive, Tankers (Fuel, Water, and Milk).

In the previous sessions, we have covered passenger vehicles, commercial vehicles, agricultural vehicles and construction equipment vehicles. Automotive technology has several other applications also, some of which we shall discuss in this session.



FIG.2.15: TRAIN

Railway locomotive is basically an automobile, but much bigger than a car, bus or a truck. In the beginning, trains were pulled by locomotives which were powered by steam. Nowadays, most rail engines (Fig. 2.15) run on diesel or electricity.



FIG.2.16: RAILWAY TRACK

In India, rail is a very important means of transportation of goods and passengers. As you know, a train cannot run on roads but runs on a rail way track (see Fig. 2.16). Another application of automotive technology is the big machines which have long extended arms for reaching high-rise buildings or the top of electric poles. These are mounted on an automobile and the complete machine is called a crane. Sometimes, the traffic police use a crane to lift cars which are wrongly parked.

Another interesting application of an automobile is the forklift (Fig. 2.17). A forklift is used mostly in industry and in large warehouses for carrying components and goods within the Premises of the factory.



FIG.2.17: FORK LIFT



FIG.2.17.1: Fire Brigade

So, a forklift is normally used for carrying goods for very short distances within the four walls of a building but never on the outside road. Tankers are also one of the automobile applications, which (Fig. 2.18) are used when liquids like water, milk, oil, petrol, diesel, etc., are required to be transported to long distances. These tankers have very big cylinders mounted horizontally on the chassis of a specially built automobile. The capacity of these tankers can vary.

Sometimes, a warning sign ‘inflammable material’ is written on the tankers that carry volatile fluids like petrol and diesel. This warning is to caution people on the road to not bring any ignited object like matchstick or fire crackers near the tanker.



FIG.2.18: MILK TANKER



FIG.2.19: TRAILER

Similarly, on roads, trailers are used for carrying heavy materials or containers (Fig. 2.19).

Suggested Activity:

ACTIVITY

1. List the important of Special Vehicles.
2. Make a different type of special Vehicles using clay, wood, mud and different materials.
3. Make a chart of different types of Special Vehicles and put in your class rooms.

Learning outcome:

SL. No	Expected Outcome for students
01	Able to understand about meaning of special vehicles.
02	Able to understand importance of Special Vehicles.
03	Able to list out different types of special vehicles in India.

A. Fill in the blanks:

1. A train is pulled by..... .
2. Rail engines run on..... .
3. The crane is a vehicle. .
4. The tanker vehicle is used for carrying..... .

B. Multiple choice questions:

1. In earlier times trains were pulled by .
(a) locomotives (b) car (c) motorcycle (d) Bus
2. Tanker is used for carrying .
(a) liquid (b) water (c) milk (d) All of these
3. Rail is used for carrying .
(a) passengers (b) goods (c) water (d) All of these
4. Which machine does the traffic police use for lifting cars?
(a) crane (b) dumper (c) road roller (d) None of these

C. Answer the following questions:

1. Define the role of special vehicles.
2. What is the purpose of using cranes?
3. List out the types of special vehicles.

D. Match the following.

The type of the Vehicles are given in Column 'A' and the examples of vehicles are given in Column 'B', Match them.

Column A

1. Special Vehicle
2. Commercial Vehicle
3. Agriculture Vehicle
4. Construction equipment vehicle
5. Passenger vehicle

Column B

- A) Scooter
- B) Dumper
- C) Fork lift
- D) Truck
- E) Bus
- F) Combine harvester
- G) Car

Column A

1. Special Vehicle
2. Commercial Vehicle
3. Agriculture Vehicle
4. Construction equipment vehicle
5. Passenger vehicle
6. Two wheelers

Column B

- A) Motor bikes
- B) Road roller
- C) Jeep
- D) Truck
- E) Fork lift
- F) Tractor
- G) Combine harvester

UNIT INFORMATION

Unit name: Major System and Components of an Engine

Unit code: Auto L1U3-NQ2024.

Unit descriptor:

This unit provides the introductory knowledge & skills covering major components and systems of an automobile. This covers Chassis Frame, Auto Body, Engine, Transmission, Front and Rear Axle, Steering System, Suspension System, Wheels and Tyres, Brakes, Electrical & Electronic Systems, Air Conditioning System, Lubrication System, Cooling System and Active and Passive Systems.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters of various components of an automobile.
- Animations and videos of various components of vehicle used in daily life.
- Sample and cut out of various components and assembly system of an automobile.

Nominal hours: 60 hours.

Name of the sessions

Sl.No	Various Types of Automobiles	Duration (In Hours)
1	CHASSIS AND AUTO BODY	5
2	ENGINE AND ITS COMPONENTS	9
3	LUBRICATION SYSTEM	6
4	COOLING SYSTEM	4
5	FUEL SUPPLY SYSTEM	4
6	TRANSMISSION SYSTEM	4
7	FRONT & REAR AXLE	4
8	STEERING AND SUSPENSION SYSTEM	4
9	WHEELS & TYRES	4
10	BRAKES	4
11	ELECTRICAL & ELECTRONIC SYSTEM	4
12	AIR CONDITIONING SYSTEM	4
13	ACTIVE AND PASSIVE DEVICES	4
	Total Duration in Hours	60

Element and Performance Criteria

<i>Element</i>	<i>Performance Criteria</i>
1. Role of each components and system of an automobile as follows. • <i>Chassis Frame,</i> • <i>Auto Body,</i> • <i>Engine,</i> • <i>Transmission</i> • <i>Lubrication System,</i> • <i>Cooling System</i> • <i>Front and Rear Axle,</i> • <i>Steering System,</i> • <i>Suspension System,</i> • <i>Wheels and Tyres,</i> • <i>Brakes,</i> • <i>Electrical & Electronic Systems,</i> • <i>Air Conditioning System.</i> • <i>Active and Passive Systems</i>	1. Able to identify make drawing, sketch & describe importance and use of bellow components and system of an automobile. • <i>Chassis Frame,</i> • <i>Auto Body,</i> • <i>Engine,</i> • <i>Transmission</i> • <i>Lubrication System,</i> • <i>Cooling System</i> • <i>Front and Rear Axle,</i> • <i>Steering System,</i> • <i>Suspension System,</i> • <i>Wheels and Tyres,</i> • <i>Brakes,</i> • <i>Electrical & Electronic Systems,</i> • <i>Air Conditioning System</i> • <i>Active and Passive Systems</i>

UNIT-3

MAJOR SYSTEMS AND COMPONENTS OF AN AUTOMOBILE



UNIT OVERVIEW:

In this Unit, you will learn about the various components and systems that make a complete automobile, The engine and its parts, The body and chassis, Drive Transmission and Steering parts, suspension and Brake parts, Electrical parts and other systems that make it possible for running of an automobile.

INTRODUCTION:

In the previous Units, we learnt about the different types of automobile. In this Unit, we will discuss the major systems and components of an automobile. An automobile is made of several components, assemblies and systems. The growing automotive industry has given rise to a growing auto component industry also.

The auto components industry is divided into five segments.

- Body and chassis.
- Engine parts
- Drive transmission and steering parts
- Suspension and brake parts
- Electrical parts.

Chassis:

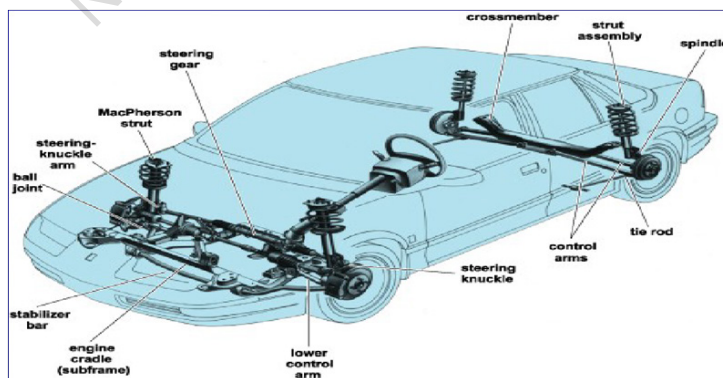


FIG.3.1 CHASSIS LAYOUT

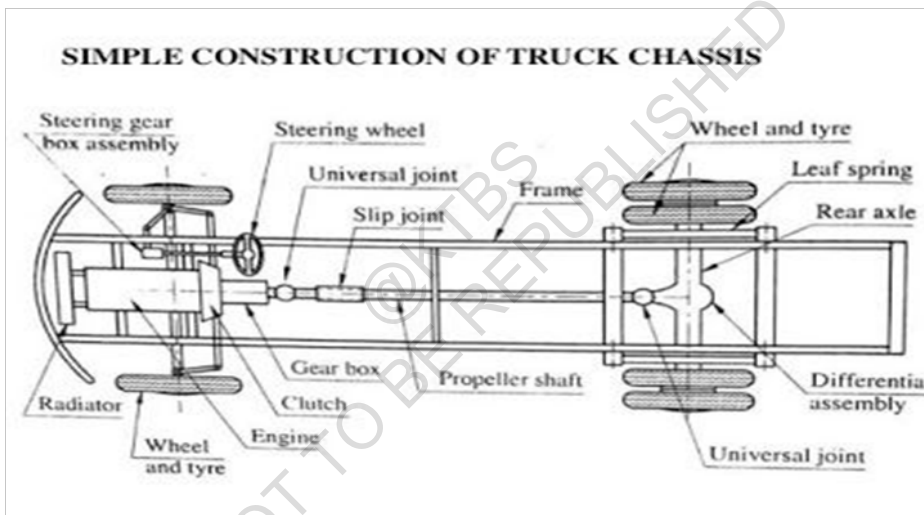
SESSION 1: CHASSIS AND AUTO BODY

Session 1 -Overview: Student will be able to understand about vehicle basic structure chassis and auto body super structure.

LEARNING OUTCOME:

1. Understand the meaning and uses of chassis in a vehicle.
2. Students know about importance of chassis with functions of chassis in a vehicle.
3. Know about Vehicle body and its structure with basic requirements.

Chassis:



Chassis is a French term and was initially used to denote the frame or main structure of a vehicle. The chassis (Fig.3.1) contains all the major units necessary to propel the vehicle, guide its motion, stop it and allow it to run smoothly over uneven surfaces. It is the main mounting for all the components including the body. It is also known as the carrying unit.

The chassis includes the following major components.

- a) A steel frame, which is a major part.
- b) In case of a passenger car, the whole body is also an integral part of the chassis called integral chassis. However, in commercial vehicles like Trucks and Buses, the body is not a part of the chassis called conventional chassis.

- c) Other major components include Engine, Transmission System, Front and Rear Axle, Steering System, Suspension System, Wheels, Tyres and Brakes.

Functions of the chassis frame:

1. To carry the weight of the vehicle and its passengers.
2. To withstand the engine and transmission torque and thrust stresses, as well as accelerating and braking torque.
3. To withstand the centrifugal force while cornering.
4. To withstand the bending loads and twisting due to the rise and fall of the front and rear axles.

Automobile Body or Superstructure:

In case of integral or frameless construction, the body is an integral part of the chassis. But, in case of the conventional chassis, the body or superstructure is made after receiving the chassis from the manufacturer.

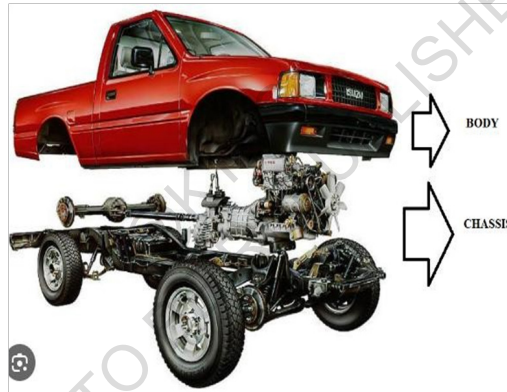


FIG.3.2– CONVENTIONAL CHASSIS

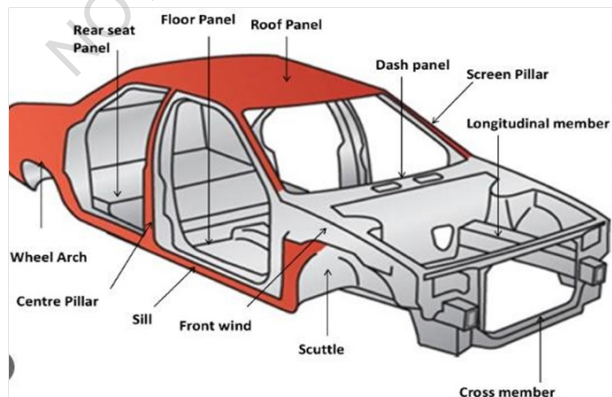
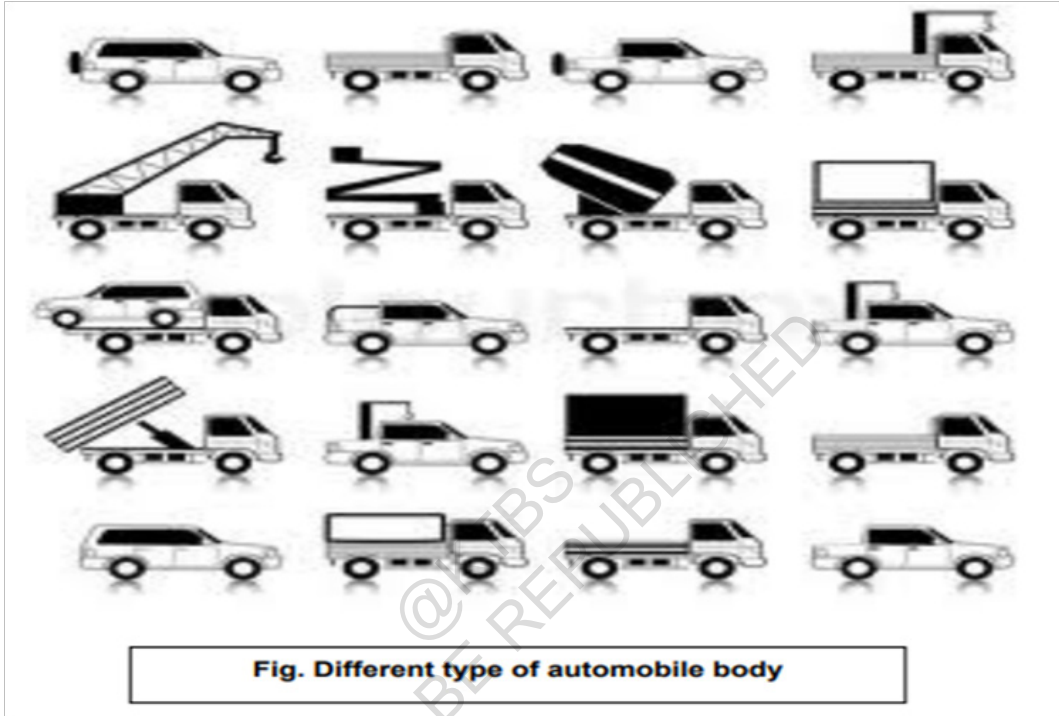


FIG:3.2.1 INTEGRAL CHASSIS

The shape of the body depends upon the ultimate use for which the vehicle is meant. The body of a car is made of a sheet of metal or fiber glass, so that passengers can sit in it. To make the journey comfortable, cushioned seats are provided. The body is provided on all sides with glass panes fixed to protect the passengers from dust and rain.



Auto body or superstructure:

Auto body is made of sheet metal or fiber glass, so that the passengers can sit in it. To make journey comfortable cushioned seats are provided. Body is provided on all sides with glass-panes fixed to protect the passengers from dust and rain.

The body of a bus is made of metal, like

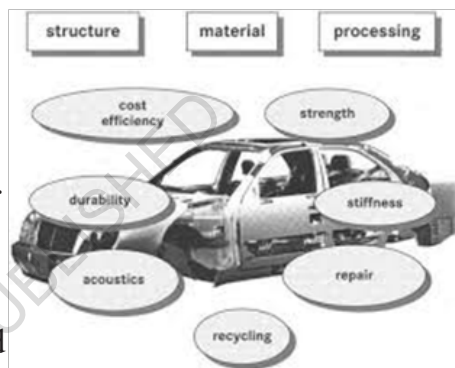
- a) Steel section pillars with steel sheet paneling,
- b) Steel section pillars with aluminum paneling.
- c) All aluminum bodies, i.e., pillars, framework and paneling made of aluminum sections and sheets. This is because aluminum is very light in weight compared to steel. The body is fixed to the chassis with the help of I-or U-bolts with rubber packing placed between the chassis and body cross members.



Requirements of automobile body: -

The body of a motor vehicle should fulfill certain requirements. It should

- Be lightweight.
- Have minimum number of components.
- Have long fatigue life.
- Have uniformly distributed load.
- Have sufficient space for passengers and luggage.
- Have good access to the engine and suspension system.
- Have minimum vibrations when the vehicle is running.
- Have minimum resistance to air.
- Be cheap and easy in manufacturing.
- Have clear all-round vision through glass areas.
- Have an attractive shape and colour.



Suggested Activity:

ACTIVITY

1. List the important of chassis & Auto Body.
2. Make a different type of chassis using clay, wood, mud and different materials.
3. Make a chart of different types of Chassis & Auto Body and put in your class rooms.

Learning outcome:

S.No	PERFORMANCECRITERIA
01	Able to understand about meaning of chassis
02	Able to list components of chassis
03	Able to explain importance of chassis
04	Able to identify general sections used in chassis frame

A. Fill in the blanks:

1. A chassis is almost a complete mounting body. .
2. Major part of a chassis is the frame.
3. In commercial vehicles like trucks and buses the body is not a.....of the chassis.

B. Answer the following questions:

1. What is meaning of chassis?
 2. What are the different types chassis frames used in automobile?
 3. Explain the use of the chassis frame.
 4. How does auto body help in transport?
 5. Draw the neat diagram of Chassis layout and label the parts.
-

There are different processes of fuel combustion. When the fuel is burned within the engine, it is called an Internal Combustion (IC) engine, and when it is burned externally and the produced steam is used for the mechanical movement, it is called an External Combustion (EC) engine.

Nowadays, automobile engines are quite economical due to the developments taking place in the field of internal combustion engine.

On the basis of the process of ignition, the automobile engines are classified into spark ignition engine (petrol or gas) and compression ignition engine (diesel). In an IC engine, the reciprocating motion of the piston is converted into rotary motion of the crankshaft and the produced power is then transmitted to move the vehicle.

Spark Ignition Engine (Petrol or Gas Engine)

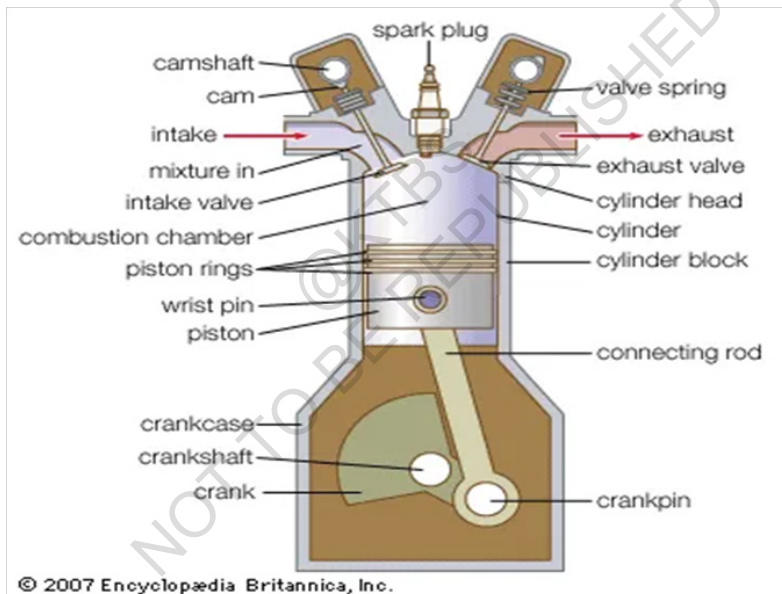


FIG.3.5. SI ENGINE

The spark ignition engine uses a highly volatile fuel, such as gasoline, which turns into vapor easily. The fuel is mixed with air before it enters in the combustion chamber, and forms a combustible air-fuel mixture. This mixture then enters the cylinder and gets compressed with the help of a piston. An electric spark is produced by the ignition system which ignites the combustible air-fuel mixture. The combustible gases burn and expand, which forces the piston downwards for generating power.

Compression Ignition Engine (Diesel Engine)

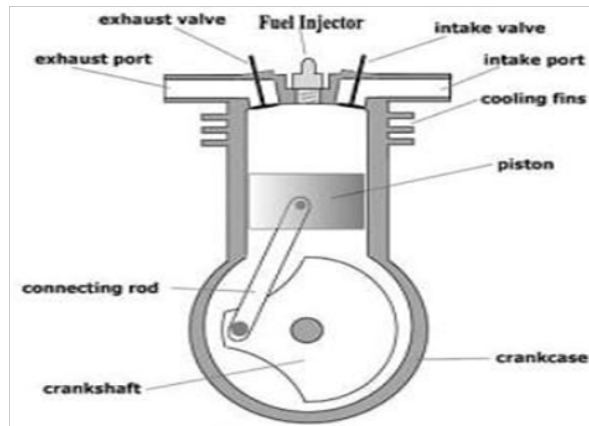
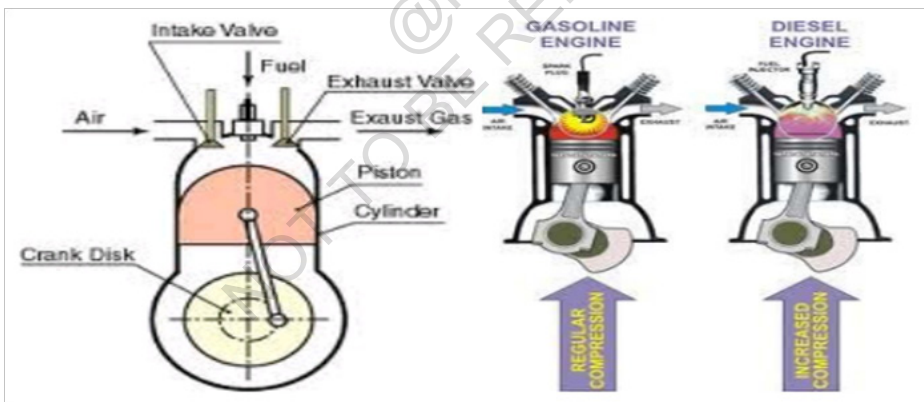


FIG.3.6 CI ENGINE

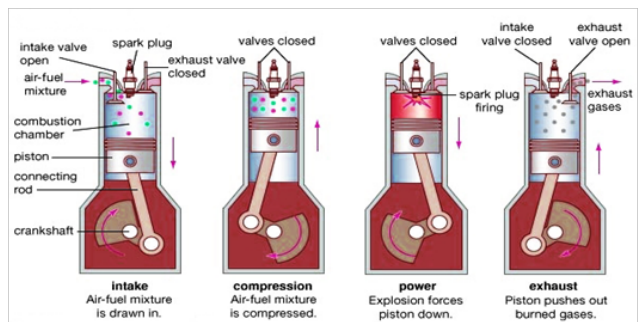
In the compression ignition engine or diesel engine, only fresh air enters the cylinder, which is compressed to a very high pressure and temperature, which could go up to 1000°F (538°C). The diesel is then injected or sprayed into the engine combustion chamber. This spray contains very fine and tiny particles of diesel in an atomized form. The hot air or heat of compression ignites the fuel and generates the power stroke.



4. Stroke Engine Working:

Four stroke engine (SI and CI) is works with following strokes,

- Suction/Intake stroke
- Compression stroke
- Power stroke
- Exhaust stroke



Components of an IC Engine

1. Cylinder:

- The cylinder of an IC engine is fitted in the cylinder block which is a single casted unit
- It is considered to be the main body of an engine.
- The piston reciprocates up and down from TDC to BDC generate power inside the cylinder.
- The cylinder block has to withstand very high pressure (about 70 bars) and temperature (about 2200°C) during power stroke.
- Should be good conductor of heat and should resist to rapid wear and tear due to reciprocating parts.
- The cylinder block is well-designed with water passages to remove
FIG.3.7 CYLINDER the excess heat and separate oil passages are provided for the circulation of lubricating oil.
- The top portion of the cylinder block is covered by the cylinder head.
- Generally, ordinary cast iron is used, but in case of heavy-duty engines, alloy steels or aluminum alloy are used. Nowadays, cylinder liners are made of special alloy and internal portion is coated with material like titanium which provides mirror finish and can withstand the wear resistance.

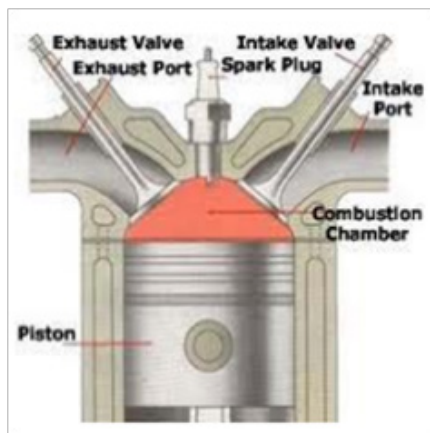


FIG.3.7 CYLINDER

2. Cylinder head

- The cylinder head is also single-casted unit and bolted to the top portion of the cylinder block.
- The combustion chamber is a part of the cylinder head, where the combustion of gases takes place.
- In latest engines, the cylinder head also houses the camshaft.
- This provision is made to fix spark plug in SI engines and nozzle in CI engines.

- The material used for the cylinder-head is also cast iron or aluminum alloy.



FIG.3.7 CYLINDER HEAD

3. Piston and Piston Rings:-

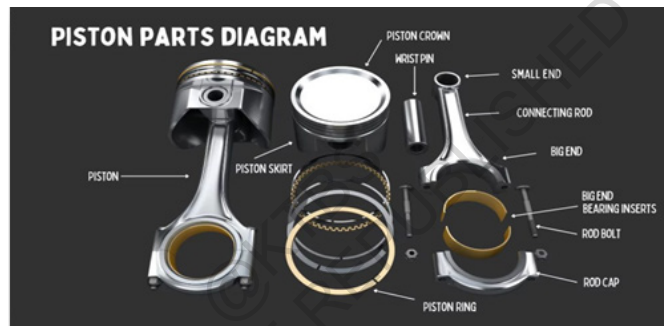


FIG.3.8 PISTON & PISTON RINGS

- Piston is the heart of the engine.
- Piston is a cylindrical unit, used to compress the charge during compression stroke and to transmit the gas force to the connecting rod and then to the crankshaft during power stroke.
- The pistons of IC engines are usually made of aluminum alloy, which has high thermal conductivity and is light in weight.
- The material of piston must have the ability for higher heat transfer.
- The piston moves up and down (from TDC to BDC) and assists in completing the engine cycle.
- The piston rings are placed in the ring groove and provide sealing between the piston and the cylinder liner, thereby preventing the leakage of high-pressure gases.

- The upper piston rings are called the compression rings and the lower piston rings are called the oiling or oil control rings.

4. Connecting Rod:

- a. It is made in the shape of 'I' so as to reduce its weight and to withstand strength.
- b. Its small end is connected to the piston with the help of gudgeon pin and the big end is connected to the crankpin with shell bearings.

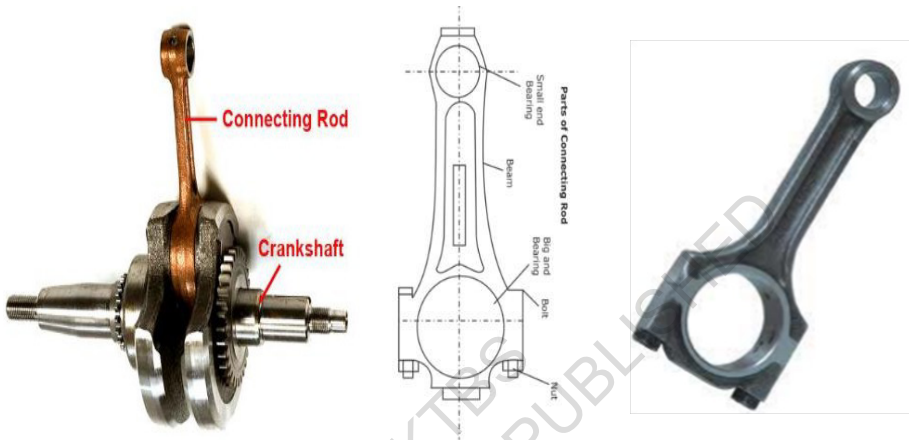


FIG.3.9 CONNECTING ROD

- It has a passage for the transfer of lubricating oil from the big end bearing to the small end bearing (gudgeon pin).
- The major function of the connecting rod is to convert the reciprocating motion of piston to the rotary motion of the crankshaft.

6. Crank and Crankshaft:



FIG.3.10 CRANK SHAFT

- The crankshaft (Fig. 3.10) is called the backbone of an engine because it converts the reciprocating motion of piston into the rotary motion of the crankshaft.
- The crankshaft is a single casted unit and is made of drop-forged steel main journals which are placed and supported in the crank case.
- The main journal and connecting journals are machined to a smooth finish to reduce friction and shell bearings are used for smooth rotation of crankshaft.
- Front end of the crankshaft will transmit drive to the camshaft and also to the timing gear, whereas the flywheel is bolted to the flange at rear end of the crankshaft. Main journal of the crankshaft carries the oil passages to lubricate shell bearings.

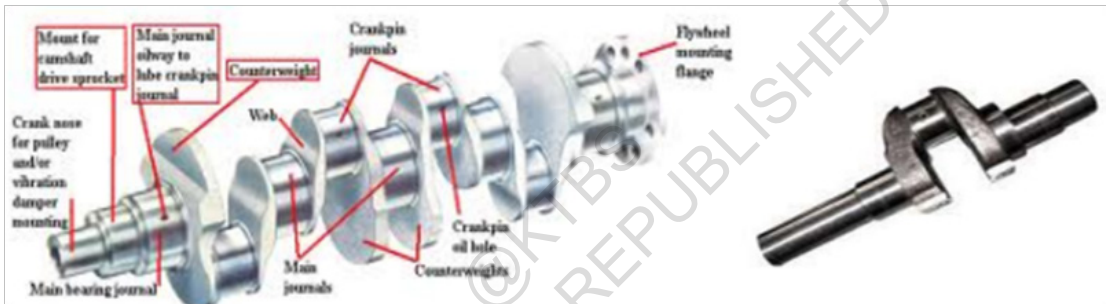


Fig: crankshaft of multi cylinder engine

Fig: crank shaft of single cylinder engine

7. Piston Pin or Gudgeon Pin:

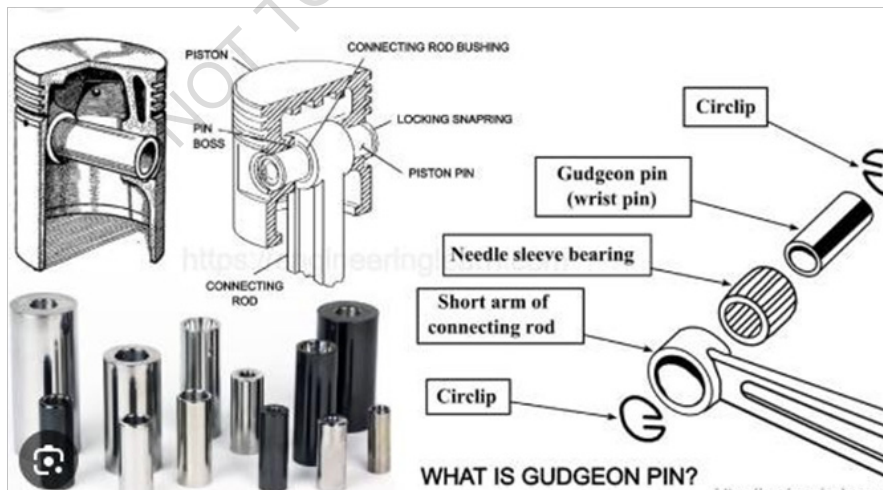


FIG.3.11: COMPONENTS OF PISTON PIN

8. Inlet Valve and Exhaust valve:

- The major role of the INLET VALVE is to submit fresh charge in to the cylinder during the suction stroke.
- Opening and closing of the valve will control the admission of the charge into the petrol engine or air into diesel engine during suction stroke of an engine.

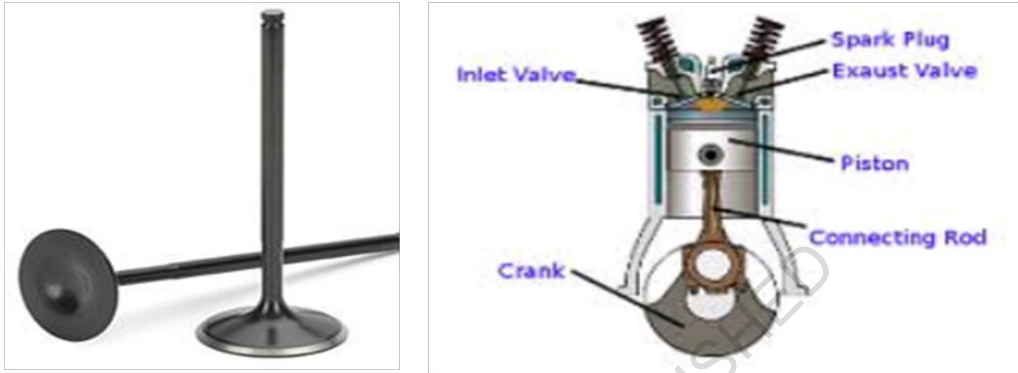


FIG: 3.11.1 VALVES

- The inlet valve has a wider face or in latest engines two inlet valves are used.
- The EXHAUST VALVE removes out the burnt gases from the combustion chamber after power stroke.
- The exhaust valve has to bare more heat and resistance.

9. Inlet Manifold: It is the passage which carries the charge from carburetor to the petrol engine or only air to the diesel engine



FIG: 3.12 MANI FOLD

10. Exhaust Manifold. It is the passage which carries the exhaust gases from the exhaust valve to the atmosphere.

11. Camshaft:

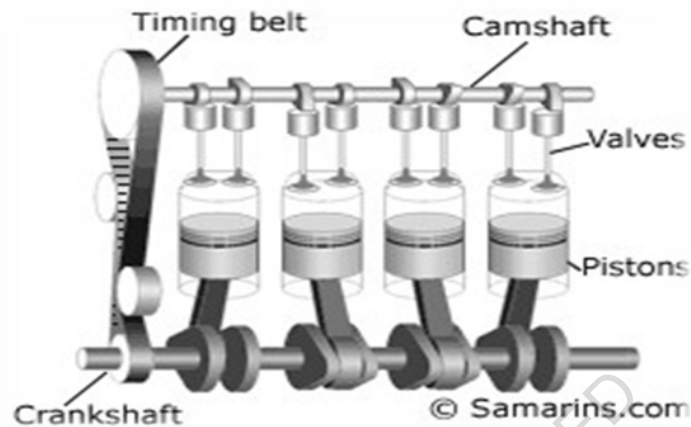


FIG.3.13: CAMSHAFT

- The major function of the camshaft is to operate the intake and exhaust valves through the cams, cam followers, push rods & rocker arms.
- The camshaft (Fig. 3.13) is driven by crankshaft at half the speed of the crankshaft.

12. Push Rod and Rocker Arm

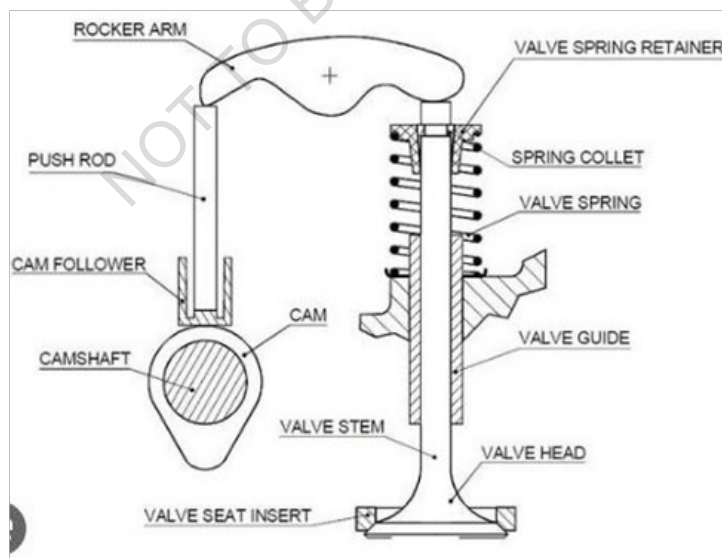


FIG.3.14: PUSHROD AND ROCKER ARM

- The motion of the cam is transmitted to the valve through the push rod and rocker arm.
- This movement pushes the push rod (Fig. 3.14) and the rocker turns the upward motion of the push rod to the downward movement of the valve stem resulting in opening of the valve.

12. Radiator

- The major function of the radiator is to radiate the heat from the coolants.
- It has two tanks located at the top and bottom.

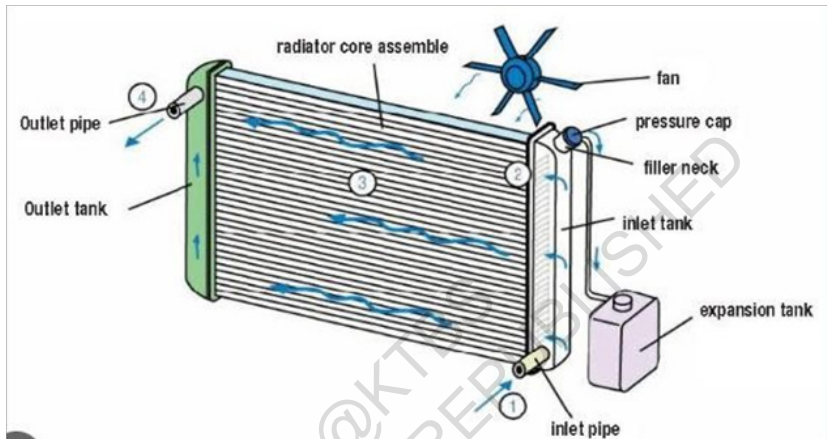


FIG3.15: RADIATOR

- The upper tank is connected to the lower tank with the core through the passages for easy radiation of the heat.
- The radiator storage of coolant for cooling the engine.

13. Carburetor:

- The major function of the carburetor (Fig. 3.17) is to supply uniform air-fuel to the cylinder of a petrol engine as per speed and the engine load.
- In petrol engines the carburetor is mounted on the induction manifold.
- The quantity of fuel air mixture in appropriate ratio is controlled by the throttle valve and the movements of the throttle valve are connected to the accelerator.

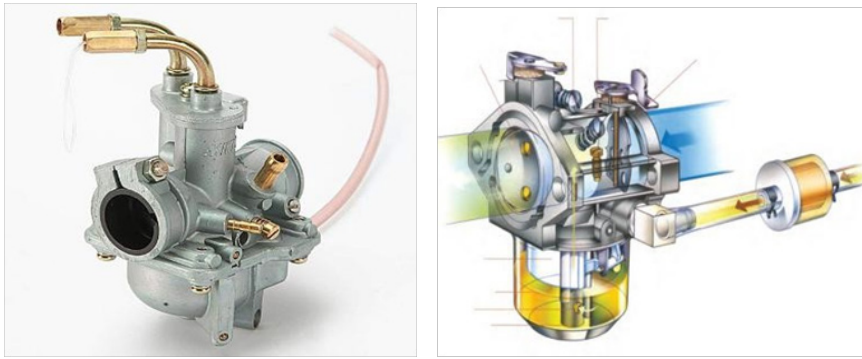


FIG.3.16 CARBURETOR

14. Sparkplug:

- The function of the sparkplug is to ignite the fuel air mixture after completion of the compression stroke in an engine.
- It is generally placed in the combustion chamber of the cylinder head.
- This is only used in petrol engine.



FIG.3.18: SPARKPLUG

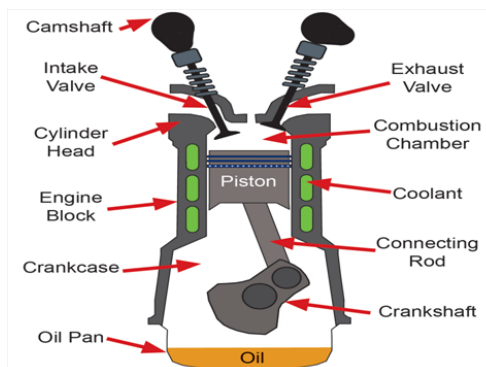
15. Fuel Injector:



FIG.3.20: FUEL INJECTOR

- The function of fuel injector is to break the fuel into fine spray (atomized condition) as it enters the combustion chamber of diesel engine.
- In case of an MPFI engine fuel is injected at the end of compression stroke as the fine spray of the fuel burns more efficiently in the combustion chamber giving better fuel efficiency with less air pollution.

Suggested activity:



Did you know?

Engine terminology:

TDC-Top Dead Center

BDC-Bottom Dead Center

Bore-Diameter of cylinder bore

Stroke-Distance traveled by piston from TDC to BDC.

SI Engine- Spark Ignition Engine (Petrol engine)

CI Engine- Compression ignition engine (Diesel engine)

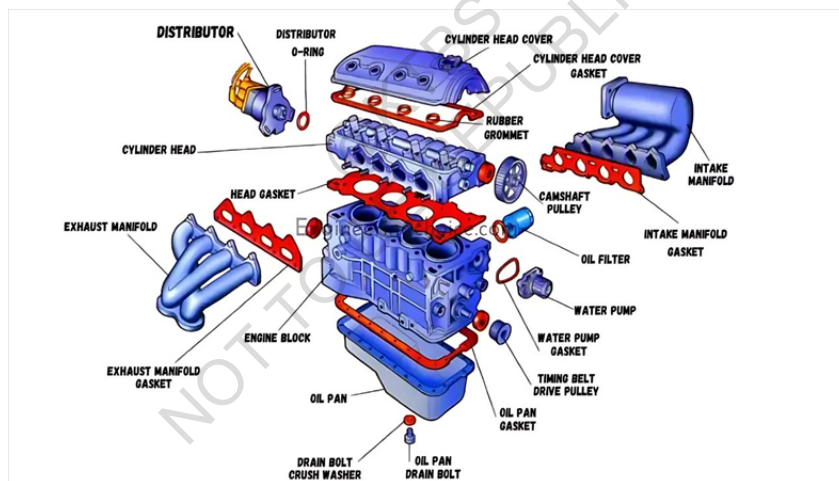


Fig: ENGINE AND ITS PARTS

Suggested activity:

ACTIVITY

1. Observe and identify components of an engine in your area and draw their diagram.
2. Identify the engine assembly and disassembly.
3. To identify the different types of engine used in automobile.

Learning outcome:

S.No	PERFORMANCE CRITERIA
01	Able to understand about meaning of engine
02	Able to list components of engine
03	Able to explain importance of engine
04	Able to identify assembly and disassembly sections of an engine.
05	Able to classify the engine

A. Fill in the blanks:

1. Engine is the of an automobile.
2. Engine converts the Chemical Energy (heat energy) to.....Energy.
3. Major parts of engine are.....,.....and.....
4. The function of the carburetor is to supply uniform.....to the cylinder of a.....through the intake manifold.
5. Sparkplug is used to

B. Multiple choice questions:

1. The compression-ignition engine air is compressed so that its temperature goes up to,
(a) 538°C(1000°F) or higher (b) 348 °C
(c) 2480°C (d) 300°C
2. The cylinder of an IC engine is generally made of .
(a) Cast iron (b) Copper
(c) Iron (d) Fiber
3. The heart of the engine is the .
(a) Piston (b) Crank shaft
(c) Cam shaft (d) valves

C. Answer the following questions:

1. What is the meaning of engine?
2. List the major systems of an automobile.

-
3. Explain the role of engine and its components.
 4. Explain the difference between compression ignition engines and spark ignition engine?
 5. Draw the neat diagram of Fuel Injector and label its parts.
 6. Draw the neat diagram of Spark plug and label its parts.
 7. Draw the neat diagram of SI and CI engines and label its parts.

@KTBS
NOT TO BE REPUBLISHED

SESSION3: LUBRICATION SYSTEM

UNIT OVERVIEW: Student will be able to understand about Lubrication system and its components in automobile.

LEARNING OUTCOME:

1. Students able to understand of importance of lubrication system.
2. Identify the Functions of lubrication system.
3. To understand the different types of lubricant and its characteristics.

INTRODUCTION

Lubrication system is one of the most important parts of an engine. The engine cannot run smoothly for more than a few minutes without the lubricating oil.

Whenever two metallic surfaces move over each other under direct contact, dry or solid friction is produced. This is due to the irregularities on the two surfaces interlocking each other. The dry friction thus created produces a lot of heat and results in wear and tear of the metal surface.

As you know, our body requires fluids like water and also oil in the form of fats like ghee, butter, cooking oil for maintenance of our system. Similarly, lubrication is required for maintenance of engine.

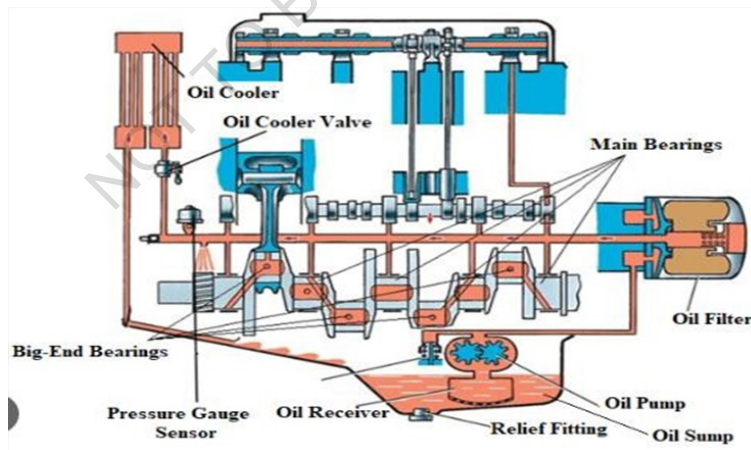


FIG.3.20 – LUBRICATING SYSTEM

Whenever two metallic surfaces move over each other under direct contact, dry or solid friction is produced. This is due to the irregularities on the two surfaces

interlocking each other. The dry friction thus created produces a lot of heat and results in wear and tear of the metal surface.

Objectives of Lubrication:

The main objectives of lubrication are;

1. To reduce friction between moving parts to its minimum value so that power loss is minimized.
2. To reduce wear and tear of the moving parts as much as possible.

Apart from these objectives, lubrication also serves other important purposes, which may be called secondary.

These are as follows.

- **To provide cooling effect:**

The lubricating oil takes heat from the hot moving parts during its circulation and delivers it to the surrounding air through the crank case.

- **To provide cushioning effect:**

The lubricating oil also serves as a good cushion against the shocks experienced by the engine. For example, instant combustion of the fuel in the combustion chamber produces a sudden rise of pressure in the cylinder and the shock goes to the bearings through the piston, gudgeon pin and the connecting rod.

- **To provide cleaning action:**

The lubricating oil serves another useful purpose of providing a cleaning action. During its circulation, it carries away many impurities, such as carbon particles, etc.

- **To provide a sealing action:**

The lubricating oil also helps the piston rings in maintaining an effective seal against the high- pressure gases in the cylinder thus preventing leakage towards the crank case.

Did you know?

- Viscosity is a property of lubricant / fluid and it resists the oil to flow.
- It is measured by Viscometer.
- Viscosity is changes with temperature are called ‘Viscosity Index’.

SUGGESTED ACTIVITY:

ACTIVITY

- Observe and identify components of lubrication system.
- Draw a neat diagram of lubrication system and put it in your class room
- To identify the different types of lubrication system used in automobile
- Differentiate between different types of lubrication.

LEARNING OUTCOME:

S.No	PERFORMANCE CRITERIA
01	Able to understand about meaning of lubrication system
02	Able to list the components which requires lubrication.
03	Able to explain importance of lubrication system
04	Able to classify the lubricants

A. Multiple choice questions

1. Viscosity is measured using a .
(a) Barometer (b) Thermometer
(c) Viscometer (d) Pathometer
2. Lubricating oil is used for .
(a) Minimizing wear in moving parts
(b) Help in keeping parts cool
(c) Both (a) and (b)
(d) none of the above
3. Viscosity index is a measure for the change of viscosity with changing
(a) Pressure (b) Temperature (c) Volume (d) Mass

B. Answer the following questions:

1. Explain the importance of lubrication in engine.
2. List the objectives of lubricant.

SESSION4 : COOLING SYSTEM

SESSION OVERVIEW: Student will be able to understand about cooling system and its components in automobile.

LEARNING OUTCOME:

1. Understand the meaning and importance of cooling system in a vehicle.
2. Various types of cooling systems and its components.
3. Understand, how the cooling system removes heat from engine?

INTRODUCTION

Cooling System: As our body requires air and water for cooling our system similarly engine also requires cooling. The cooling system has three primary functions.

The functions of cooling system are as follows:

1. Remove excess heat from the engine.
2. Maintain a constant engine operating temperature.
3. Increase the temperature of a cold engine as quickly as possible by maintaining the thermostat valve in closed position which is fitted in the path of coolant circulation.

Types of cooling system

1. Air cooling system
2. Water cooling system (liquid cooling system)

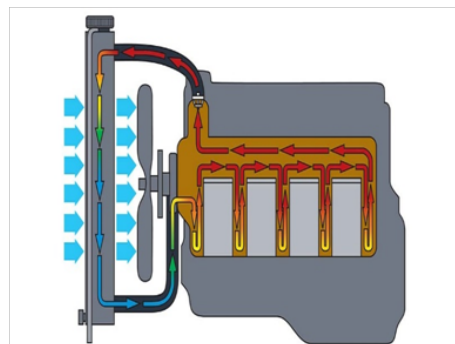
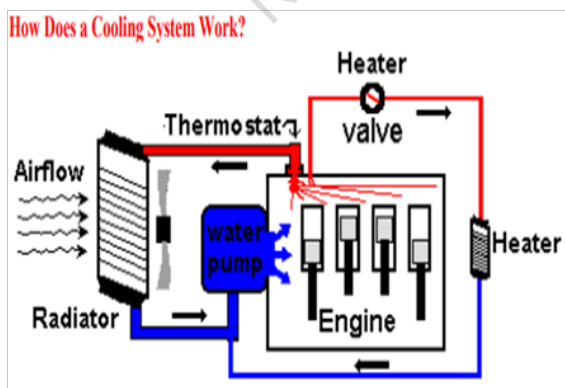


FIG.3.21. COOLING SYSTEM OF AN ENGINE

The major components of cooling systems are, Radiator, Thermostat, Water pump, Cooling fan, fan belt, Hoses pipe, Water jacket etc..

Necessity of Cooling:

- The cylinders of internal combustion engines require cooling because the engine cannot convert all the heat energy released by combustion into useful work.
- Liquid cooling is employed in most of the IC engines, whether they are used in automobiles or elsewhere. The water (coolant) is circulated around the cylinders to pick up heat and then dissipate it through a radiator.
- As the temperature increases from 71 to 82 degrees centigrade, the thermostat valve opens and sends water to the radiator to radiate the heat.
- When the temperature rises above 82 degrees, the thermostat switch operates the cooling fan to support the cooling process in radiator.

SUGGESTED ACTIVITY

ACTIVITY

- Observe and identify components of cooling system.
- Draw a neat diagram of cooling system and put it in your class room
- To identify the different types of cooling system used in automobile

LEARNING OUTCOME:

S.No	PERFORMANCECRITERIA
01	Able to understand about meaning of cooling system
02	Able to list components of cooling system
03	Able to explain importance of cooling system
04	Able to classify the cooling method
05	Able to classify the coolant

A. Fill in the blanks

1. The cooling system removes excess.....from the engine.
2. Cooling maintains a constant engine operating..... .

B . Answer the following questions:

1. What are the functions of cooling system?
2. How does a cooling system work?

SESSION 5: FUEL SUPPLY SYSTEM

SESSION OVERVIEW: Student will be able to understand about fuel supply system and its components.

LEARNING OUTCOME:

1. Understand about meaning of fuel supply system.
2. Identify the various components of fuel supply system.
3. Explain importance of fuel supply system.
4. Classify the fuel supply system.

Fuel Supply System in Petrol Engine:

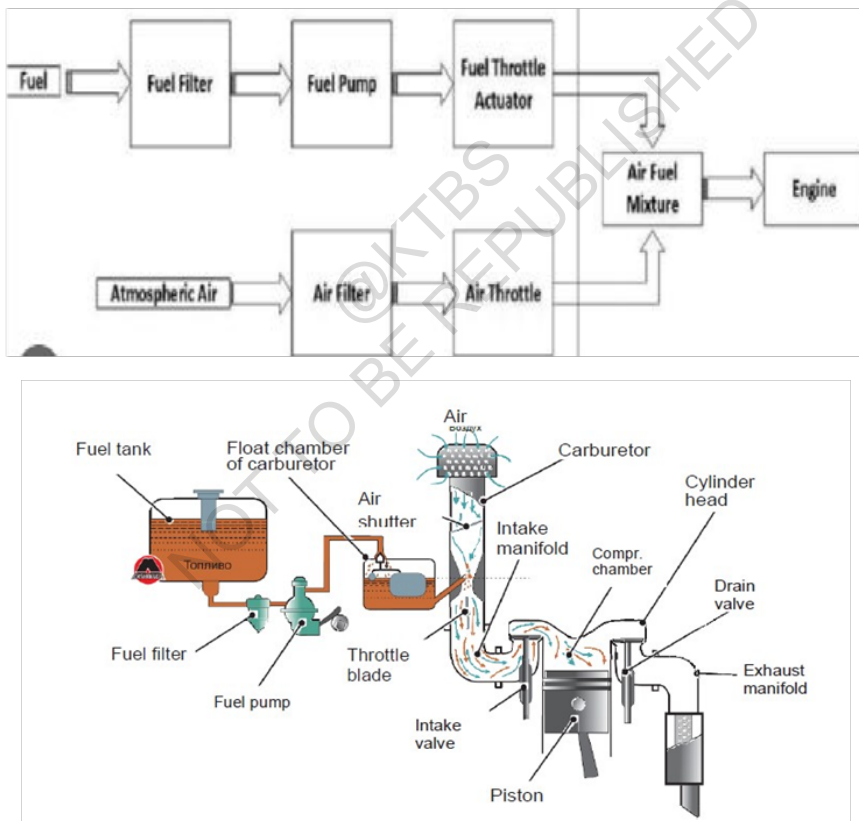


FIG.3.22 FUEL SUPPLY SYSTEM IN PETROL ENGINE

In petrol engines, the fuel and air mixture are supplied to the combustion chamber of an engine. This mixture is atomized and then vaporized by the carburetor. Then the mixture is ignited by the spark plug. The fuels, such as petrol,

benzyl and alcohol are used in an SI engine. Vaporizes easily if injected in the flow of air, therefore, the engine suction is sufficient to draw the mixture easily in to the cylinder.

Fuel Supply System in Diesel Engine:

In case of compression ignition engine (diesel) the fuel is sent through the fuel pump to the injector and the injector sprays the fuel at end of compression stroke. The oil fuels which are used in CI engines do not vaporize easily.

Therefore, a separate injection system is used consisting of fuel injection pump (FIP) and injectors. These injectors atomize the fuel and it is then sent for combustion.

Nowadays, in case of compression ignition engine the common rail direct injection system (CRDI) is used for better engine performance.

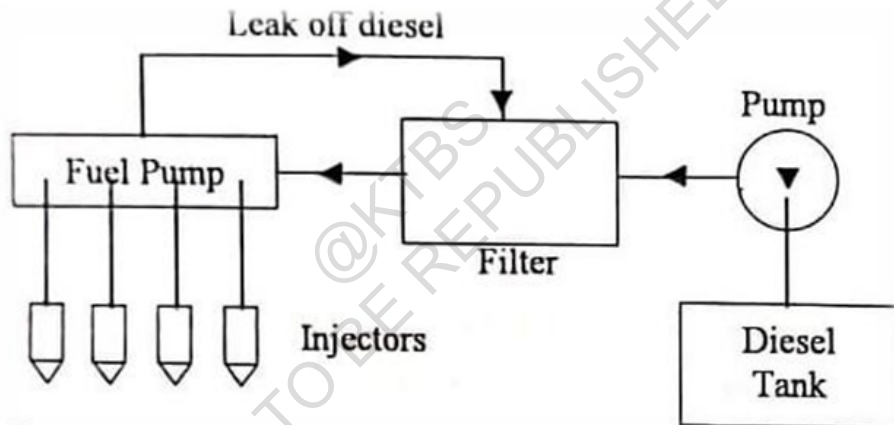


FIG.3.23 FUEL SUPPLY SYSTEM IN DIESEL ENGINE

Fuel Supply Components:

FUEL SUPPLY COMPONENTS FOR S.I. ENGINE	FUEL SUPPLY COMPONENTS FOR C.I. ENGINE
• Fuel tank • Fuel lines • Fuel pump (A.C. mechanical type or electrical type) • Fuel filter • Carburettor • Inlate manifold • Air cleaner	• Fuel tank • Fuel lines • Fuel feed pump (Mechanical type or electrical type) • Fuel filters • Fuel injection pump (FIP) • Fuel injectors

SUGGESTED ACTIVITY:

ACTIVITY

1. Observe and identify components of Fuel supply system.
2. Draw a neat diagram of fuel supply system and put it in your class room
3. To identify the different types of fuel supply system used in automobile

LEARNING OUTCOME:

Sl.No	PERFORMANCE CRITERIA
01	Able to understand about meaning of fuel supply system
02	Able to list components of fuel supply system.
03	Able to explain importance of fuel supply system
04	Able to classify the fuel supply system

A. Fill in the blanks.

1. Air and fuel are outside the engine.
2. The fuels, such as petrol, benzyl and alcohol are used in.....engine.
3. Oil fuels which are used in CI engines donot.....easily.
4. The fuel system is controlled by the.....

B. Multiple choice questions:

1. The carburetor is used to .
(a) Mix petrol and air in correct proportion
(b) Supply fuel air mixture to the engine
(c) Both(a)and(b) (d) None of the above
2. In a multi-point fuel injection, the injector is used for how many cylinder engines?
(a) Five (b) Two (c) Four (d) Six
3. Which of the following is not an injector fault?
(a) Blue nozzle body (b) Nozzle wetness blue nozzle body
(c) Excessive leak off (d) Blow holes

C. Answer the following questions:

1. Write the components of a fuel supply system.
2. Draw the line diagram of fuel supply for petrol engine.

SESSION6: TRANSMISSION SYSTEM

UNIT OVERVIEW: Student will be able to understand about Transmission system and its components in automobile.

OBJECTIVES:

1. Understand about meaning of Transmission system
2. Identify the various components of Transmission system and their functions.
3. Classify the Transmission system
4. Draw the diagram of transmission components.

INTRODUCTION

Transmission system is used in motor vehicles to supply the output of the internal combustion engine to the drive wheels. The transmission reduces the higher engine speed to the slower wheel speed, increasing torque in the process. Transmissions are also used in pedal bicycles, fixed machines and where rotational speed and torque need to be adapted.

Transmission System:

The transmission system consists of the following components.

- Clutch assembly.
- Gearbox assembly (Transmission case assembly).
- Propeller shaft.

Clutch assembly:

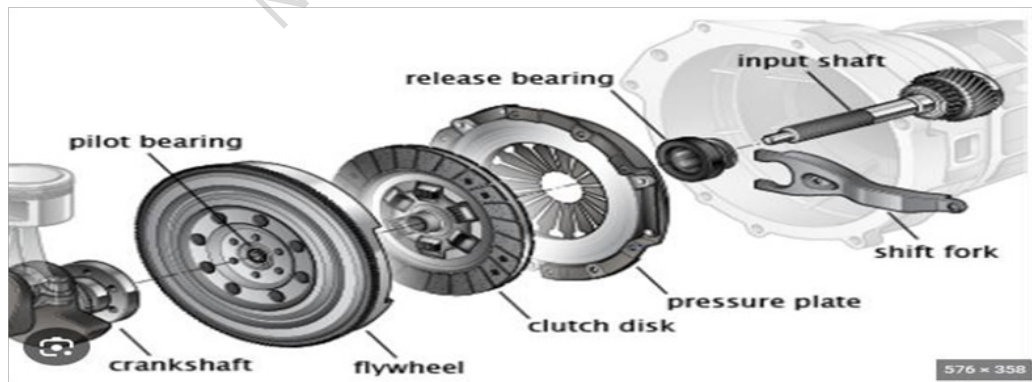


FIG.3.24: CLUTCH ASSEMBLY

Did you know?

What is clutch?

A clutch is a mechanical component that engages and disengages the engine's power from the transmission or rear axle, allowing for control over the transmission of power and enabling smooth gear shifts in vehicles.

Functions of clutch:

- To disconnect the engine power from the gear box
- To start the engine and warm it up;
- To engage first and second gear to start the vehicle from rest.
- To facilitate changing the gear as required; and
- Disconnect from the engine to stop the vehicle after application of brakes.
- To allow the engine to take upload gradually without shock or jerk.

Requirements of a Clutch:

- Ability to transmit maximum torque of the engine.
- To engage gradually and avoid sudden jerks.
- Ability to dissipate large amount of heat generated.
- Size of the clutch should be as small as possible. so
- Free pedal play, which helps the clutch to reduce effective load.
- Light weight of the driven member of the clutch.

Main Parts of a Clutch:

The main parts of a clutch are divided in to three groups.

1. Driving members:

- The driving members consist of a flywheel mounted on the engine crankshaft
- Thus, the entire assembly of the fly wheel and the cover rotate all the time.

2. Driven members:

- The driven members consist of a disc or plate, called the clutch plate.
- It carries friction material on both of its surfaces.

- When it is gripped between the flywheel and the pressure plate, it rotates the clutch shaft through the splines.

3. Operating members:

- The operating members consist of a foot pedal, linkage, release bearing, release levers and the springs.

Gearbox (Transmission Case) Assembly:



FIG.3.25.GEARBOXASSEMBLY

Did you know?

A gearbox is a mechanical device used to change the speed and torque (turning force) from the engine to the wheels of a vehicle.

At the time of starting the vehicle, the maximum amount of torque is available on the flywheel, for which low gear ratio is selected for the movement of the vehicle. As the engine speed increases, the amount of torque is reduced on the flywheel and it is required to select higher gear ratio.

Functions of a gearbox:

- To provide a means to vary the leverage or torque ratio between the engine and the road wheels as required.
- The transmission also provides a neutral position so that the engine and the road wheels are disconnected even with the clutch in the engaged position.
- It provides a means to reverse the car by selecting the reverse gear.

Propeller Shaft:

This is a shaft which transmits power from an engine to the rear wheels of a motor vehicle. It is a hollow tubular shaft and consists of mainly three parts.

1. Shaft
2. Universal joint
3. Slip joint

Did you know..?

Drive shaft

A drive shaft is a mechanical component used to transmit torque and rotational motion from one part of a machine to another. It's most commonly found in vehicles, where it transmits power from the engine or transmission to the wheels or other moving parts.

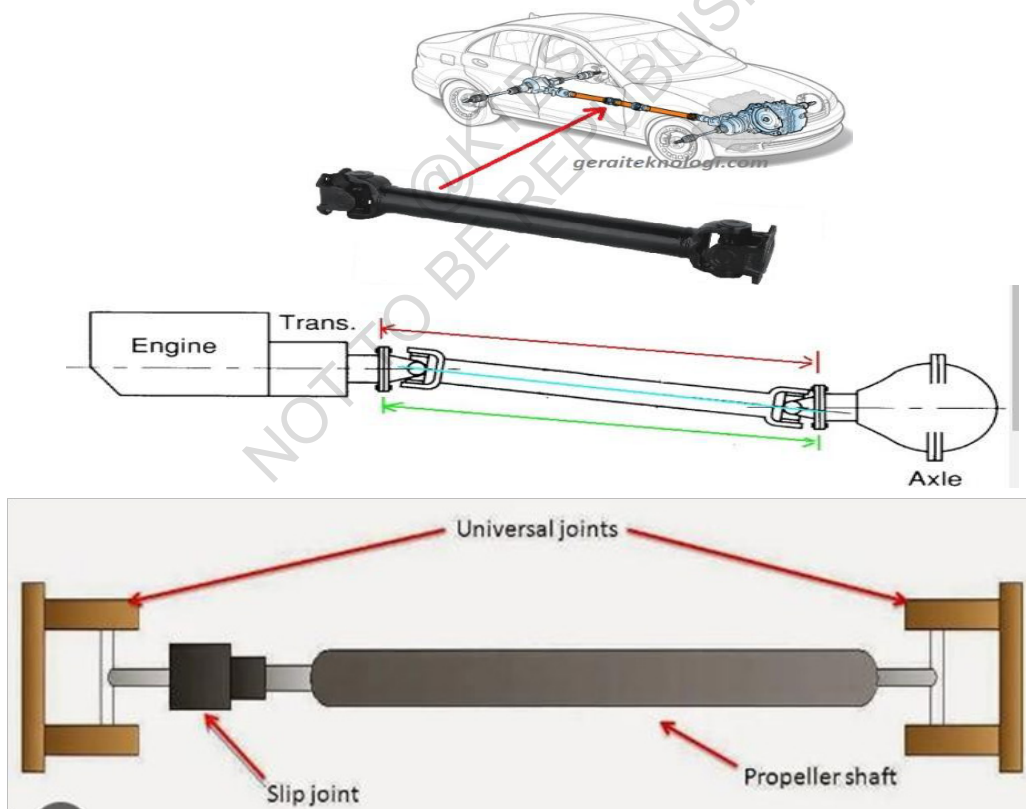


FIG 3.25.1: PROPELLER SHAFT

SUGGESTED ACTIVITY:

ACTIVITY:

1. To identify the different types of transmission system used in automobile
2. Differentiate between different types of transmission system
3. Identify the different types of clutches.

LEARNING OUTCOME:

<i>Sl.No</i>	<i>PERFORMANCE CRITERIA</i>
01	Able to understand about meaning of Transmission system
02	Able to list components of Transmission system.
03	Able to classify the Transmission system
04	Draw the diagram of two piece propeller shaft

A. Fill in the blanks

1. Transmission system consists of.....components.
2. The main parts of clutch are.....and .
3. Different gear ratios in the.....make the vehicle move at different speeds.
4. The clutch assembly consists of flywheel, pressure plate and.....

B. Multiple choice questions:

1. Which of these systems is used in motor vehicles to supply the output of the internal combustion engine to drive wheels?
(a) Transmission system (b) Power system (c) Torque system
(d) none of the above
2. Which type of transmission system is used for a disengagement and engagement between the engine and the remainder of transmission system?
(a) Clutch (b) Differential (c) Propeller shaft (d) Drive shaft
3. Four-wheel drive there is .
(a) One live axle (b) no live axle
(c) two live axle (d) none of these

4. Produces different gear ratios in automobiles.

(a) Transmission (b) Differential (c) Steering (d) Gear box

C. Answer the following questions:

1. Discuss the role of a transmission system.
2. What is clutch?
3. Mention the functions of clutch and gear box.

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SESSION7: FRONT AND REAR AXLE

UNIT OVERVIEW: Students will learn about the front and rear axle systems in automobiles, including their components and functions.

LEARNING OUTCOME:

1. Understand the meaning of front and rear axle.
2. Explain importance of front axle.
3. Able to identify front axle.

Front axle:

Front axle carries the weight of the front portion of the automobiles well as facilitates steering and controls the rolling of wheels. It also absorbs road shocks arising due to road surface variations.

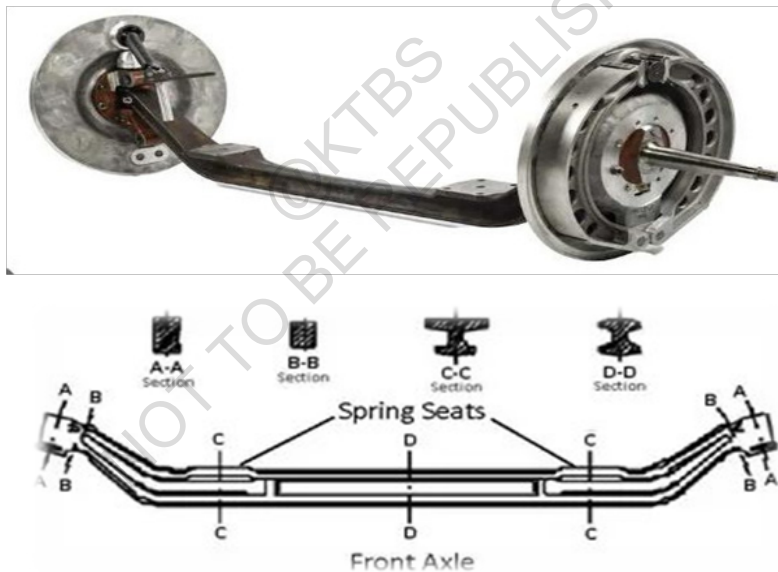


FIG.3.26: FRONT AXLE

In case of a commercial vehicle the front axles are generally dead axles. The front axle is designed to transmit the weight of the automobile from the springs to the front wheels, turning right or left as required. Front axle includes the axle-beam, stub-axles with brake assemblies.

The axle is made of I-section at center and of circular or elliptical section in the ends since it has to bear the bending stress and tensional stress. In order to lower

the chassis height a downward sweep is provided at the center of the beam axle. The main beam axle is connected to the stub axle with a king pin. The front road wheels are mounted on the stub axle.

Functions of Front axle:

- It carries the weight of the front portion of the automobile.
- To prevent interference due to front engine location Providing greatest ability and safety at high speeds.

Rear Axle:

Like the front axle, the rear axle is also made of drop forged steel.

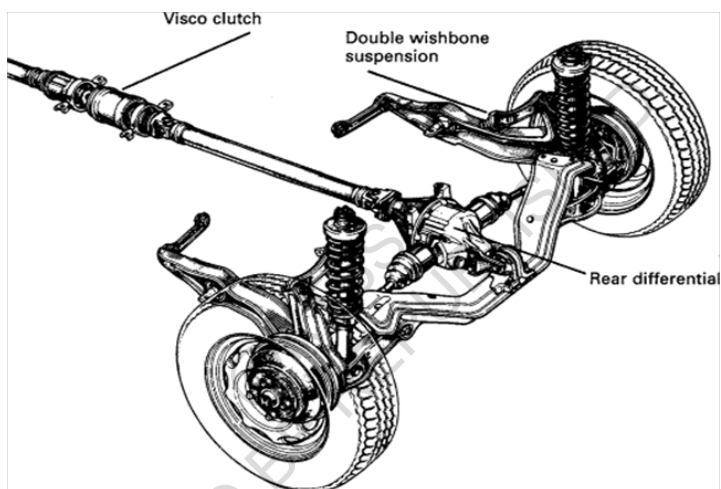


FIG.3.26: REAR AXLE

Functions of Rear axle:

- The rear axle bears the weight of the vehicle body and load with springs.
- It enables to transmit the driving and breaking torque to the chassis frame.
- It also bears the side thrust or pull due to any side load on the wheel.
- It supports various parts like bevel pinion, bevel gear, cage of sun gear and star pinions, axle shafts, and different support bearings.

Did you know?

The rear road wheels are mounted on the axle shaft, and the differential mechanism allows the outer wheel to rotate faster than the inner wheel when the vehicle is turning. This helps in smooth turning and prevents tire wear.

SUGGESTED ACTIVITY:

ACTIVITY

1. Observe and identify components of a front and rear in your area and draw their diagram
2. To identify the different types of front and rear axle used in automobile
3. Differentiate between different types of axles.

Learning outcome:

Sl.No	PERFORMANCECRITERIA
01	Draw the diagram of two-piece propeller shaft
02	What is meaning of front and rear axle?
03	Able to explain importance of front axle.
04	Able to identify front axle

A. Fill in the blanks:

1. Axle and steering system transmit to the wheel.
2. Front and rear axle system is used for..... .
3. Differential mechanism enables them.....to move faster than the inner wheel while taking a turn
4. Rear axle the weight of vehicle body.

B. Multiple choice questions.

1. The central portion of the front axle is made of .
(a) I section (b) T section (c) Section on (d) U section
2. The end of the front axle is mounted with .
(a)Stub axles (b)King pin (c)Piston ring (d)Axle shaft
3. What kind of load does the axle take due to the load of the vehicle?
(a)Bending load (b) Frictional load
(c) Tensional load (d) none of these

C. Answer the following questions:

1. What is the role of a front axle?
2. Why are rear axles required?
3. Draw the neat diagram for Propeller shaft and label its parts.

SESSION 8: STEERING AND SUSPENSION SYSTEM

UNIT OVERVIEW: Student will be able to understand about Steering & Suspension system and its components in automobile.

LEARNING OUTCOME:

1. Know the meaning and importance of steering and suspension system
2. Describe the principle operation of a steering system.
3. Describe the components and operation of pneumatic steering system.
4. Describe the functions of steering system and suspension system of a vehicle.

Steering System:

The steering mechanism permits the driver to control the car on a straight road and turn right or left as desired. The steering mechanism includes a steering wheel, which the driver controls, a steering gear, which converts rotary motion of steering wheel in to straight line motion and steering linkages.

In modern cars, the manually operated steering system (Fig. 3.27) is assisted by power and is called power steering. The electric power drawn from the battery or hydraulic power is used.

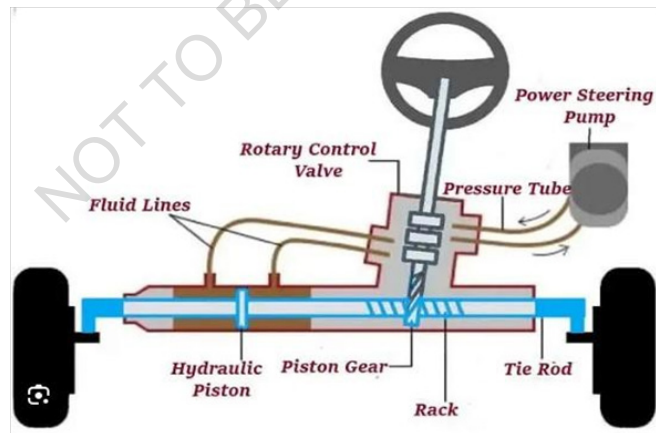


FIG:3.27. STEERING SYSTEM

Various components of Steering System:

- Steering wheel
- Steering Column

-
- Steering arm
 - Steering linkage with universal joint.
 - Steering gear box
 - Rack and pinion mechanism.
 - Hydraulic Piston and Fluid lines.

Functions of a Steering System:

- It is used to turning the vehicle according to the will of the driver
- It provides directional stability to the vehicle when moving in a straight (ahead) direction.
- It controls the wear and tear of the tyres
- It provides perfect steering condition.
- It helps in achieving the self-straightening effect after completion of turn.
- It converts the rotary motion of the steering wheel into angular displacement of the front wheel.
- It multiplies the effort of the driver to ease operation.

Requirements of a Good Steering System:

- It should be very accurate.
- It should be easy to handle.
- The effort required should be minimal.
- It should provide directional stability.
- The wheels should automatically come to the straight-ahead position after completion of turn.
- The system must be irreversible to a certain degree so that minimum front wheel shocks are transmitted to the driver's hands.

Suspension System:

Suspension is the term given to the system of springs, shock absorbers and linkages that connects a vehicle to its wheels.

The suspension system serves a dual purpose, contributing to the vehicle's road holding or handling and breaking for safety and driving comfort, and keeping the vehicle occupants comfortable and reasonably well isolated from road noise, bumps and vibrations, etc.

Importance of suspension system:

The main functions of a suspension system are as follows:

- To safe guard the occupants against road shocks and provide riding comfort.
- To minimize the effects of stresses due to road shocks on the mechanism of the motor vehicle and provide a cushioning effect.
- To keep the body perfectly in level while travelling over rough uneven ground, i.e., the up and down movement of the wheels should be relative to the body.
- To isolate the structure of the vehicle from shock loading and vibration due to irregularities of the road surface without impairing its stability.
- To provide the requisite height to the body structure as well as to bear the torque and braking reactions.

Functions of a Suspension System

1. It provides comfort.
2. It gives cushioning effect.
3. It relieves strain on the frame and other components due to the road shocks.
4. It maintains body level and prevents it from rolling.
5. It provides a good contact with road & tyres.
6. It transfers driving torque to the wheels as well as breaking force to the chassis

Various Types of Suspension System:

I. Mechanical Suspension:

a. Leaf springs:

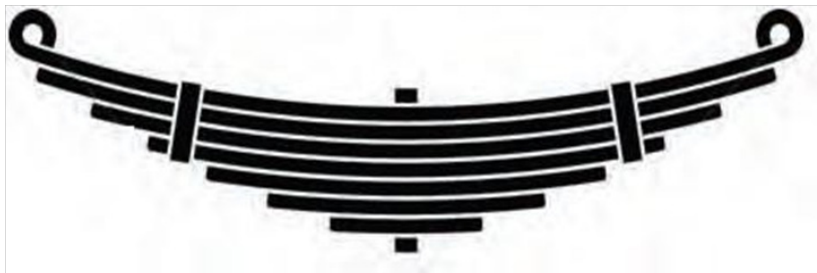


FIG:3.28 LEAF SPRING

- b. Coil springs:** Coil springs are commonly called compression springs, torsion springs or helical springs. They store energy and release it to absorb shock or maintain a force between two contacting surfaces.



FIG:3.28 COIL SPRING

- c. Rubber springs:** A rubber spring stores more energy per unit mass than any other type of spring material. The rubber spring (Fig.3.30) is installed between the frame and the top link of the suspension system.



FIG:3.29 RUBBER SPRINGS

- d. Torsion bars:** Torsion bars are of two types—helical or spiral. These bars are used in automobile vehicles for transmitting torque.

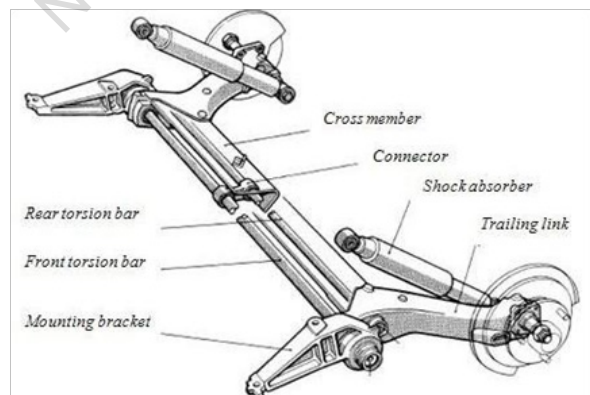


FIG:3.30 TORSION BARS

II. Hydraulic Suspension: This type of suspension system used in vehicles that uses hydraulic fluid to adjust and control the ride height, damping, and overall suspension performance. It provides a smooth, comfortable ride and can be used to adapt to different driving conditions or load situations by adjusting the stiffness and height of the suspension.

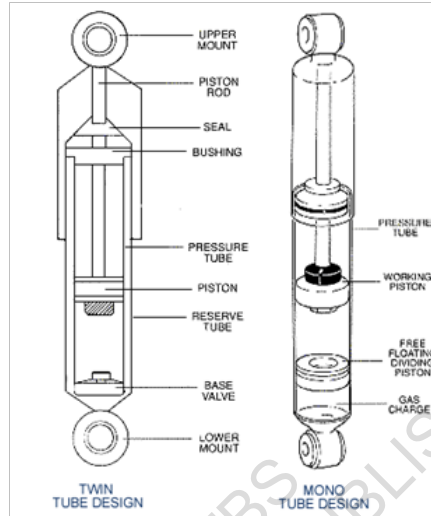


FIG3.35: HYDRAULIC SUSPENSION

- a. Hydraulic shock absorber
- b. Telescopic fork absorber

III. Air Suspension

(Compressed air is used in an air suspension system.)

This suspension system is operated with air and controlled by a microprocessor. It helps in maintaining self-driving conditions and supports the weight of the vehicle.

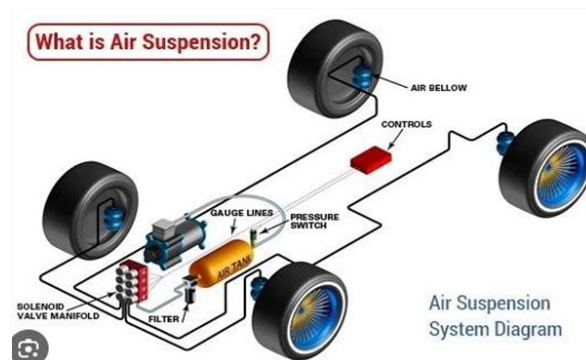


Fig3.36 AIR SUSPENSION SYSTEM

SUGGESTED ACTIVITY:

ACTIVITY

- Observe and identify components of a steering and suspension system in your area and draw their diagram
- To identify the different types of steering system used in automobile
- Visit nearest service center and identify the various components of suspension system.
- Analyze the various types of suspension system.

LEARNING ACTIVITY:

Sl.No	PERFORMANCE CRITERIA
01	Able to understand the steering system.
02	Able to explain importance of steering system
03	Able to identify steering gear.
04	Able to identify steering system
05	Able to identify suspension system

A. Fill in the blanks:

1. Steering system is used for _____.
2. Main parts of steering system are _____ and steering column.
3. A suspension system consists of springs _____ and linkages that connect a vehicle to its wheels.
4. A suspension system keeps vehicle occupants _____.

B. Multiple choice questions:

1. Leaf spring absorbs shocks by _____.
(a) Tension (b) Compression (c) Twisting (d) Bending
2. Compressed air is used for _____.
(a) Air suspension system (b) Hydraulic suspension
(c) Mechanical suspension (d) none of the above

C. Short answers questions:

1. What is the meaning of steering system?
2. What is a power steering system?
3. What are the functions of steering system?
4. Define suspension system and write the functions of suspension system.
5. List out the types of suspension system

SESSION9: WHEEL AND TYRE

UNIT OVERVIEW: Student will be able to understand about Wheel & Tyre and its components in automobile.

LEARNING OUTCOME:

1. Understand the meaning of wheels and its components.
2. Students can identify the various wheels, types of wheels.
3. Classify the tube and tube less tyres.



FIG.3.37: WHEEL

The wheel is an important component of a vehicle. Wheel of a four-wheeler vehicle is mounted on a hub and consists of parts like rim, tyre and tube. The wheels not only support the weight of the vehicle, but also protect it from road shocks. All the four wheels must resist the braking stresses and withstand side thrust. A wheel should be light and easily removable.

Rim :

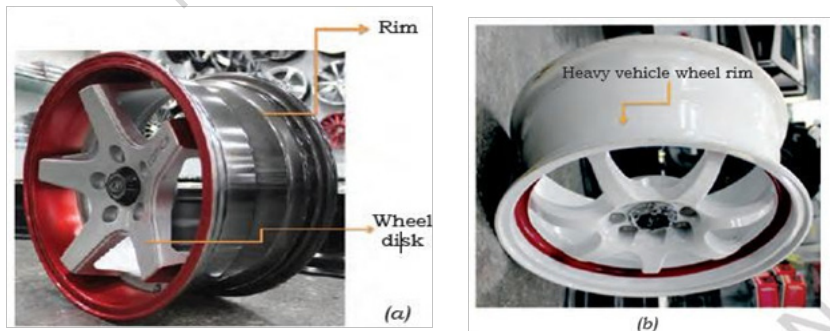


FIG.3.38RIM

The rim is the ‘outer edge of a wheel, holding the tyre’. It makes up the outer circular design of the wheel on which the inside edge of the tyre is mounted on vehicles,

Such as automobiles. For example, on a bicycle wheel the rim is a large hoop attached to the outer ends of the spokes of the wheel that holds them and the tube.

Different types of wheel rim:

1. Disc wheel Rim:

A wheel is generally composed of rim and disc. Rim is an outer part of the wheel and holds the tyre. Disc is a part of wheel which connects the rim and the axle hub.

2. Wire Spoke Wheel Rim (used in motorcycle, bicycle):

Wire spoke wheel rim is where the outside part of the wheel (rim) and axle installed part are connected by many numbers of wires called spokes.

3. Split Wheel Rim (used in scooter):

Split wheel rim is used in a multi-piece wheel. This wheel rim holds the tyre with a locking ring. A split wheel rim cannot be used normally in all types of vehicle.

4. Heavy Vehicle Wheel Rim (available in three piece and four pieces including locking ring):

Heavy vehicle wheel rim has a three and four-piece locking ring. This type of wheel rim is used in heavy vehicles wheel like truck, buses container, etc., because it has a longer life.

Tyre:

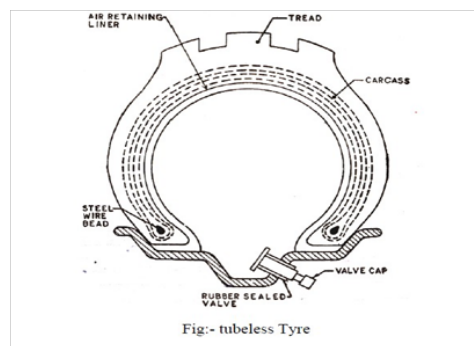
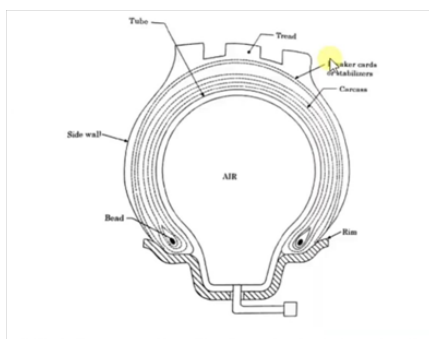


FIG.3.39: TUBE AND TUBELESS TYRE

The tyre is mounted on the wheel rim. It carries the vehicle load and provides a cushioning effect. It must produce minimum noise, while the wheel turns on the road. It resists the tendency for the vehicle to over steer. It should have good grip while accelerating and breaking the vehicle on both dry and wet roads.

Types of Tyre

1. Solid tyre:

It is used in children's cycle and is filled with solid material, like rubber, which makes it sturdy.

2. Tube tyre:

It consists of a tube between the rim and the tyre, in which air is filled. It is used in most of the vehicles seen on road.

3. Tube less tyre:

Nowadays, with the advancements in technology, tubeless tyres are replacing the tube tyres. Tubeless tyres are mainly used in modern cars. The benefits of tubeless tyres include slow leakage of air during punctures, better balancing of wheels, low cost and ease of puncture repairing.

SUGGESTED ACTIVITY:

ACTIVITY

- Identify the various types of wheels and rims and their components.
- Visit nearest service center or garage identify the various vehicle wheels dimensions.
- List the various wheels which made different materials like rubber, plastic or metal etc.
- Draw the diagram of wheels and tyres.

Learning activity:

<i>Sl.No</i>	<i>PERFORMANCECRITERIA</i>
01	Able to Understand the meaning of wheels and its components.
02	Student able to the various wheels, types of wheels.
03	Able to classify the tube and tube less tyres.
04	Able to draw the various wheels and tyres.

A. Fill in the blanks:

1. The rim is the 'outer edge of a/an _____
2. The tyre is mounted on the _____ . .

D. Multiple choice questions:

1. This type of tyre don't have tube, .
(a) Tube tyre (b) Tubeless tyre (c) both (d) non of the above
2. The scooters can used this type of rim, .
(a) Disc wheel Rim (b) Hydraulic wheel rim
(c) Spilt Wheel Rim (d) Wire spoke wheel rim

E. Short answers questions:

1. What is wheel?
2. List the various types of tyre.
3. Classify the various types of rims used in a vehicle.
4. Draw the diagram of tyre.

SESSION10: BRAKE SYSTEM

UNIT OVERVIEW: Student will be able to understand about Brake system and its components in automobile.

LEARNING OUTCOME:

1. Understand the brake system and importance of brakes in a vehicle.
2. Know about the functions of brakes in a vehicle.
3. Types of brakes

Brake:

Brakes are one of the most important control components of a vehicle. They are required to stop the vehicle within the smallest possible distance and this is done by converting the kinetic energy of the wheels into the heat energy which is dissipated into the atmosphere.



FIG.3.40 BRAKE

Requirements of a Good Braking System:

- a. To stop the vehicle in the shortest possible distance and time.
- b. To control the vehicle speed while moving on plain roads and hills.
- c. The brake should work equally well on fair and bad roads.
- d. To ensure that the pedal effort applied by the driver is not much, thereby reducing the inconvenience for the driver.
- e. To work efficiently in all weathers.
- f. It should have very few wearing parts.

-
- g. It should require little maintenance.
 - h. Brake, when applied should not disturb the steering geometry.
 - i. There should be minimum so und when brake is applied.

Types of Brakes:

1. with respect of application:
 - (a) Foot Brake: (b) Hand Brake:
2. With respect to the method of braking contact:
 - (a) Drum Brakes or Internal Expanding Brakes:
 - (b) Disc Brake or External Contracting Brakes:
3. with respect to the brake gear:
 - (a) Mechanical Brake:
 - (b) Power Brake
4. With respect to the nature of power employed:
 - (a) Hydraulic Brakes
 - (b) Anti-lock Braking System
 - (c) Electric Brake

SUGGESTED ACTIVITY:

ACTIVITY

- Observe and identify components of brakes and types of brakes in your area and Draw their diagram
- Differentiate between different types of brakes used in automobile.
- Visit nearest service center or garage and learn the servicing of brakes.(with help of teacher)

LEARNING OUTCOME:

Sl.No	PERFORMANCECRITERIA
01	Able to understand the braking system.
02	Able to explain importance of brakes system used in automobile
03	Able to identify the components of braking system.
04	Able to identify the various types of braking systems.

A. Fill in the blanks

1. Wheel is an important component of the..... .
2. Tyre is fitted on the..... .
3. Brake should work on roads.
4. Hand brake is also known as.....brake.

B. Answer the following questions::

1. What is the functions of brake in a vehicle?
2. What are the good requirements of braking system?
3. Write a short note on Drum brake and ABS.

@KTBS
NOT TO BE REPUBLISHED

SESSION11:

ELECTRICAL AND ELECTRONIC SYSTEM.

UNIT OVERVIEW: Student will be able to understand about Electrical & electronic system in automobile.

LEARNING OUTCOME

1. Students understand the about the various electrical and electronic components used in vehicle.
2. Identify the various electrical and electronic components.
3. Understand the functions of Electrical and electronic components.

Electrical or Electronic System:

Nowadays, all the automobiles run with the help of electrical and electronic system, and therefore, it plays an important part in the functioning of an automobile.

The electrical and electronic systems consist of the following:

- **Starting system:**

The starting motor is driven by means of the current taken from the battery.

- **Ignition system:**

The function of the ignition system is to produce a spark in the engine combustion chamber at the end of the compression stroke.

- **Generating or charging system:**

The function of the charging system in an automobile is to generate, regulate and supply the electrical energy for charging the battery

- **Lighting system:**

It consists of various types of lighting used during the vehicle running, such as head light, tail light, fog light, brake light, reversing light, left and right indicators, parking light, cabin light, panel board lights, etc.

- **Connections for other accessories**

Horn, Windscreen wiper, Fuel gauges, Phone charger, Fuel indicators etc.

(Note: In modern vehicles, various types of electronic sensors and actuators are fitted in different systems of the engines, which are also operated electrically.)

SUGGESTED ACTIVITY:

ACTIVITY

- Observe and identify components of electrical and electronic system in your area and
- Draw their diagram
- To identify components of electrical and electronic system used in automobile
- Differentiate between different types of electrical components used in automobile.
- Observe and identify connection of battery

LEARNING OUTCOME:

Sl.No	PERFORMANCE CRITERIA
01	Able to understand the about the various electrical and electronic components used in vehicle.
02	Able to Identify the various electrical and electronic components.
03	Able to understand the functions of electrical and electronic components.

A. Answer the following:

1. List the various electrical and electronic components used in automobile vehicles.
2. List the main functions of electrical and electronic components.

SESSION12: AIR CONDITIONING SYSTEM.

UNIT OVERVIEW: *Student will be able to understand about Air conditioning system and its components in automobile.*

LEARNING OUTCOME:

1. Understanding of AC system in a vehicle.
2. Identify the components of AC.
3. Able to explain importance of air-conditioning system

Air-Conditioning System:

During summer, an automobile requires considerable amount of refrigerating capacity to maintain cool and comfortable conditions in the sitting space. Similarly, when moving in a cold day in winter, the same vehicle would require considerable heating capacity to keep it comfortably warm for passengers.



FIG.3.43: AIR CONDITIONER IN A CAR

Modern day automobiles have an air conditioning unit to maintain suitably controlled temperature and humidity conditions inside the vehicle. An air conditioner is a refrigeration machine requiring electrical energy. In automobiles its air conditioner draws energy from the battery system. The battery of course is charged by energy of the engine. For heating purposes, the warm water from the engine cooling system is used. The heat required to warm the automobile is generally provided by circulating warm water through a heating coil

Different Components of Automobile Air Conditioning System:

- a. Compressor
- b. Magnetic clutch
- c. Condenser
- d. Receiver-drier(or dehydrator)
- e. Expansion valve
- f. Evaporator
- g. Throttling valve



FIG3.44: AIR CONDITIONING SYSTEM IN A CAR

A sensing device, called temperature tube signals the diaphragm in the expansion valve to change the size depending upon the refrigerant temperature at the evaporator outlet, thus achieving automatic temperature control.

Car air conditioner comes inbuilt in the car and same can be fitted in car also.

SUGGESTED ACTIVITY:

ACTIVITY

1. Observe and identify components of an air conditioning system in your area and draw their diagram.
2. To identify the components of air conditioning system

LEARNING OUTCOME:

Sl.No	PERFORMANCE CRITERIA
01	Able to understand the air-conditioning system
02	Able to explain importance of air-conditioning system

A. Fill in the blanks

1. is the main component of a refrigeration system.
2. Battery is used for.....vehicle.

-
3. Starting system consists of battery and starting..... .
 4. Warm temperature in the car is maintained by

B. Multiple choice questions

1. The starting motor is driven by means of the current taken from the
 - (a) Battery
 - (b) stabilizer
 - (c) Ignition coil
 - (d) None of above
2. The function of the ignition system is .
 - (a) To produce a spark in the engine combustion chamber
 - (b) To generate, regulate and supply the electrical energy
 - (c) To produce a current for charging
 - (d) None of the above
3. Air-conditioner losses energy from the .
 - (a) Battery system
 - (b) Condenser
 - (c) Engine
 - (d) None of these

C. Answer the following:

1. Discuss the importance of electrical and electronic system in automobiles.
2. What are the components of an air-conditioning system?
3. List the electrical accessories used in vehicle.

SESSION13:

ACTIVE AND PASSIVE SAFETY

UNIT OVERVIEW: Student will be able to understand about Active and Passive system and its components in automobile.

LEARNING OUTCOME:

1. Students understand meaning and importance of the active and passive components of a vehicle.
2. Understand the functions of active and passive components of a vehicle.

INTRODUCTION

There are different safety and security systems for automobiles available in the market and some of which are fitted by the manufacturer. Some of the active and passive security systems are mentioned as follows.

Safety Glass:

Safety glass is used in all windows and doors of automotive. The safety glass used in today's vehicles is of two types — laminated and tempered. These are considered as safety glass because of their varying strength.

Laminated plate glass:

It is used to make windshields. It consists of two thin sheets of glass with a thin layer of clear plastic between them. Some glass manufacturers increase the thickness of the plastic material for better strength. When this type of glass breaks, the plastic material tends to hold the shattered glass in place and thus, prevents it from causing injury.

Tempered glass:

It is used for side and rear window glass but rarely for windshields. It is a single piece of heat-treated glass and has more resistance to impact than the regular glass of the same thickness. Thus, it has greater strength compared to a laminated plate glass.

Seat belts:

A seat belt is also called a safety belt. It is a harness designed to protect the occupant of a vehicle from harmful movement, during a collision or when the vehicle stops suddenly. A seat belt reduces the likelihood and severity of injury in a traffic collision.



FIG.3.45:SEAT BELT

It prevents the vehicle occupant from hitting hard against the interior elements of the vehicle or other passengers, and keeps the occupants positioned in place for maximum benefit from the airbag.

The passenger must fasten the seat belt for crash protection. However, in case of a passive safety system, such as the inflation of air bags at the time of an accident, is automatic. No action is required of the occupant to make it functional. Nowadays, seat belts are also provided for rear seat occupants.

Airbags:



FIG.3.46:AIRBAGS

An airbag is one of the passive safety systems for the occupants of a four-wheeler. The electrical system of airbags includes impact sensors and an electronic control module. In case of an accident, the sensor detects the impact and the airbag opens up to save the driver and other occupants.

Security and Antitheft Devices:

There are three basic types of security devices available — locking devices, disabling devices and alarm systems.

In automobile vehicle, an anti-theft device is installed to prevent theft of a vehicle. Many car security devices are available in the market. These are mechanical devices and ignition cut off devices, intelligent computerized anti-theft devices, satellite tracking system, engine control module, etc. Vehicle owners may select as per risk and install it in their vehicles.

Prior to purchasing, the customers should check that these theft devices are duly approved from the Automobile Research Association of India (ARAI).

a) Alarm:

In the case of vehicle tampering, audible warning sounds emerge

b) Key-less Lock Device:

To use the vehicle, electronic coding device is required

c) Electronic Immobilizers:

These built-in transponders send signals to the ignition and fuel pump system. The vehicle remains in stationary or inoperable state if the ignition starters do not get correct signals.

d) Steering Wheel Lock:

This device is fitted in the steering of the vehicle and it locks it in one place so that no one can drive it without removing the lock.

e) Vehicle Tracking:

Even if a thief steals a vehicle, the tracking technologies can help trace it. Tracking devices offer real-time location of the stolen vehicle with the help of the global positioning system (GPS).

SUGGESTED ACTIVITY:

Activity:

1. Visit nearest service station and observe the active safety components in cars.
2. Discuss with teacher or elder about active and passive components.

LEARNING OUTCOME:

1. Students able to understand meaning and importance of the active and passive components of a vehicle.
2. able to understand the functions of active and passive components of a vehicle.

A. Fill in the blanks

1. Air bags are used for
2. Seat belt is also known as a belt.
3. Passive safety system helps.....
4. Active safety system is used for avoiding.....

B. Multiple choice questions

1. Which types of anti-theft devices are available in a vehicle?
(a) Locking devices (b)Disabling devices (c)Alarm systems
(d) All of the above
2. Tempered glass is used for
(a) Side and rear window glass(b)Auto window and door
(c)Head light (d)All of the above
3. Which of these safety systems are operated automatically?
(a) Passive safety system (b)Active safety system
(c) Energy-absorber safety (d)None of the above
4. Impact sensors are used in
(a) Electrical system (b)Mechanical system
(c)Auto-mechanical system (d)None of the above

C. Answer the following questions:

1. Discuss the components of the active and passive safety system.
2. Write importance of safety glasses in a vehicle.
3. Write a short note on Airbag and Seat belt.
4. List the modern security devices used in an automobile.

UNIT INFORMATION

Unit name: Road safety

Unit code: Auto L1 U4-NQ2024.

Unit descriptor : This unit provides the introductory knowledge & skills covering road safety to be followed in the road and while driving the vehicle. This covers components of road safety such as Importance of safety rules, road signs, traffic signals and rules, driving rules, registration and licensing are covered here with.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs,
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours:25 hours.

Name of the sessions

Sl.No	ROAD SAFETY	Duration (In Hours)
1	Importance of Road Safety	5
2	Safe and Responsible Driving	5
3	Road Signs	6
4	Driving rules and Registration	5
5	Driving License	4
	Total Duration in Hours	25

Elements and Performance Criteria

Element	Performance Criteria
• Importance of safety rules and safe practices	• Able to list safety rules to be followed
• Safe and responsible driving	• Able to use safe practices while driving
• Road Signs and Traffic signals	• Able to list safe and responsible driving
	• Able to identify various road signs traffic signals and describe rules
	• Able to make sketch of various road sign, traffic signals and describe rules

UNIT-4

ROAD SAFETY



INTRODUCTION

All of you must have seen some road accident in which people lose their life. India has a very high number of accidents on the road. In recent years there is some improvement in this area. However, with rapid increase of vehicles on the road the traffic conditions are under a lot of pressure.



FIG.4.1ROAD SAFETY

Therefore, road safety is one of the nation's most serious public health issues. It has an impact on everyone, whether you drive, walk or cycle. We should take care of ourselves and respect others on the road.

What is Road Safety?

Road safety refers to methods be adopted by everyone while using roads. These safety methods are meant for reducing the risk of accidents and injuries or causalities on the road.

These rules must be followed by all users of roads including pedestrians, cyclists, and motorists, bus & truck drivers. Safety methods also relate to the construction, layout of roads as well as traffic regulation systems.

So, we can summarize that road safety involves various aspects including.

- The design of roads and highways,
- Laws pertaining to traffic and vehicles,
- Systems of traffic safety and control,
- Driver education,

-
- School student's education about road safety
 - Mass education about road safety
 - Traffic and road safety signs,
 - Vehicle design,
 - Motor vehicle safety inspection and maintenance.

Actually, it is not difficult to keep our roads safe. Imagine that everyone follows simple safety measures and traffic rules. In that situation there will not be any accidents. In this Unit, you will develop an understanding of the various types of road safety measures to be adopted. You may understand Importance of safety rules, road signs, traffic signals and rules, driving rules, registration and licensing adopted in our country.



SESSION 1:

IMPORTANCE OF ROAD SAFETY

Session-1 Overview: Student will be able to understand the Important of Road safety.

LEARNING OUTCOME:

1. Importance of safety rules,
2. Causes for Road accident
3. Hurdles in Road Safety
4. Road safety tips
5. Few important Road Safety Tips

Road Safety Many studies have shown following major causes of road accidents are as follows;

- Lack of Highway safety
- Driving in drunken condition.
- Driving in sleepy condition
- Using cell phone while driving
- Over speeding/rash driving
- Driving in wrong lanes
- Turning without giving signal
- Over taking from wrong side

It can be seen that Road Safety is a collective responsibility. Therefore, each one of us has to take steps required of us.

Government and Public Sector:

- To develop stricter road safety polices
- Generate/ Create funds for road safety awareness
- Stricter enforcement by government
- Building of better roads and highways.

Role of General Community:

- Acceptance of Road Safety Rules.
- Regulations and Policies.
- Participation in Road Safety Awareness.
- Drives to enhance their knowledge on Road Safety.

Education Sector:

- Inclusion of Road Safety modules in school curriculum
- Impart Road Safety education with the help of experts in this area.
- Impart effective Driver Training for learners as well as existing drivers.

Role of Media:

- Communicate road safety messages through print and electronic media.
- Support Road Safety initiatives through responsible and objective reporting.
- Role of Health Professionals
- Strengthen Trauma facilities in our country
- Organize workshops for saving the lives of people in road accidents.
- Improvement in Infrastructure.
- Adopt effective and safe traffic management measures while planning designing of infrastructure. For e.g. Proper road design, design of over bridges, road signage's etc.

Hurdles in road Safety:

- Negligence of Civilians.
- Pathetic Condition of roads.
- Unsafe Vehicle Design.
- Under implementation of Road Safety Standards.
- Lack of Emergency Services.

Road Safety Tips:

Road safety is a result of contributing efforts from all the sectors of the society including both civilians and Govt. officials. In addition to the human sufferings,

the estimated costs of the road injuries are a noticeable amount in GNP per annum. So, some tips can be fruitful in this direction.

Few important Road Safety Tips are mentioned below:

- Don't use your mobile phone while driving,
- Use belt in the back seat also.
- Don't drink and drive.
- Tak especial care about children, senior citizens and pedestrians.
- Don't drive if tired.
- Pedestrians should walk cautiously and always cross the road through Zebra crossing.
- Always observe and anticipate actions by other road users.
- Keep your distances and always wear helmets and seat belts.

Safety Devices:



FIG.4.2ROADSAFETY DEVICES

Two-Wheeler Helmet:

A two-wheeler helmet is a type of protective headgear used by motorcycle and scooter riders. The primary goal of a two-wheeler helmet is rider's safety - to protect the rider's head during impact, thus preventing or reducing head injury or saving the rider's life. Some helmets provide additional conveniences, such as ventilation, face shields, ear protection etc. Out of all the organs in our body, the heart and the brain are the most vital ones. When a two-wheeler is involved in an

accident, it is the brain that might be at a greater risk of injury. And only the brain is the one that might be affected the most. A brain injury can result due to skull fracture, a concussion, brain hemorrhage, which can result in death.

Even if a part of the brain has been damaged, it might result in the loss of speech or motor skills. In order to protect the brain, one must wear a helmet. A motorcycle helmet protects the skull and the brain from extensive damage.

SUGGESTED ACTIVITY:

ACTIVITY

1. List and adopt various road safeties.
2. Reasons for road accident
3. Make a team and create some poster regarding reasons for accidents and solution for it.
3. Creates various groups in your class and Campaign road safety awareness camp in your school.
4. Trainer bring students to road (with all safety measures) observe and note, what are the reasons for accidents can we identify in the road and solutions for that reasons.

LEARNING OUTCOME:

SL. No	Expected Outcome for students
01	Able to list safety rules to be followed.
02	Able to use safe practices while driving.
03	Safe and responsible driving

A. Fill in the blanks:

1. Accident take places in our daily life due to lack of.....measure.
2. Road safety is emerging as a major.....in the country.
3. Important rules of road safety cannot be.....
4. Road safety is one of the nation's most serious.....issues.
5. Donot use your mobile phone while.....

B. Multiple choice questions:

1. Which safety device should be used while driving a two-wheeler?
(a) Helmet (b) Seatbelt
(c) Airbags (d) None of the above

2. Pedestrians should always cross the road using crossing.

- (a) Zebra (b) Side road (c) Main road (d) Footpath

C. Answer the following questions.

1. What is the meaning of road safety?
2. What is importance of road safety?
3. List the main the road safety tips we should need to follow?
4. Road safety is should taken by us while driving .Why?

D. Assignment:

1. List the Road safety rules followed in road.
2. What are the safety devices used while driving a four –wheeler?
3. List the hurdles in road safety.
4. Seat belt saves your life.How?

SESSION2:

SAFE AND RESPONSIBLE DRIVING

Session-1 Overview: Student will be able to understand the Safe and Responsible Driving.

LEARNING OUTCOME:

The students to know and understand the,

1. Physical and mental alertness
2. Know your vehicle
3. Cars with air bags.
4. Know your blind spots
5. Lighting systems

INTRODUCTION

This unit provides the knowledge & skills covering invention of safe and responsible driving.

Safe and Responsible Driving Getting ready to drive. Before driving

- Ensure that you are comfortable with your mental and physical condition.
- Inspect your vehicle and observe the driving conditions.

While driving you should carry your driving license, registration certificate, insurance certificate and pollution control certificate. Transport and commercial vehicle drivers should carry the permits and vehicle fitness certificates also.

A combination of knowledge, Attitude and Skill is required to be a safe driver.

- Knowledge of traffic rules and driving practices that help traffic move safely.
- Attitude to co-operate with other drivers to keep traffic moving safely. We must be courteous, giving other drivers space to change lanes, not cutting them off and signaling before turning.
- Skill to care about the safety of others on the road. We all are responsible for avoiding accidents.

Physical and mental alertness:



Be in good physical and mental condition before driving.

Don't Drive if you,

- have been drinking alcohol.
- taking any medicine or drug that affects your responses.
- are tired as tiredness affects your driving skills and reaction time.
- are sick or injured.
- are angry or upset.

You could be risking your life or lives of others on the road.

Know your vehicle before riding:

- Go through the vehicle owner's manual.
- You should know the features of the vehicle you are going to drive.
- Example-Anti-lockbrakes,4-wheeldrive.
- Check that all emergency signals and in strumpets work.



FIG.4.4SEATBELT SAFETY

You should be able to turn on wipers, washers, headlights, indicators etc. without having to look at them and without taking your eyes off the road. Seating position Proper, upright position gives more stability while driving. Make sure you can see over the steering wheel and hood. You should be able to see the ground 4- 5 feet in front of the vehicle for proper judgment. Sit straight upright in the seat with your elbows slightly bent.

Adjust the seat so your feet reach the pedals easily. Place your feet flat on the floor under the brake pedal. You are seated properly if you can do this. Adjust the head-rest to proper height. It protects in case of a collision.

Cars with air bags:

Airbag can cause injuries if the seating position is in correct.

Know your blind spots:

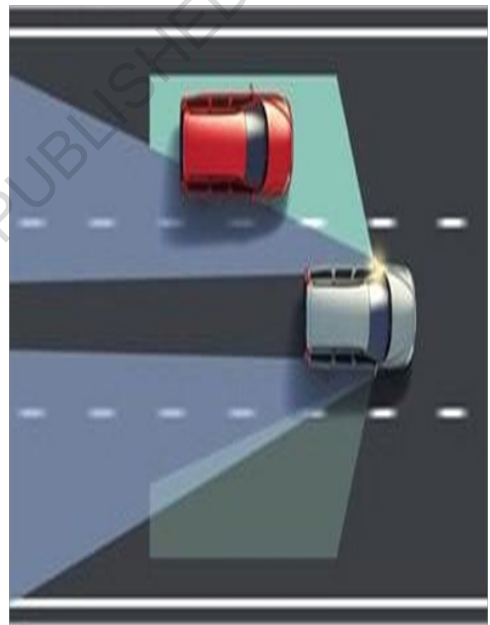
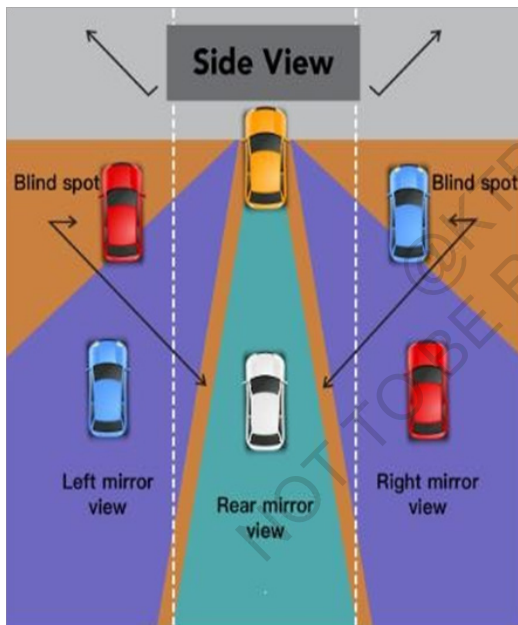


FIG.4.3.BLIND SPOTS

Blind spot is an area on each side of the vehicle that you cannot see through the mirrors.

Mostly blind spots are to the back left and back right of the vehicle. In the above graphic, there car is in the blind spot area of the silver car. The green areas in the above graphic show the blind spots of the silver car.

Adjustment of Exterior and Interior mirrors:

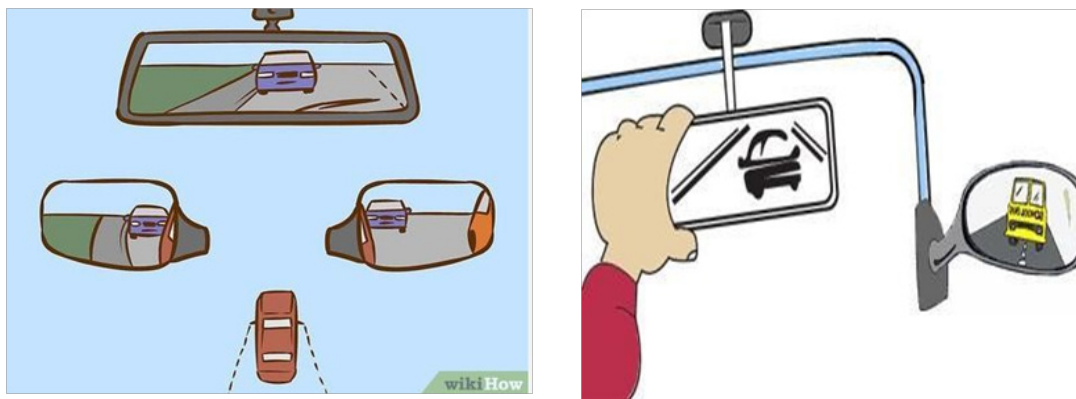


FIG.4.4 EXTERIOR AND INTERIOR MIRRORS:

Adjust the mirrors to get the maximum view and identify your blind spots. You may not see vehicles when they are in these spots. Position the interior mirrors so that the center of the mirror shows the center of the rear window. When the interior mirror is properly adjusted you would be able to see directly behind your vehicle.

The exterior (wing) mirror adjustment should be made while seated normally for driving. Do not set the right-hand exterior mirror by placing your head against the glass of the driver's door window. Do not adjust the left-hand exterior mirror by leaning to the center of the vehicle. Side mirrors show only narrow angles of view, so you have to turn your head to make sure there is nothing in your blind spots.

Fasten your seat belt:

Fasten your seat belt before you start. Seat belts are for your safety not just for avoiding challans. Seat belts should be worn comfortable enough to keep you in your seat if there is a collision. Put the shoulder strap over your shoulder, never under your arm. The lap belt should be put low over the hips, not over the stomach.



FIG4.5.FASTENING OF SEAT BELT

SEATBELT SAVES LIFE:

- Seat belt keeps you behind the wheel and in control of the vehicle in case of a collision.
- Seat belt keeps your head and body from hitting the inside of the vehicle.
- Seat belt keeps you inside the vehicle in a collision. A person who is thrown out of the vehicle during the collision has a higher chance of getting serious injury.

Turn on headlights at night and in poor light conditions:

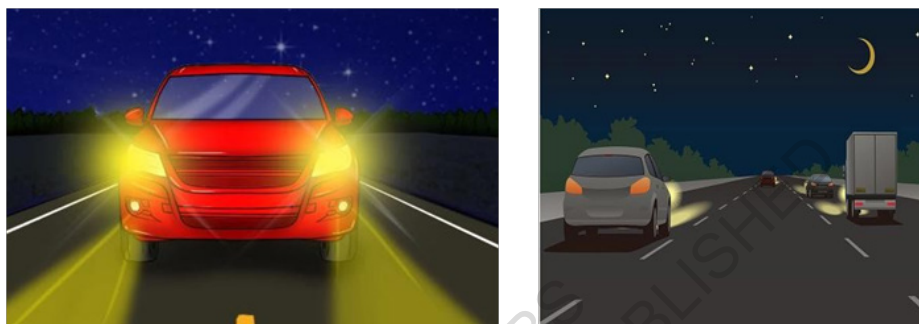


FIG4.6. LIGHTS DURING NIGHT

Turn on headlights around 30 minutes before sunset and keep them on until 30 minutes after sunrise. Turn on your lights when fog or rain reduces your visibility to less than 100 meters. Keep your headlights clean and get them adjusted regularly so that they aim properly. In dim light, use your headlights, not parking lights. Parking lights are only for parking.

High beams are banned in cities like Delhi, Chandigarh and other cities. You should not use high beams on roads. If you are travelling on a highway and using high beam headlights, switch to low beams within 150 meters of an oncoming vehicle. Switch to your low beams when you are less than 60 meters behind another vehicle.

Suggested Activity:

ACTIVITY

- Give demo about physical and mental alertness
- Give a demo about vehicle number and various details of a vehicle
- Give demo about air bags
- Visit any nearest road with safety measures know about blind spot and safety measure

Learning outcome:

SL. No	Expected Outcome for students
01	Able to state safety procedure while driving
02	Able to distinguish between various safety measure
03	Able to know Physical and mental alertness
04	Able to Know your vehicle
05	Able to working of Cars with air bags.
06	Able Know your blind spots
07	Able to know importance of Lighting systems

A. Fill in the blanks:

1. Before driving you should have important.....with you.
2. Mental status before driving should be
3. Mirror is adjusted to see view.
4. Avoid and while driving.
5. Proper, upright position gives more.....while driving.
6. You should know the of the vehicle you are going to drive

B. Multiple choice questions.

1. Mirror is adjusted to see the view.
(a)Maximum (b)Minimum
(c)Equal view (d)None of the above
2. Which areas on each side of the vehicle are not visible through the mirrors?
(a)Front spot (b)Blind spot
(c)Danger area (d)None of the above

C. Answer the following questions:

1. List out any three Safe practices followed in car.
2. Mention the importance of seat belt.
3. What is the meaning of Blind spot while driving car?
4. List out the know your vehicle rule followed in driving.
5. Mention the any four major causes for road accident.
6. What are the Safety precautions have been taken while driving two or four-wheeler?

SESSION 3:

ROAD SIGNS:

Session-1 Overview: Student will be able to understand the important of Road Signs.

LEARNING OUTCOME:

1. Identify and understand the road signs, hand signals, traffic signals.
2. Read the Typical Cautionary Sign, parking Signs, prohibitory Signs
7. Compulsory Direction Control and Other Signs

INTRODUCTION

This unit provides the knowledge & skills covering on Signal plays important role during smooth movement of traffic. Road signals are to be followed systematically; otherwise it may lead to an accident.

Arm signals:

Arm signals are used when direction indicator signals are not used, or when necessary to reinforce direction indicator signals and stop lights.

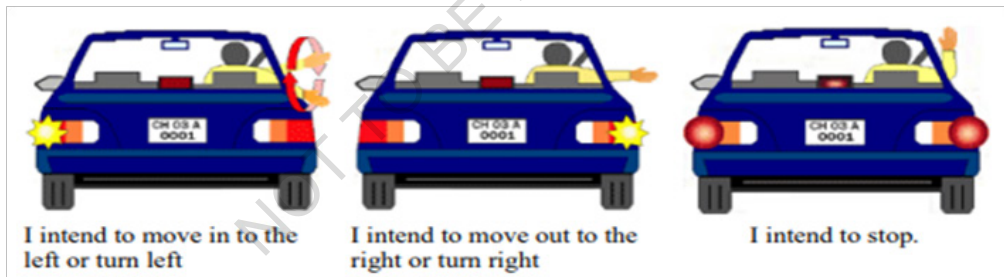
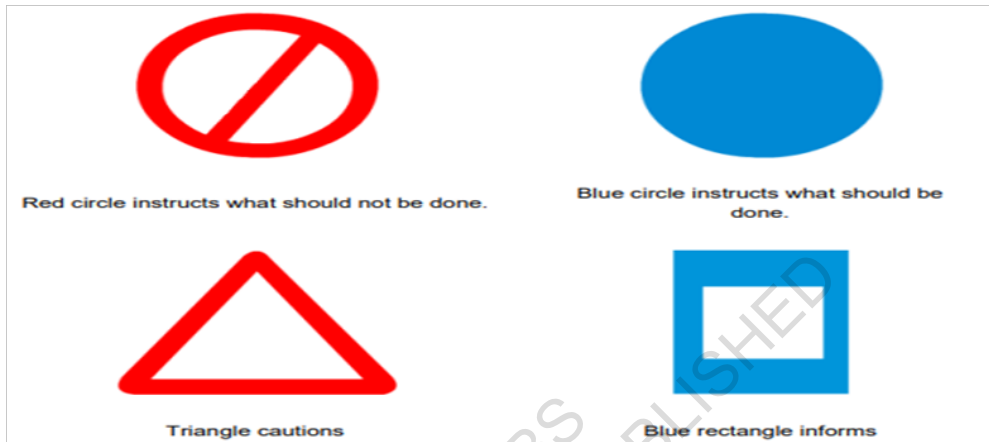


FIG.4.6 ARMSIGNALS

TRAFFICSIGNS:

Traffic signs are divided into 3 main categories

1. Mandatory/Regulatory signs.
2. Cautionary signs.
3. Information signs.



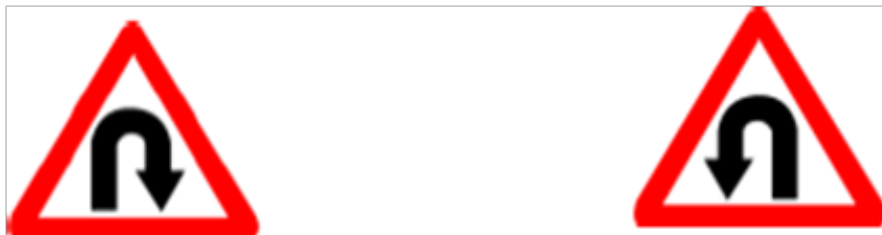
Typical Cautionary Signs:

Right/Left Hand Curve:



This sign is used where the direction of alignment changes. The sign for warns the driver to reduce the speed and proceed cautiously along the road.

Right/Left Hair Pin Bend:



This sign is used where the change in direction is so considerable that it amounts to reversal of direction. The symbol bends to right or left depending up on the road alignment

Right/Left Reverse Bend:



This sign is used where the nature of the reverse bend is not obvious to approaching traffic and constitutes a hazard. If the first curve is to the right, a right reverse bend shall be used. If the first curve is to the left, a left reverse bend is used.

Narrow bridge and Gap in Median:



Narrow bridge sign is erected on roads in advance of bridges where the clear width between the kerbs or wheel guards is less than normal width of carriageway

Gap in Median is installed head of a gap in the median of a divided carriage way, other than an intersection.

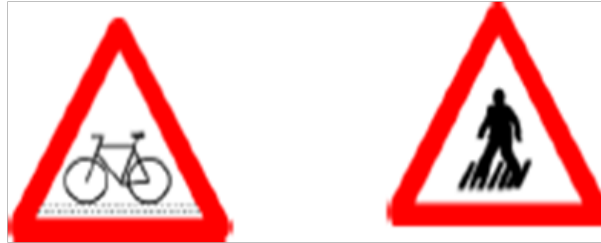
Narrow road and Road Widen:



Narrow road sign is normally found in rural areas where a sudden reduction in width of pavement causes a danger to traffic.

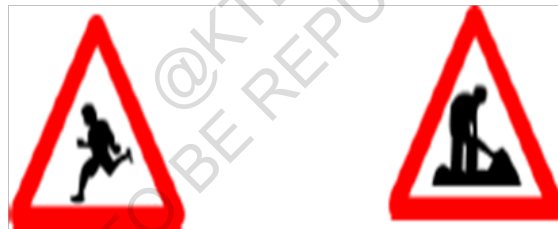
Road Widens sign is normally found in rural areas where a sudden widening of road causes a danger to traffic, such as, a two-lane road suddenly widening to a dual carriageway.

Cycle Crossing and Pedestrians Crossing:



Cycle Crossing sign is erected in advance of all uncontrolled cycle crossings. Pedestrians Crossing sign is erected in advance of both approaches to uncontrolled pedestrian crossings.

School and Men at work:



School sign is erected where school buildings or grounds are adjacent to the road where the traffic creates a hazard to children.

Men at work sign is displayed only when men and machines are working on the road or adjacent to it or on overhead lines or poles. This sign is removed when the work is completed.

Side Road Left /Right:



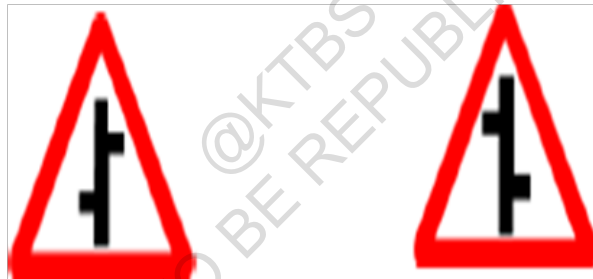
Side Road Left/Right sign is displayed in advance of the side road intersections where a large volume of entering traffic, together with restricted sight distance, is likely to constitute a hazard. The driver is warned of the existence of a junction.

Major Road:



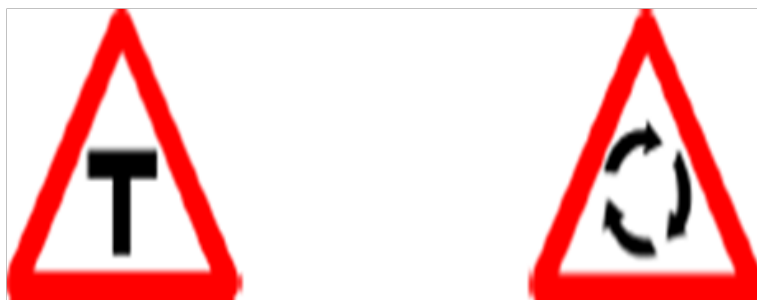
These signs are displayed in advance of crossing with the major road, where a sufficiently large volume of traffic together with restricted sight is likely to cause a hazard.

Staggered Intersection:



This sign is used to indicate junctions where the distance between two junctions is not more than 60 meters.

T-Intersection and Round about:



T- Intersection sign is displayed in advance of T-junctions where the nature of inter-section is not obvious to approaching traffic. This sign is used to warn the

driver of the existence of a junction. Round about sign is used where it is necessary to indicate the approach to a roundabout.

Start of dual and End of dual carriage way:



Start of dual carriage way sign is displayed when a single carriage way ends into a dual carriage way.

End of dual carriageway sign is displayed when a dual carriageway is ending and a single carriageway is starting.

Two-way Operation and Crossroad:

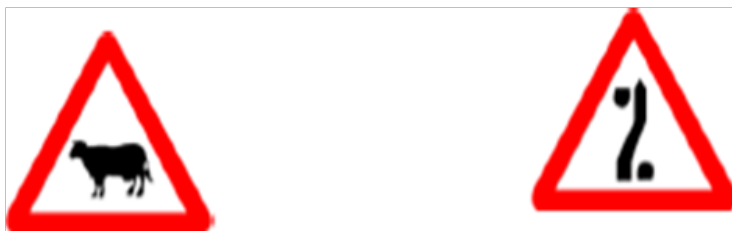


Two-way Operation sign is used to caution the driver of a changed pattern of traffic operation of the carriageway expected to carry traffic in one direction only.

Cross road sign is displayed in advance of the cross road where a sufficiently large volume of crossing or entering traffic with restricted sight distance is likely to constitute a hazard.

Typical Cautionary Sign:

Cattle and Traffic diversion on dual carriageway:



Cattle sign is used where there is danger due to farm animals or cattle crossing on the road.

Traffic diversion on dual carriageway sign warns the driver of the diversion of traffic from one carriageway to the other. It is used on dual carriageway when one carriageway is closed.

Falling rocks and Ferry:



Falling rocks sign is used wherever rocks are liable to fall on the road sea or throughout the year. The symbol may be reversed to show the side from which rock fall is expected.

Ferry sign is used to warn the drivers about the existence of a ferry crossing across a river.

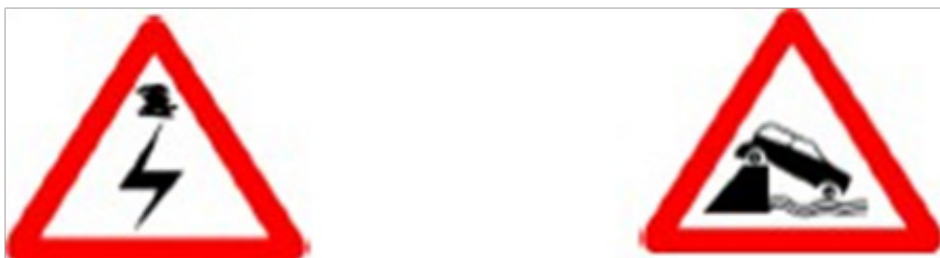
Barrier and Loose gravel:



Barrier sign is erected in advance of a gate controlling entry into a road. A definition plate with words "SLOW BARRIER AHEAD" or "TOLL BARRIER AHEAD" is also displayed on the sign.

Loose Gravel sign is used on section of a road on which gravel may be thrown up by fast moving vehicles.

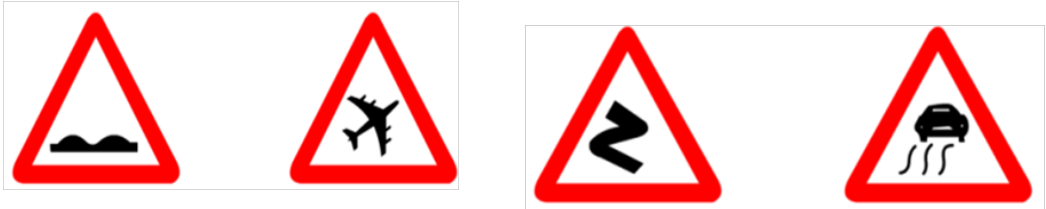
Overhead Cable and River bank or Quariside:



Overhead Cable sign cautions driver of the presence of overhead power transmission lines.

River bank or Quari side sign is used to caution the driver of the presence of water by the side of the road and the impending danger.

Rough Road, Runway, Series of Bends and Slippery Roads:



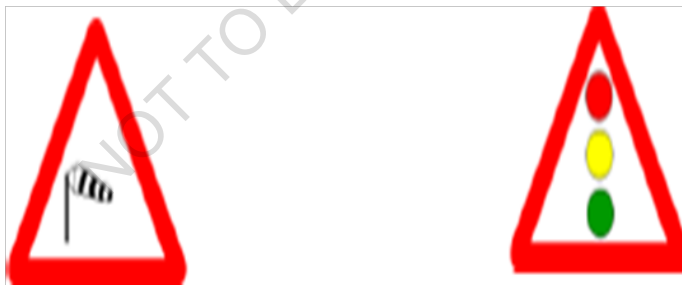
Rough Road sign is posted where the road is rough and the drivers are required to slow down their vehicles for safe travel.

Runway sign is used to warn the drivers of the presence of runway ahead and possible movement of the aircrafts.

Series of Bends sign is used to install to caution the driver of the presence of zig-zag for a long distance over the section of road ahead.

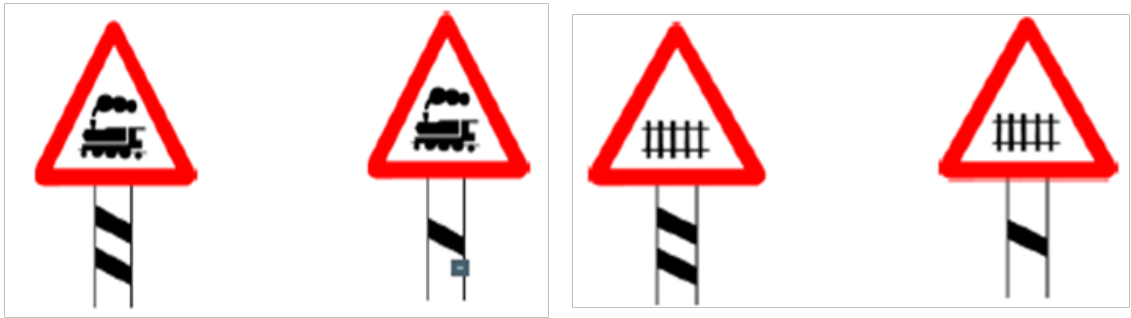
Slippery Roads sign is used to warn that the section of the road ahead may be particularly slippery.

Sudden side wind and Traffic Signal:



Sudden side wind sign is used to caution the driver of the danger of side winds which endangers the lives of travelers. This sign is posted at places where such weather conditions exist.

Traffic Signal sign is used to caution the drivers of the presence of traffic signals.

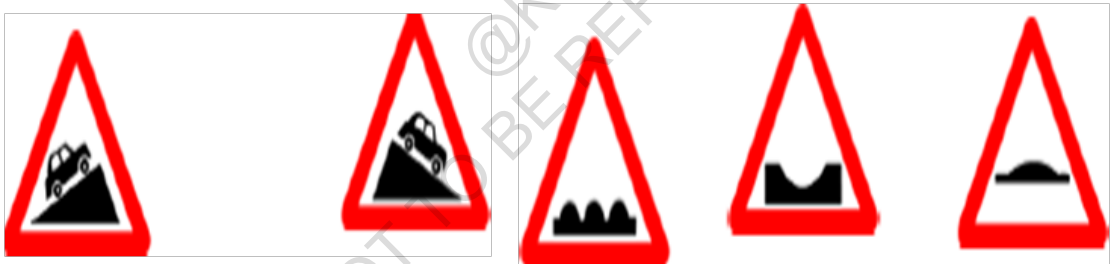


Unguarded Railway Crossing and Guarded Railway Crossing:

First two signs are used on the approaches of level crossings where there are no gates or other barriers. An advance warning sign (with two bars) is installed at a distance of 200 meters and second sign (with one bar) is installed near the crossing.

Other signs are used to warn traffic on the approaches to guarded railway crossing. An advance warning sign (with two bars) is installed at a distance of 200 meters and second sign (with one bar) is installed near the crossing.

Steep Ascent/ Descent, Rumble Strip, Dangerous dip and Speed Breaker:



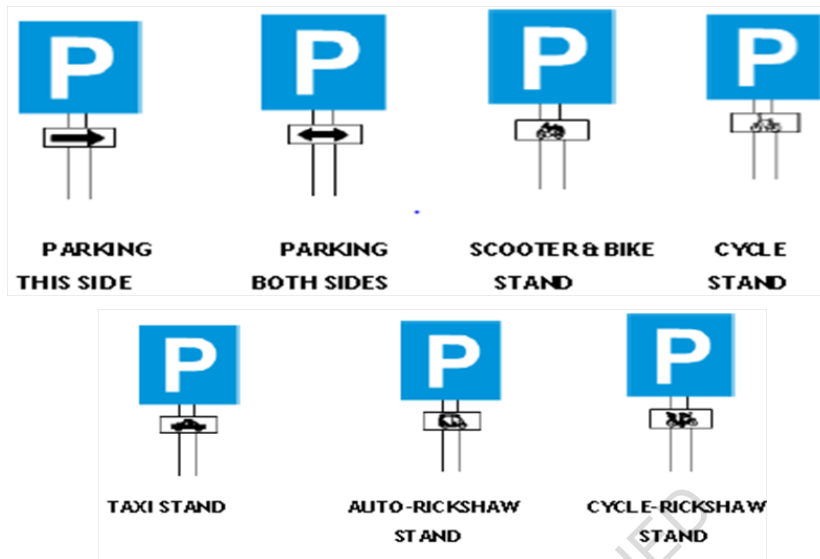
Steep Ascent / Descent signs are displayed before a steep upgrade/downgrade that may constitute a hazard to traffic. A gradient of 10 per cent and above is considered steep gradient.

Rumble Strip sign is installed in advance of the rumble strips provided on the road to control the speed of the vehicle.

Dangerous dip sign is used where a sharp dip in the profile of the road or a cause way is likely to cause considerable discomfort to traffic.

Speed Breaker sign warns the drivers of the presence of a speed breaker.

PARKINGSIGNS:



SPEEDLIMITANDVEHICLECONTROLSIGNS:

Speed Limit:



Speed limit sign is erected at the beginning of the section of the road or area covered by a speed restriction, with numerals indicating the speed limit in kilometers per hour.

Width limit and Height limit:



Width limit sign is used where entry of vehicles exceeding a particular width is prohibited.



Height limit sign is erected in advance of an overhead structure where entry is prohibited for vehicles whose height exceeds a certain limit.

Length Limit and Load Limit:

Length Limit sign is used where entry of vehicles exceeding a particular length is prohibited



Load Limit sign is used where entry of vehicles is prohibited for vehicles whose laden weight exceeds a certain limit

Axle load limit sign is used where entry of vehicles is prohibited for vehicles whose gross load exceeds a certain limit.

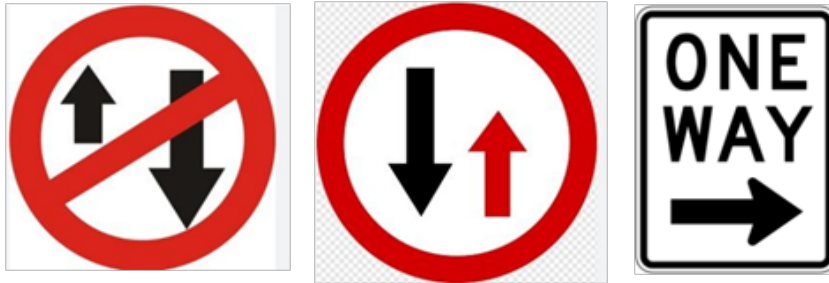


Straight Prohibited OR NO-ENTRY:



These signs are located at places where the vehicles are not allowed to enter. It is generally erected at the end of one-way- road to prohibit traffic entering the roadway in herring direction and also at each intersection along the one-way road.

One Way Sign:



These signs are located at the entry to the one-way street and repeated at intermediate intersections on that street.

Vehicles prohibited in both directions and Horn prohibited:



Vehicles prohibited in both directions sign is used at the approach end of the roads where entry to all types of vehicular traffic is prohibited, especially in areas which have been designed as pedestrian malls

Horn prohibited sign is used on stretches of the road where sounding of horn is not allowed, near hospitals and in silence zones.



RIGHT/LEFT TURN PROHIBITED: these signs are used at places where vehicles are not allowed to make a turn to the right or left. The signs are also used at the inter-sections of one-way street to supplement the one-way sign.

U-Turn Prohibited and Overtaking Prohibited:



U-Turn Prohibited sign is used at places where vehicles are forbidden to make a turn to the reverse direction of travel between the sign and the next inter-section beyond it.

Overtaking Prohibited sign is erected at the beginning of such sections of highways where sight distance is restricted and overtaking will be dangerous.

STOP, GIVE WAY SIGNS and RESTRICION ENDS SIGN:



‘STOP’ sign is used on roadways where traffic is required to stop before entering a major road. The vehicle shall proceed past the stop line only after ascertaining that this will not cause any damage to traffic on the main road.

GIVE WAY’ sign is used to assign right-of-way to traffic on certain roadways and intersections, the intention being that the vehicles controlled by the sign must give way to the other traffic having the right-of-way.

‘RESTRICION ENDS’ sign indicates the point at which all prohibitions notified by prohibitory signs for moving of vehicles cease to apply.



COMPULSORY DIRECTION CONTROL AND OTHER SIGNS:



COMPULSORY TURN LEFT/RIGHT: These signs indicate the appropriate direction in which the vehicles are permitted to proceed.



COMPULSORY AHEAD OR TURN LEFT/RIGHT: These signs indicate the appropriate directions in which the vehicles are permitted to proceed. Vehicles are supposed to move either of the given two directions.



COMPULSORY AHEAD: This sign indicates that the vehicle is only permitted to proceed ahead.

COMPULSORY KEEP LEFT: This sign is most frequently used on bollards or islands and refuges in the middle of the carriageway and at the beginning of central reserves of dual carriageway. The vehicles are obliged to keep left only.



COMPULSORY CYCLE RICKSHAW TRACK: This sign means only cycles and rickshaws are allowed on this road/carriageway.

COMPULSORY SOUND HORN: This sign means the motor vehicles shall compulsorily sound horn at the location where the sign is placed. This sign is mostly put at sharp curves on hill roads.



SLIP ROAD AHEAD: This sign means the vehicles can either go straight or turn left.

MAIN ROAD AHEAD: This sign means the vehicles can either go straight or turn right.



PEDESTRIANS ONLY: This sign means only pedestrians are allowed and the traffic is not allowed on this road / carriageway.

BUSES ONLY: This sign means that only buses are allowed and other traffic is not allowed on this road/carriageway.

SUGGESTED ACTIVITY:

ACTIVITY

- Road Signs and Traffic signals
- Able to identify various road signs traffic signals and describe rules
- Able to make sketch of various road sign, traffic signals and describe rules
- Able to state safety procedure while driving.
- Visit any nearest road and observe the road sign and draw it and discuss in a class.

A. Multiple choice questions.

1. Given Sign in forms that

- a) Vehicle is prohibited in both directions
- b) Vehicle prohibited in one direction
- c) Vehicle prohibited in right direction
- d) None of the above



2. Given Signal informs that

- (a) Speed limit
- (b) Crossing
- (c) Distance
- (d) None of the above



3. Sign shows.

- (a) Guarded rail way crossing
- (b) Unguarded railway crossing
- (c) Road crossing
- (d) None of the above



4. Given Sign informs about.

- (a) Danger due to animal
- (b) Danger due to light
- (c) Danger due to forest
- (d) None of the above



5. Right- or left-hand curve sign is used where the direction of alignment is

- (a) Does not change
- (b) is straight
- (c) Changes
- (d) None of the above

-
6. Red circle instructs
- (a) What should not be done (b) What should be done
- (c) What should be seen (d) None of the above
7. In traffic signal 'Green light' indicates.....
- a) Stop b) Move right c) Move left d) Go
8. Identify the sign of 'height limit' of a vehicle.



C. Answer the following.

1. Draw a "No-entry" sign.
2. List the different road signs.
3. Importance of Signal role in road safety.
4. Draw various signs of traffic .

SESSION 4:

DRIVING RULES AND REGULATIONS:

Session-1 Overview: Student will be able to understand the driving rules and registration.

LEARNING OUTCOME:

1. Students to understand the driving rules and registration.

INTRODUCTION

This unit provides the knowledge & skills covering driving rules and registration

The basic idea to devise driving rules is to make the traffic more organized and safer. Driving rules are very important; Government has made driving rules for the citizen. These rules are to be followed by every citizen. If you've late then you have to

pay the fine or you have to appear in front of court. Rule and their rule number with penalty is explained here. The driving rules and their number with penalty is explained next (these rules change from time to time).

- Motor Vehicle Acts and Rules MVA-MotorVehicle Act- 1988
- CMVR- Central MotorVehicle Rules- 1989
- DMVR-DelhiMotorVehicleRules-1993
- DelhiMotorVehicleRules,1993

Driving rules:

Table1:Traffic Offence and Penal Sections:(It changes according to new rule find with your teacher)

Sl.No.	Rules description	Rule No	Fine
1	Violation of mandatory signs	199/177/MVA	Rs100
2	Improper Parking	122/177/MVA	Rs100
3	Without Helmet	129/177/MVA	Rs100
4	Not using seat belt	138.3/CMVR/177	Rs100

5	Using un-registered vehicle/ Violation of R.C. Condition	39/192/MVA	Rs2000
6	Number plate not as per guidelines	50/177/CMVR	Rs100
7	Without Light/Head/Tail light	105 CMVR/177/ MVA	Rs2000
8	Without Helmet pillion rider	129/177/MVA	Rs 100
9	Triple riding	128/177/MVA	Rs 100
10	Carrying passenger in goods Vehicles	84.2/OMVR 177/ MVA	Rs 100
11	Conductor without uniform	23 DMVR 177 MVA	Rs 100
12	Driver without uniform	7DMVR 177/MVA	Rs 100
13	Driver without permit/Violation of permit conditions	66.1/192A/MVA	To Court
14	Without Registration Certificate	32/RRR/ 177/MVA	Rs 100
15	Wrong overtaking	184/MVA	Rs1000
16	Violation of speed limit	112.1/183/MVA	Rs400
17	Use of Tinted Glass	100.2CMVR/ 177MVA	Rs100
18	Violation of stop line	177/MVA 185/ MVA	Rs100
19	Drinking Driving	177/MVA	To Court
20	Violation of no entry restrictions	115/194/MVA	Rs100

Registration:

Whenever a vehicle is purchased then it is registered with State Transport office. All the district has Road Transport Office (RTO). RTO gives a registration number to all road vehicles. Every vehicle is fixed with a registration plate which is commonly known as number plates. These number plates are placed in the front and back of the vehicle.

Registration Rules and Process:

Necessity for Registration:

No person shall drive any Motor Vehicle and no owner of Motor Vehicle shall cause or permit the vehicle to be driven in any public place or any other place, unless the vehicle is registered in accordance with Chapter 4 of IMV Act 1988.

Registration where to be made?

Every owner of Motor Vehicle shall cause the Vehicle to be Registered by a Registration Authority in whose Jurisdiction he has residence or place of business where the vehicle is normally kept.

Temporary Registration:

An application for Temporary Registration shall be made in Form

20 of the Central Motor Vehicle Rules, 1989 prescribed for Registration, under the Act marked "Temporary" to the Registering Authority or to the dealer dealing in the sale of New Motor Vehicles Recognized by the Transport Commissioner. It shall not be necessary to fill in the items 23 to 32 of the Form 20 in case of commercial vehicles like trucks.

Permanent Registration:

An application for registration of a Motor Vehicle shall be made in Form 20 to the Registering Authority within a period of 7 days from the date of delivery of such vehicle excluding the period of journey and shall be accompanied by Sales certificate in Form 21.

- a. Road worthiness certificate in Form 22 from the manufacturers (Form 22A from the Body builder).
- b. Valid Insurance Certificate.
- c. Proof of Address (Ration Card, Aadhar card, Electricity Bill,).
- d. Design approval copy of STA in case Trailer or Semi-Trailer.
- e. Original Sales Certificate from the concerned Authorities in Form 21 in the case of Ex-Army Vehicle.
- f. Pollution Under control (PUC) Certificate.
- g. Customs Clearance Certificate in the case of Imported Vehicles.
- h. Appropriate Fee as specified in Rule 81 of CMV Rules.

SUGGESTED ACTIVITY:

ACTIVITY

- Know about various forms used in vehicle registration
- Note the various documents required to buy a vehicle.
- Create two teams and allot one team as a vehicle registration team and another one is as a customer team, assign various tasks regarding vehicle registration.
- Create a group as a tag traffic police and should explain the driving rules and fines for violations.

LEARNING OUTCOME:

SL. No	Expected Outcome for students
01	Why registration is required?
02	What are the different types documents used in registration?
03	What are advantages of using driving license?
04	Important rules of registration should be known to all.
05	Able to know about various types of registration.

I. Fill in the blanks.

1. RTO is office used for.....of vehicle
2. Vehicle registration is made at.....office
3. Vehicle registration is compulsory for driving.....
4. Minimum age of driving of a vehicle is.....year.
5. An application of temporary registration can be made in.....of the Central Motor Vehicles Rules, 1989.

II. Answer the following questions:

1. Why vehicle registration is required?
2. What are the different types of documents need while vehicle registration?
3. Write the different types of vehicle registrations.

SESSION5:

DRIVING LICENSE

Session-1 Overview: Student will be able to understand the Driving License.

LEARNING OUTCOME:

Students can understand the,

1. Driving License
2. Importance of driving license
3. Classification /types of DL
4. Documents need submit to obtain DL.

As you must know that while driving a vehicle a person or driver must have a valid document of driving a vehicle, this document is called Driving License’.

We can say it driver's license/license or driving license, it is an official document which states that a person may operate a motorized vehicle, such as a motorcycle, car, truck or a bus, on a public roadway. Minimumageis18years for all vehicles, however motor cycle having engine capacity below 50 cc may be driven at age of 16 years.

According to the Motor Vehicle Act - 1988, a valid Driving License is necessary to drive any motor vehicle on public roads.

- i. Driving License is issued by the Regional Transport Office (RTO) of Motor Vehicles Inspector's Office after the recipient has passed a driving test and has proved the required age.
- ii. The Driving License in India is segregated as Motorcycle License, Light Motor Vehicle (LMV) license, and Heavy Motor Vehicle (HMV) License.
- iii. Learner's License is issued after passing a theory test.
- iv. The legislation of Driving License is done through the 'Rules of the Road Regulation' and the Motor Vehicle Act 1988.
- v. Thedriverofthevehicleisrequiredtokeeptheoriginalcopyofthelicense while driving.



Types of Driving Licenses in India:

To drive a motor vehicle in any public place an effective Driving License is necessary. By effective Driving License it means license issued to a person authorizing him/her to drive vehicle of that particular category. There are different types of licenses issued by the RTO offices.

1. Learner Driving Licence:

This is a temporary license that is valid upto 6 months from the date of issue.

It is basically issued to learn driving of Motor Vehicles.

2. Permanent Driving Licence:

Permanent driving license is issued to those who become eligible for it after thirty days (to apply within 180 days) from the date of issue of the learner license. Person supposed to get permanent driving license should be conversant about the vehicle systems, driving, traffic rules & regulations.

3. Duplicate Driving Licence:

In case of loss, theft, or on mutilation, Duplicate License is issued. The documents to be produced are FIR of the lost license, challan clearance report from RTA Office (in case of Commercial license renewal) and an application in Form LLD. The particulars are verified by the authority from the records.

The duplicate license will have the valid period same as the previous license. If the license is lost and expired by more than 6 months it requires permission from Head Quarter of Transport Department.

It is recommended to keep a photocopy of the original license or particulars of license noted in order to make it easier for the issuing authority to locate the particulars from their record.

4. International Driving Licence:

The motor licensing authority also issues International Driving License. The validity of this license is for one year. Person visiting the country is required to collect the license from there within one-year period. Apart from address proof and birth certificate, one has to produce a valid passport and valid visa while applying.

5. Motorcycle License or Two-wheeler License:

Two-wheeler license is issued by the Regional Transport Authority (RTO) to permit driving of only two-wheeler vehicles like bike, scooter and moped.

6. Light Motor Vehicle License (LMV):

Light Motor Vehicle License is issued to drive light vehicles like auto rickshaws, motor car, jeep, taxi, three-wheeler delivery vans, etc.

7. Heavy Motor Vehicle License (HMV):

Heavy Motor Vehicle License is issued to drive heavy vehicles like trucks, buses, tourist coaches, cranes, goods carriages, etc. A person with HMV license can drive light vehicles but Light Motor Vehicle License do not permit to drive heavy vehicles.

SUGGESTED ACTIVITY:

ACTIVITY

- Able to know about different driving license.
- Trainer shows a driving license and informs the contents of DL
- Tell them to students to discuss about DL in their home.

Learning outcome:

SL. No	Expected Outcome for students
01	Why license is required?
02	What are advantages of using driving license?
03	Important rules of license should be known to all.

A. Fill in the blanks.

1. RTO is office used for of vehicle
2. Driving license is issued at.....office.
3. License is compulsory for driving..... .

-
4. Learner's License is issued after passing a test.
 5. RTO is office used for registration of.....
 6. Minimum age for driving a vehicle below 50 cc is.....years

B. Multiple choice questions.

1. The full form of LMV is.....
 - (a) Light Motor Vehicle
 - (b) Low Motor Vehicle
 - (c) Light Meter Vehicle
 - (d) None of the above
2. The full form of HMV is.
 - (a) Heavy Motor Vehicle
 - (b) High Motor Vehicle
 - (c) High Meter Vehicle
 - (d) None of the above
3. International Driving License is valid for
 - (a) 1 year
 - (b) 2 years
 - (c) 3 years
 - (d) 4 years
4. Passport and Visa is necessary for obtaining which type of driving license?
 - a) Light Motor Vehicle DL
 - b) International DL
 - c) learner DL
 - d) Heavy Motor Vehicle DL

III. C. Answer the following questions:

1. Differentiate between temporary and permanent license.
2. Why driving license is required?
3. What are the different types documents required to get license?
4. List the different types of driving licenses.

UNIT INFORMATION

Unit name: Automobile and Environment

Unit code: Auto L1U5-NQ2024.

Unit descriptor: This unit provides introductory knowledge & skills covering automobile and its impact on environment. Students will be given a broad view of important issues like our environment, air Pollution, auto emissions as well as Standards like EU/ BS, PUC Certification and ways to control pollution.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs,
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours:20 hours.

Name of the sessions

Sl. No	Automobile and Environment	Duration (In Hours)
1	Air Pollution	5
2	Auto Emission and EU/BS Standards	5
3	PUC Certification	10
	Total Duration in Hours	20

Elements and Performance Criteria

Element	Performance Criteria
Air pollution	Able to list sources of air pollution Able to identify air pollution caused by poorly maintained automobiles
Auto emissions and EU/ BS Standards	Able to identify various Standards like EU/ BS
PUC Certification	Able to describe about PUC Certification process

UNIT-5



AUTOMOBILE AND ENVIRONMENT

INTRODUCTION:

Pollution is of great concern to the human race. As we know that we are not able to conserve our environment properly. If we don't start conserving our environment then our natural resources will be depleted / finished soon.

Pollution in any form is dangerous. Pollution of air, water, noise has to be controlled to save our environment. It is necessary for us to adopt national and international emission standards which ensure better utilization of resources. These standards help in controlling the pollution. Governments all over the world are now serious about environment.

Therefore, we get emission standards to follow in design & maintenance of automobiles. All the product and services have to follow national standards.

Now day's strict measures are being taken by car designers to adopt Bharat Standard (BS). You must have noticed 'BS-IV' written on vehicles. This is the latest version of emission standards to be followed in India.

Similarly, all the vehicles are supposed to carry PUC (Pollution under Control) certificate so that pollution is controlled. You should visit a nearby petrol pump and observe how they check pollution coming out of an automobile.

In this Unit, you will develop an understanding of the air pollution, auto emissions, Standards like EU/BS, PUC Certification and ways to control pollution.

SESSION1: AIR POLLUTION

Session-1 Overview: Student will be able to understand about Air Pollution.

LEARNING OUTCOME:

1. Understand the importance to controlling the air pollution.
2. Identify the different types of air pollution

Air Pollution:

Human population size has grown enormously over the last hundred years. This means increase in demand for food, water, home, electricity, roads, automobiles and numerous other commodities. These demands are exerting tremendous pressure on our natural resources, and are also contributing to pollution of air, water and soil.

The need of the hour is to check the degradation and depletion of our precious natural resources and pollution without halting the process of development.

'Pollution' is an undesirable change in physical, chemical or biological characteristics of air, land, water or soil. Agents that bring about such an undesirable change are called pollutants.

In order to control environmental pollution, the Government of India has passed the Environment (Protection) Act, 1986 to protect and improve the quality of our environment (air, water and soil).

AIR POLLUTION AND ITS CONTROL:



FIG.5.1 AIR POLLUTION FROM VEHICLES

AIR POLLUTION AND ITS CONTROL:

We are dependent on air for our respiratory needs. Air pollutants cause injury to all living organisms. They reduce growth and yield of crops and cause premature death of plants. Air pollutants also deleteriously affect the respiratory system of humans and of animals. Harmful effects depend on the concentration of pollutants, duration of exposure and the organism.

Smoke stacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants to gather with harmless gases, such as nitrogen, oxygen, etc. These pollutants must be separated/filtered out before releasing the harmless gases into the atmosphere.

Automobiles are also a major cause for atmospheric pollution at least in the metro cities. Actually, it is the badly designed and badly maintained automobiles that are a major cause of air pollution. You must have seen on roads a bus or truck or car or tempo releasing black smoke. This is because of poor maintenance of the vehicle. This happens when engine is not burning the fuel completely or properly. It can also happen because of improper mixture of air and fuel or perhaps the poor quality of fuel could be the reason. As the number of vehicles increase on the streets, this problem is now shifting to the other cities also.

Proper maintenance of automobiles along with use of lead- free petrol or diesel can reduce the pollutants they emit. Catalytic converters, having expensive metals namely platinum-palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes through the catalytic converter, unborn hydrocarbons are converted into carbon dioxide and water. Also, carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas, respectively. Motor vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol reduces effectiveness of the catalyst.

Controlling Vehicular Air Pollution:

A Case Study of Delhi:

With its very large population of vehicular traffic, Delhi leads the country in its levels of air-pollution – it has more cars than the states of Gujarat and West Bengal put together. In the 1990s, Delhi ranked fourth among the 41 most polluted cities of the world. Air pollution problems in Delhi became so serious that public interest litigation (PIL)

Was filed in the Supreme Court of India. After being censured very strongly by the Supreme Court, under its directives, the government was asked to take, within a specified time period, appropriate measures, including switching over the entire fleet of public transport, i.e., buses, from diesel to Compressed Natural Gas (CNG).

It was nice that the government of Delhi decided to convert all the buses of to run on CNG by the end of 2002. This resulted in dramatic improvement in the pollution levels.

You may ask the question as to why CNG is better than diesel. The answer is that CNG burns most efficiently and completely. On the other hand, petrol or diesels are partly left un burnt. Moreover, CNG is cheaper than petrol or diesel, cannot be siphoned off by thieves and cannot be adulterated like petrol or diesel. The main problem with switching over to CNG is the difficulty of laying down pipelines to deliver CNG through distribution points/pumps and ensuring uninterrupted supply.

Simultaneously parallel steps are also being taken for reducing vehicular pollution include phasing out of old vehicles, use of unleaded petrol, use of low-Sulphur petrol and diesel, use of catalytic converters in vehicles, etc.

Euro II norms, for example, stipulates that Sulphur be controlled at 350 parts-per-million (ppm) in diesel and 150 ppm in petrol. The goal, according to the roadmap, is to reduce Sulphur to 50 ppm in petrol and diesel. Corresponding to the fuel, vehicle engines will also need to be upgraded. All automobiles and fuel-petrol and diesel – were to have met the Euro III emission specifications in these 11 cities from April 1, 2005 and have to meet the Euro-IV norms by April 1, 2010. The rest of the country will have Euro-III emission norm compliant automobiles and fuels by 2010.

SUGGESTED ACTIVITY:

ACTIVITY

1. List the important of air pollution.
2. Draw different types of air pollution
3. Make a chart of different types of air pollution and put in your class rooms.

LEARNING OUTCOME:

SL. No	Expected Outcome for students
01	Able to understand about meaning of air pollution.
02	Able to list out different types of air pollution.
03	Able to understand importance of air pollution and different types of air pollution.

I. Fill in the blanks

1. Need of the hour is to check the.....and of our precious natural resources and pollution.
2. In order to control environmental pollution, the Government of India has passed the Act, 1986 to protect and improve the quality of our (air, water and soil).
3. Air pollutants deleteriously affect the system of humans and of animals.
4. Full form of CNG is
5. Automobiles are a major.....for atmospheric pollution.
6. Euro II norms, for example, stipulate that sulphur be controlled at parts-per-million (ppm) in diesel and.....ppm in petrol.

II. Multiple choice questions.

1. The latest version of emission standards to be followed in India is.....
(a) BS - IV (b) BS - I (c) BS - II (d) BS - VI
2. A substantial fall of which gases level was found in Delhi between 1997 and 2005 due to CNG?
(a) CO₂ and SO₂ (b) CO₂ and SiO₂
(c) CO and SO₂ (d) None of the above
3. Anundesirable change in physical, chemical or biological characteristics of air, land, water or soil is known as
(a) Population (b) Pollution
(c) Propulsion (d) None of the above

-
4. The Government of Delhi decided to convert all the buses to CNG by the end of year
- (a) 2022 (b) 2016 (c) 2002 (d) 2006

III. Answer the following questions:

1. Why control of air pollution is necessary?
2. What is the role of converter in automobile?
3. How has CNG helped in controlling pollution?
4. Which first city has followed strictly air pollution norms?
5. List the reasons for air pollution.

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SESSION 2:

AUTO EMISSIONS AND EU/BS STANDARDS:

Session-1 Overview: Student will be able to understand about Auto Emission and EU/BS Standards

LEARNING OUTCOME:

1. Understand the air pollution is to controlling of air getting polluted.
2. Understand the about auto emission and BS standards.

INTRODUCTION

This unit provides the knowledge & skills covering on Auto Emission and EU/BS Standards

Sometimes you must have seen black or white smoke coming from car, scooter, tempo or truck. This smoke is a byproduct of combustion process and from evaporation of fuel itself. This smoke is called pollution. It is also known as auto emission.

Auto Emissions:

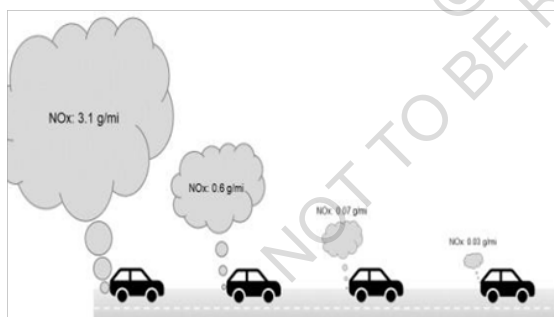


FIG.5.2 AUTO EMISSIONS

When emission from automobiles carries unburnt hydrocarbons, it causes air pollution. Pollution from cars comes from by-products of this combustion process (exhaust) and from evaporation of the fuel itself.

The Combustion Process: Petrol and diesel fuels are mixtures of hydrocarbons, compounds which contain hydrogen and carbon atoms. In a “perfect” engine, oxygen in the air would convert all the hydrogen in the fuel to water and all the carbon in the fuel to carbon dioxide. Nitrogen in the air would remain unaffected.

In reality, the combustion process cannot be “perfect,” and automotive engines emit several types of pollutants.

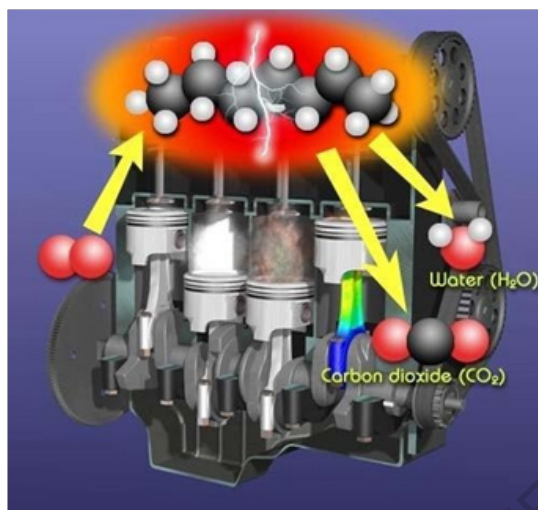


FIG.5.3 COMBUSTION PROCESS

Emission Standards:

Governments and regulatory bodies all over the world sit down with Automobile companies and list down requirements that set specific limits to the amount of pollutants that can be released into the environment.

Many emissions standards focus on regulating pollutants released by automobiles and other powered vehicles but they can also regulate emissions from industry, power plants, small equipment such as lawn mowers and diesel generators.

Emission Norms in India:

It was only in 1991 that the first stage emission norms came into force for petrol vehicles and in 1992 for diesel vehicles. From April 1995 mandatory fitment of catalytic converters in new petrol passenger cars sold in the four metros of Delhi, Calcutta, Mumbai and Chennai along with supply of Unleaded Petrol (ULP) was affected. Availability of ULP was further extended to 42 major cities and now it is available throughout the country.

The emission reduction achieved from pre-1989 levels is over 85% for petrol driven and 61% for diesel vehicles from 1991 levels. In the year 2000 passenger cars and commercial vehicles started meeting Euro I equivalent India 2000 norms, Euro II equivalent Bharat Stage II norms are in force from 2001 in 4 metros of Delhi, Mumbai, Chennai and Kolkata.

India is still behind Euro norms by few years. These are standards followed by European countries. However, with many vehicles manufactured in India now being aligned with Euro standards and vehicular technology is being accordingly upgraded. Indian Vehicle manufactures are also working towards bridging the gap between Euro standards and Indian emission norms.

Bharat stage emission standards are emission standards instituted by Government of India to regulate the output of air pollutants from internal combustion engine equipment's, including motor vehicles. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests.

Nowaday's India has adopted Bharat stage–VI norms in automobile sector.

For metro cities, it has become compulsory to use standard product.

The implementation schedule of EU emission standards in India is presented here in below given Table.

Standard	Reference	Year	Region
India2000	Euro1	2000-01	Delhi, Mumbai, Kolkata, Chennai
Bharat Stage II	Euro2	2003-04	Delhi, Mumbai, Kolkata, Chennai, Agra
Bharat Stage III	Euro3	2005-06	National wide
Bharat Stage IV	Euro4	2010-14	National wide
Bharat Stage VI	Euro 6	2020	National wide

The above standards apply to all new 4-wheel vehicles sold and registered in the respective regions. In addition, the National Auto Fuel Policy introduces certain emission requirements for interstate buses with routes originating or terminating in Delhi or the other 10 cities. For 2-and 3-wheelers, Bharat Stage II has been applicable since April 1, 2005 and Stage III standards came in force from April 1, 2010.

SUGGESTED ACTIVITY:

Activity:

1. Visit service station and understand the concepts of auto emission and BS standards

LEARNING OUTCOME:

SL. No	Expected Outcome for students
01	Able to understand about meaning of air pollution.
02	Able to understand the auto emission and BS standards.

I. Fill in the blanks.

1. Burning of fuel takes place in the ____ of automobile to give power to vehicle.
2. Smokes are by product of ____ process (exhaust) and from.....of fuel itself.
3. First stage emission norms came in to force for petrol ____ vehicles in the year
4. Emission reduction achieved from pre-89 levels is ____ for petrol driven and ____ levels for diesel vehicles from 1991. ,

II. Multiple choice questions

1. Petrol and diesel fuels are mixtures of ____
(a) Hydrocarbons (b) carbons
(c) Nitrogen (d) carbon monoxide
2. Government standards generally regulate the emissions of ____
(a) Nitrogen oxides (NO_x) (b) Sulphur oxides (SO_x)
(c) Particulate matter (PM) or soot (d) All of the above
3. In a perfect engine, oxygen in the air would convert all the hydrogen in the fuel to .
(a) Water (b) Gases (c) Smoke (d) Pollution

III. Answer the following questions:

1. Why emission control of air pollution is important?
2. List the reasons for auto emission pollution.
3. Observe and identify auto emission of vehicle in your area and list the remedies for it.

SESSION 3: PUC CERTIFICATION (POLLUTION UNDER CONTROL CERTIFICATE)

Session-1 Overview: Student will be able to understand about PUC certification.

LEARNING OUTCOME:

1. Understand the purpose of PUC of a vehicle.

INTRODUCTION

In this chapter you have learnt about various aspects of automobile pollution and measures taken to control pollution. Adulteration of fuel leads to the weak Combustion process and ultimately leads to pollution. You must have read in Newspaper that some petrol pumps owner's adulterate petrol with kerosene to get higher margin of profit. They should not do this because it causes incomplete combustion which leads to air pollution from vehicles using adulterated petrol.

Steps have also been taken to improve the quality of fuel. Proper maintenance of vehicle keeps pollution check by reducing the emission. Gradually, new measures like lead free fuel, CNG fuel, biofuel etc. are also being adopted in automobile sector.

Hence quality of fuel is very important. The Fuel Quality plays a very important role in meeting the stringent emission regulation. The fuel specifications of petrol and diesel have been aligned with the Corresponding European Fuel Specifications for meeting the Euro II, Euro III and Euro IV emission norms.

Pollution under Control (PUC) Certificate:

Presently, all vehicles need to undergo a periodic emission check (3 months/6 months) at PUC Centers at Fuel Stations and Private Garages which are authorized to check the vehicles. It is mandatory for every vehicle owner to carry a valid Pollution under Control (PUC) Certificate and maintain the vehicle within prescribed emission norms.

You must have seen at a nearby petrol pump the computerized facilities for checking of pollution levels and issue of PUC Certificates. These authorized Pollution Checking Centers are spread in all cities. At present, number of Centers

for petrol driven vehicles and the diesel driven vehicles are functioning. These centers issue Pollution under Control Certificates (PUC) if the vehicle is found meeting prescribed emission norms. In case the vehicles found polluting beyond prescribed norms, necessary repairs/ tuning in the vehicle would be required.

If a vehicle is not having the valid PUC pollution certificate, then is liable to be prosecuted under Section 190(2) of the Motor Vehicles Act. A penalty of Rs.1000/-for first offence and Rs.2000/- for every subsequent offence of violation has been provided.



FIG.5.4 EMISSION TEST

If any vehicle is found polluting although it is carrying a valid PUC certificate then the PUC Certificate of vehicle shall be cancelled and you will be directed (under Rule 116 of CMV Rules) to produce a fresh PUC Certificate within seven days.

If vehicle is not polluting and PUC Certificate has expired or do not have a PUC Certificate then also offence of not having a PUC Certificate also attracts prosecution under section 190(2) of the Motor Vehicles Act.

There are regulations also that require, transport vehicles to undergo an annual fitness check carried out by RTOs for emissions, safety and road worthiness.

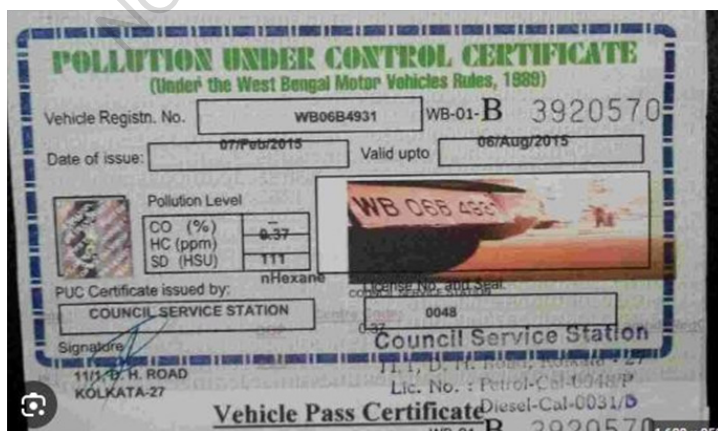


FIG.5.5PUC CERTIFICATE

Some other way to control pollution is to,

- Keep car one day off in a week
- Pool the car for going to office
- Use bicycle for short distances
- Keep your vehicle properly maintained
- Delhi metro and Bengaluru Namma metro are the best examples of controlling pollution
- And providing comfort to the public.

COMPUTERISED POLLUTION UNDER CHECK CENTERS
(Rule 231(B)(8) of KMV Rules 1989)

Licence No : 298/1999-2000

Center Name : Vijay, Alignment Center Unit-II
Center #301, 15th Cross, 5th Phase,
Address : J.P.Nagar, Bangalore-560078

Customer Name :
Customer Mobile : 9980137148

Pucc No : D051106463
Vehicle No : KA04ME7103
Year of Regn : 19-09-2007

Type of Vehicle : CAR
Make : Hyundai Motor
Model : VERNA
Test Date : 18-10-2014
Time : 13:29
Valid UpTo : 17-04-2015

Test Data

Flushing Cycle			
Avg	RPM Min	RPM Max	Temp
0822	2373	136	

Srno	RPM Min	RPM Max	Km	HSU%	Temp
1	0822	2200	0.10	4.0	0136
2	0822	2255	0.05	2.5	0136
3	0822	2230	0.06	4.0	0136
4	0822	2634	0.09	5.0	0136
5	0822	2480	0.10	2.5	0136
Mean			0.08	3.5	

Seal of Testing Station Testing Station Code **D051** Authorised Signatory

PLEASE DESTROY THE OLD CERTIFICATE & DO NOT HAND OVER TO ETC IN ANY CIRCUMSTANCES.

Photo of Vehicle


Certificate price: ₹ 100

Pres Limit for Diesel vehicle	K(Light Absorption Co-efficient)	Harridge Units %
Free Acceleration	2.45	65

This Vehicle meets Emission Standards Prescribed by Rule 115(2) of CMVR 1989. Accordingly the Certificate is All India valid for Six Months.

FIG: 5.5.1 Computerised PUC

SUGGESTED ACTIVITY:

Activity:

1. Visit nearest PUC center and observe the process with help of your teacher.
2. Visit the nearest PUC center and identify the procedure for Conduct test for PUC certificate for various vehicles.

A. Fill in the blanks

1. New alternate fuel used in Delhi is
2. Meaning of PUC is
3. PUC is checked at
4. Full form of CNG is.....
5. Adulteration of fuel leads to.....combustion process.

B. Multiple choice questions.

6. Which state of India has the largest number of CNG commercial vehicles running in comparison to anywhere else in the world?
(a) Maharashtra (b) Punjab (c) Delhi (d) Gujarat
7. India has setup at ask force for preparing the.
(a) Carbon road map (b) oxygen road map
(c) Hydrogen road map (d) hydro carbon road map

C. Answer the following questions.

8. Why control of pollution is necessary?
9. What is the purpose of PUC?
10. Give any four important tips to controlling the pollution.
11. Delhi metro and Bengaluru Namma metro is successful model of controlling pollution. How?
12. Prepare a poster depicting controlling of air pollution by better Designed and better maintained automobiles.
13. Collect a PUC certificate.

UNIT INFORMATION

Unit name: Introduction to Vehicle Maintenance and Servicing

Unit code: Auto L1U6-NQ2024.

Unit descriptor: This unit provides the knowledge & skills covering Introduction to Vehicle Maintenance & Servicing of automobile. It covers basic tips for vehicle maintenance and servicing.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs,
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours:30 hours.

Name of the sessions

Sl. No	Introduction to Vehicle Maintenance and Servicing	Duration (In Hours)
1	Importance to Vehicle Maintenance and Servicing	10
2	Tips to Extend the Life of Vehicle	10
3	Introduction to Vehicle service procedure	10
	Total Duration in Hours	30

Elements and Performance Criteria

Element	Able to do basic vehicle maintenance.
Importance of Vehicle Maintenance and Servicing	Able to describe vehicle maintenance
Tips to Extend the Life of Vehicle	Able to list Tips to Extend the Life of Vehicle
Introduction to Vehicle service procedure	Able to list service procedure adopted by service station of a vehicle

UNIT-6



INTRODUCTION TO VEHICLE MAINTENANCE AND SERVICING

INTRODUCTION

Automobiles need Maintenance from time to time. Like we need to wash, bathe similarly our automobiles also need to be kept clean. Automobiles have to run on dirty roads and in polluted environment.

Automobiles also run on uneven roads with pot holes and other obstructions. Automobiles and its parts are subjected to loads as described above. This makes them either damaged or in poor working condition.

Therefore, there is need for regular maintenance and servicing of automobiles. Maintenance of an Automobile is usually done in a place called Auto Workshop or Auto Service Station. In this Unit, you will develop an understanding of the concept of vehicle maintenance and servicing.



SESSION1:

IMPORTANCE TO VEHICLE MAINTENANCE AND SERVICING

SESSION OVERVIEW: In this session the students will be able to understand the importance of vehicle maintenance and servicing.

LEARNING OUTCOME:

1. Understand the Importance of maintenance of vehicle.
2. Understand the vehicle servicing.
3. Know the various safety tips for maintaining the vehicle

As you know that there is increase in the number of vehicle in our city. Vehicles such as motorcycle, scooter, bus, car, jeep, tempo, truck and tanker etc are running in the cities.

Every new vehicle comes with a vehicle maintenance manual. Vehicle owner should read and use this manual. This manual helps user for vehicle maintenance tips during driving. People after getting a car or vehicle often care little about regular car maintenance. Although you may be doing regular servicing of your vehicle, but with the help of vehicle maintenance tips given in your vehicle maintenance manual, lasting of your vehicle can be increased to a much greater extent. The Vehicle Maintenance and Servicing is carried out when the vehicle completes certain kilometer on its normal running and when the vehicle does not give proper performance. It is suggested that vehicle owner should do regular and periodical checkup of their vehicle. Some of checks are given her for users.

Daily Inspection (DI):

It is the responsibility of a driver or owner of a vehicle to carry out the following inspection/checks daily before the starting of engine to avoid any type of breakdown on the road.

1. Check the entire tyre pressure visually or hitting the tyre wall with the help of a stone piece and judging the sound.
2. Check radiator coolant level.
3. Check the fan belts for looseness

-
4. Check the level of engine oil.
 5. Check the wind screen, rear view mirror and rear window glass for their cleanliness.

Maintenance Checkup:

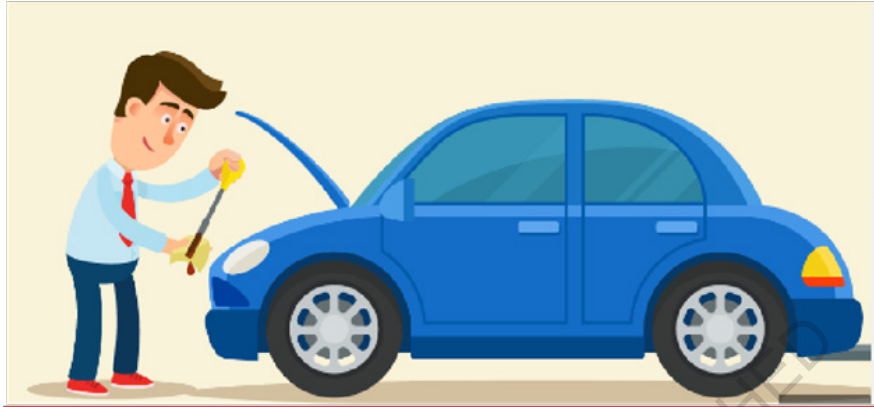


FIG6.1 OIL CHECK-UP

When you plan to go outside from your home for long distance travel, it is necessary to do some routine checkup. We should read vehicle maintenance manual for more clarification.

Some of important checkups is to be done for better maintenance.

- Topping of oil level
- Proper tension of Belt
- Battery for cleanliness and level of electrolyte (Add only distilled
- Water for topping of electrolyte water)
- Brakes
- Topping up of Coolant if required in the coolant reservoir
- Check the Serviceability of cooling system Hoses
- Proper Tyre inflation pressure
- Air-conditioning.

Vehicle maintenance/checkup is generally done at vehicle service center. You must visit to nearby vehicle service center and see how a vehicle is being properly maintained. We will be visiting a nearby vehicle service center and see the how the common checkups are being made by service mechanic. Some of important checkup are discussed here:

Check/ Top up all vehicles' oil levels:



FIG6.2 TOPUP OF OIL LEVEL

Service mechanic with the help of measuring stick check the engine oil, coolant, brake oil, and water. During routine checkup, oil, water, coolants are topped up otherwise it is changed.

Belt Checkup:

Checking of belt is very important. If it is loose or broken then it will be replaced immediately.

Battery:

Battery is very important component of a vehicle. It should be checked up regularly. Battery electrolyte (distilled water) is checked by removing the battery caps and looking inside. If level is low, it will be topped up by distilled water. Now day's battery is maintenance free batteries. Maintenance free batteries have

Sealed caps and require no checking. But some batteries say maintenance free but do have removable caps. These should be checked in the usual manner.

Brakes:

Service mechanic checkup the break also by pushing the pedal. If he feels that there is need of servicing, he will inform to the customer.

Cooling System:

Technician checks the cooling system by topping up the coolant. The cooling system should be refilled with the correct coolant. Don't refill with just straight water.

Air-conditioning:

Service mechanic will check the cooling and heating by checking the airflow is coming from all appropriate vents.

Tyres:

Mechanic will check the tyre by checking correct tyre pressures. He will also see also external damage also if any



FIG6.3BATTERY, TYRE AND BRAKE CHECKUPS

The Safety Rules during servicing of vehicle:

You have visited the service station and seen that service technician is doing their work properly. During servicing of vehicle in a garage or service station the technician must follow some precaution and safety rules to prevent the accidents to occur, please observe that whether safety rules are being followed or not. These safety rules are:

1. Always select right tools for specific job. The wrong tool could damage the part being worked on and could cause you to get hurt.
2. Keep your tools and equipment's under control.
3. Wipe excess oil and grease off your hands and tools so that you can get a good grip on tools or parts.
4. Work quietly and give full attention on your job.
5. Keep jack handles out of the way. Stand the creeper against the wall when it is not in use.
6. Do not put sharp objects, such as screw drivers, in your pocket. You could cut yourself or get stabbed, you could damage the seat.
7. Make sure that technician cloths are right for the job and he should wear full leather safety shoes.

8. If oil, grease, or any liquid spill on the floor, cleans it up so that no one will slip and fall.
9. Always wear eye protection when using a grinding wheel or welding equipment or working with chemicals such as solvents.
10. While using jack, place it properly to avoid slip.
11. Never run an engine in a closed garage that does not have proper ventilation system. The exhaust gases contain carbon monoxide. Carbon monoxide is a colorless, odorless, tasteless poisonous gas that can kill you.

Suggested activity:

ACTIVITY

1. Visit the nearest service center and list the various activities to be taken.
2. List the main maintenance tips for vehicle owners.
3. Imagine you are buying a new car or bike and discuss with the salesperson: "What are the maintenance tips to maintain the vehicle?"

Learning activity:

Sl.No	PERFORMANCECRITERIA
01	Able to understand the Importance of maintenance of vehicle.
02	Able to understand the vehicle servicing.
03	Able to know the various safety tips for maintaining the vehicle

I. Fill in the blanks.

1. The Vehicle Maintenance and Servicing is carried out when the vehicle completes kilometer.
2. After over hauling the vehicle regains its almost
3. When you plan to go.....from your home for long distance travel, take some time to make sure that you are ready to take you to outside.
4. Always select right.....for specific job.

II. Multiple choice questions:

1. Before starting the engine the driver or owner of the vehicle must inspect the.

-
-
- (a) Tyre pressure (b) radiator coolant (c) Engine oil
(d) All of the above
2. The exhaust gases contain.....
- (a) Carbon monoxide (b) carbon oxide
(c) Carbon dioxide (d) hydrocarbon
3. If the battery electrolyte level is low it can be topped-up using.
- (a) Pure water (b) Distilled water
(c) Sea water (d) rain water
4. Coolant is used in.... ..
- (a) Engine oil (b) brake oil
(c) Cooling system (d) battery

III. Answer the following questions.

1. What are the safety rules to be followed during servicing of vehicle?
2. Why right tools are selected for right jobs. List the reasons.
3. What is the important safety gadget should be used by service technician?
4. List the pre-checkup activity of a vehicle to be taken
5. List some tips for maintaining a vehicle.

SESSION2:

TIPS TO EXTEND THE LIFE OF VEHICLE:

Learning outcome:

1. Understand the various tips to need to extend the life of vehicle.

Care and Maintenance tips keep your vehicle running in good condition. These tips will help in better maintaining of a vehicle. You must observe these points in your daily life.

Safety tips of vehicles:

- Drive the vehicle with care everyday
- Be patient during the accident or breakdown of a vehicle, call helpline number of vehicle or police or hospital.
- Buy petrol at reputable service stations.
- Don't fillup if you see the tanker.
- Go easy when you're stuck.
- Car key chain should be lighten.
- Preserve your car during long-term storage.
- Park in the shade.
- Clean the inside, too.
- Clean dash gauges carefully.
- Preserve door and window seals.
- Don't try to carry too much.
- Place a towel under baby seats.
- Protect car paint from the sun.
- Wash in winter
- Wax to protect your cars paint job.
- Maintain proper inflation
- Check for un even wear

-
-
- Rotate your tires
 - Have wheel alignment checked
 - Top off your brake fluid
 - Care for anti-lock brakes
 - Check engine oil at every other fill-up
 - Change oil frequently
 - Don't mix coolants
 - Avoid hose hassles
 - Test drive-belt tension
 - Clean your engine
 - Run your AC in winter
 - Maintain your car's battery
 - Seal a leaky radiator.
 - Dilute your coolant.

SUGGESTED ACTIVITY:

ACTIVITY

1. Visit the nearest service center and know about the tips to extend the life of vehicle.

Learning Outcome:

1. Students able to understand the various tips to need to extend the life of vehicle.

I. Multiple choice questions.

1. During the break down of a vehicle we may call.....

(a)Police	(b)Hospital
(c)Help line of service centre	(d) Fire station
2. Wax is used to protect the car's.

a) Life	b)Paint job	c)Engine	d)Battery
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II. Assignment

1. List some important safety tips of a vehicle.

SESSION3: INTRODUCTION TO VEHICLE SERVICE PROCEDURE

Learning outcome:

1. Understand the servicing procedure for vehicles.
2. Understand the procedure for job card filling.

During the visit of vehicle service center, you must have seen that authorized automobile service center adopt certain procedure during service of a vehicle. We shall list the common activity done in the center. One of the most important part is Job Card and its filling procedure. At this level you must know some of these servicing activities in your training programmed.

Common activity in the workshop:

- Job card and its filling procedure
- Washing of vehicle and Washing Procedure
- Engine Minor tune up
- Oil Replacement
- Checking of battery electrolyte level and top up
- Clutch and brake free play and their adjustment



FIG.6.5 VEHICLES WORKSHOP

-
- Lighting System, its various part and their checking
 - Identification of greasing points of wheelers and procedure of greasing.
 - Checking of tyre inflation and procedure of inflation.

Job card and its filling procedure:

When a vehicle owner enters in service center. He is attended by supervising engineer. Customer informs about vehicle defect.

After getting the feedback from the vehicle owner/driver regarding defects of the vehicle, the supervising engineer in a service station or workshop carry out an inspection on it.

The defects pointed out or listed are noted down in a standard format, which is called the Job card or Work Order.

In order to indicate his satisfaction with the diagnosis made by the supervising engineer, the customer of the vehicle puts his signature on the Job card before the repairs on the vehicle are started. The work assigned to the appropriate person to carry out the repairs. And the supervisor puts his signature on the job card. The work order/Job card is prepared in duplicate.

Contents of a standard job card:

1. Job card Number.
2. Name address & phone no.of the Service Centre.
3. Name address & phone no.of customer.
4. Details of vehicle such as–Make; Model, Registration No., Chassis
5. No, Engine No., Date of Sale, Kms. Reading, Receiving date & time and delivery date & time by the service center.
6. Check list before trial
7. Customer's observation and Job to be done.
8. Estimated cost in Rs. for customer and Insurance company
9. Labor required
10. Name of Mechanic.
11. Name & Signature of Supervisor.

SUGGESTED ACTIVITY:

ACTIVITY:

1. Visit nearest service center and know the procedure for servicing a vehicle.
2. Visit the nearest service center and know the procedure to fill the job card.

Learning Outcome:

1. Students able to understand the procedure for servicing of a vehicle.
2. Able to fill the job card.

I. Fill in the blanks.

1. Job card is used for filling.....of a vehicle.
2. Customer of the vehicle puts his.....on the Job card before there pairs on the vehicle is started.
3. The work order/ Job card is prepared in
4. Engine tuneup means different things to different
5. The work order / Job card is prepared in

II. Multiple choice questions.

1. Defects pointed out are noted down in a standard format which is known as.
(a) Complaint book (b) Rulebook
(c) Job card (d) Register
2. What type of vehicle information is required to be mentioned in a job card?
(a) Chassis No. (b) Engine No.
(c) Model No. (d) All of the above
3. The acknowledgement form must have the signature of the .
(a) Supervising engineer (b) Mechanic
(c) Owner of service centre (d) none of the above

III. Answer the following questions.

1. What is Jobcard?
2. What are the activities to be taken during service of a vehicle?
3. List out the contents of job card.

UNIT INFORMATION

Unit name: Innovation and Development

Unit code: Auto L1U7-NQ2024.

Unit descriptor: This unit provides introductory knowledge & related skills covering innovation and developments taking place in automobile.

Resource implications:

- Notebooks, Pen, Pencil, Eraser,
- Computer, Open Source Software for making digital presentation, LCD projector.
- Sketches, drawing, pictures and posters, Photographs,
- Animations and videos of various types of Automobiles used in daily life.
- Sample and cut out of wheels of a cart and other vehicle.

Nominal hours: 15hours.

Name of the sessions

Sl. No	Automobile and Environment	Duration (In Hours)
1	Innovation and Development	15
	Total Duration in Hours	15

Elements and Performance Criteria

Element	Performance Criteria
Importance of innovation and development.	Able to identify major areas of innovations taking place in automobiles.
	Able to broadly describe major new developments

UNIT-7



INNOVATION AND DEVELOPMENTS

INTRODUCTION

As you know whenever there is a demand of any item, then innovation takes place. Innovation leads to development of a technology. With the development of new technologies customer get benefits in term of comfort and safety. Sometime innovation also results in lower cost.

Automobile sector is also witnessing lot of innovations and development due to which new automobile models are launched in the market. Innovation has also been seen in the field of passenger safety. A number of devices are now provided in the cars so that in case of any accident air bags are coming into the operation to save the passenger.

There is lot of research going on in the area of alternative fuel due to economic reasons and environmental concern. Even solar energy based cars have been designed these days. And these cars can go up to 80 km in a day. Some cars have been designed to use electrical energy. A combination of electrical and petrol energy have been used in cars called hybrid cars.



SESSION1:

INNOVATION AND DEVELOPMENT

SESSION OVERVIEW: "Students will be learning about the main innovations in automobiles and their importance."

LEARNING OUTCOME:

1. Understand the importance of innovation in automobile.
2. Important innovations in automobile.

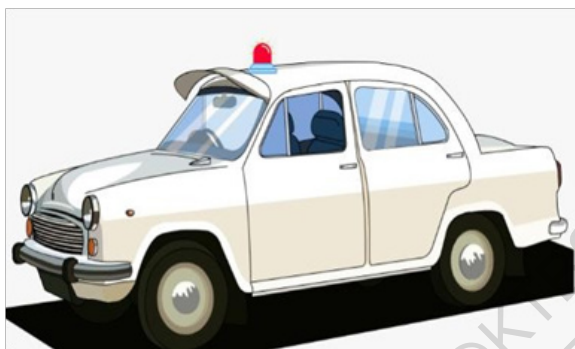


FIG7.1 AMBASSADOR AND NANO

You must have seen some old car running on roads in your village, town or city. Some old models like Ambassador Cars can still be seen but these are reducing in numbers day by day. You must be noticing much more stylish looking cars on the roads now a day. Same is the case with scooters and motorcycles. Even buses and trucks are looking different day by day.

Can you name a famous car innovation done by an Indian company few years back? It was Tata Nano car manufactured by Tata Motors. One of the smallest as well as lowest powered cars in the world, it was designed to be the cheapest car in India aimed mainly at the lowest price segment in the India.

Apart from looks and style as you know one important challenge among car manufacturers is use of alternate fuel, as petrol and diesel stock is limited and we have to search new alternative fuel. Lot of research has gone in this area and some results are coming out. Some companies are working on a project to run vehicles on water or air only! Some of the technologies being incorporated into new automobile designs include gas-electric hybrids, fuel cells and biomass fuel sources including methane.

Electric Car:

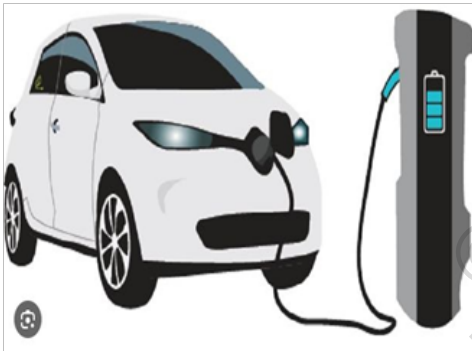
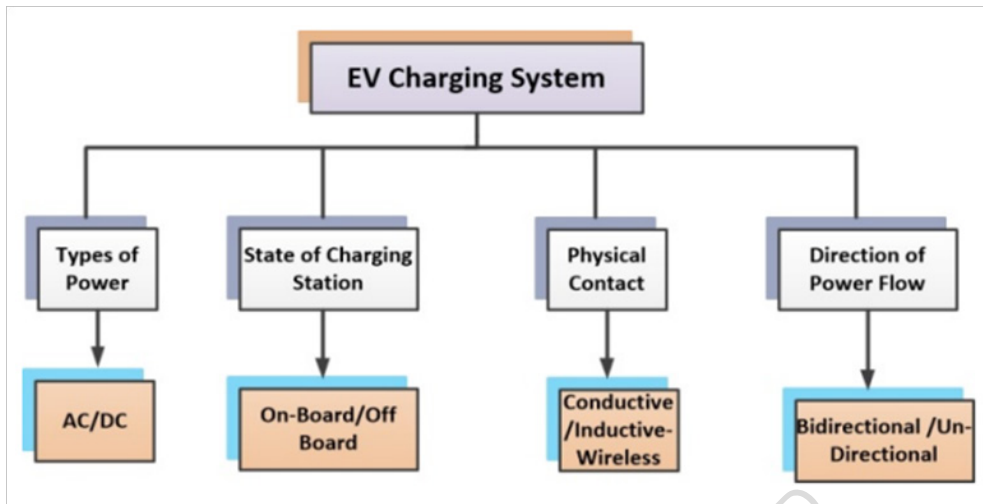


FIG7.2 ELECTRIC CAR

You must have heard about an Electric car. An electric car is an automobile that is propelled by one or more electric motors, using electrical energy stored in batteries or another energy storage device. Electric cars are pollution free and have zero tail pipe emission. This car helps in reduction of urban air pollution. Electric cars are generally more expensive than petrol. The primary reason is the high cost of car batteries.

Hybrid Vehicle:

A hybrid vehicle is a vehicle that uses two or more distinct power sources to move the vehicle. Hybrid vehicle is known as Hybrid Electric vehicles (HEVs). This vehicle combines an internal combustion engine and electric motors. Although electric cars have been around since the inception of the automobile, a new breed of gas-electric hybrid autos were introduced in the US several years ago.

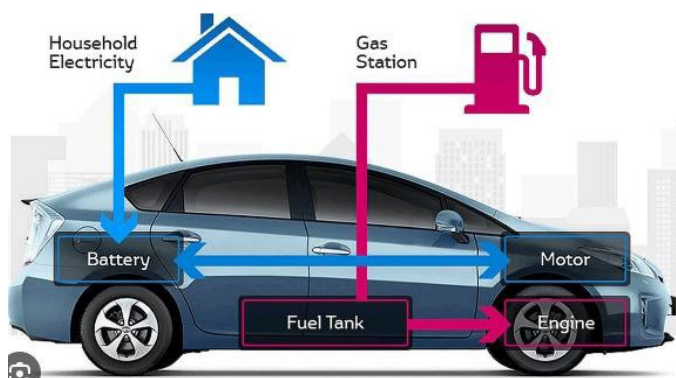


FIG7.3 HYBRID CAR

Most of the major automobile manufacturers including GM, Honda, Toyota, Ford and Daimler Chrysler have either introduced or are planning to introduce new hybrid models during the next several years. New car sales on hybrids have increased by approximately 36 per cent in the US. The car in picture is Toyota Prius which is the world's top selling hybrid car.

FUEL CELL:

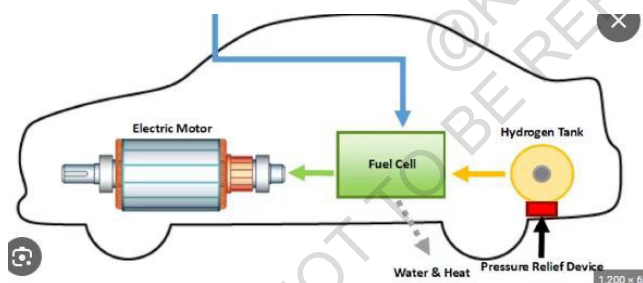


FIG7.4 FUEL CELL CAR

Automobile fuel cell technology is under development and has not been marketed yet, however, this innovative energy technology has the potential to revolutionize transportation. Fuel cell car technology under development creates electricity through a chemical reaction between hydrogen and oxygen (air). The reaction creates and heat which is stored in batteries to power the car. The reaction creates only water and heat and may off a solution to our energy and environmental situations.

Biomass Fuel:



FIG7.5 BIOMASS FUEL CAR

Biomass automotive fuels and lubricants have been gaining acceptance over the past several years primarily as a result of environmental concerns. Biomass fuels are typically generated through the decay of organic matter.

Bio fuel:

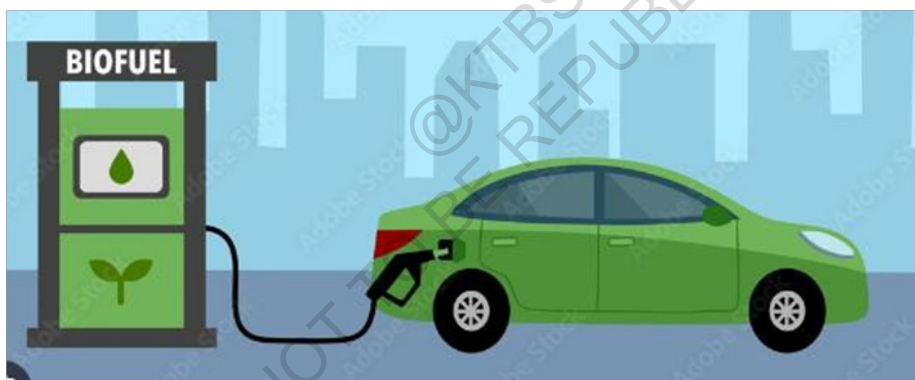


FIG7.6 BIO FUEL CAR

You must have heard about Jatropha plant. This Jatropha plant seeds are very rich in oil (40%). Jatropha oil has been used in India for several decades as biodiesel for the diesel fuel requirements of remote rural and forest communities; jatropha oil can be used directly after extraction i.e. without refining) in diesel generators and engines.

The former President of India, Dr. Abdul Kalam, is one of the strong advocates of jatropha cultivation for production of biodiesel. In our country out of the 600,000 km² of wasteland that is available in India over 300,000 km² are suitable for Jatropha cultivation. Once this plant is grown the plant has a useful lifespan of

several decades. During its life, Jatropha requires very little water when compared to other cash crops. Jatropha oil is being blended with diesel and being used in Indian vehicles.

New Development:

Car Technology:

(The Latest Innovations in Engine Development and Safety)

Car technology is focusing increasingly on safety, efficiency and the environment, and some of the major new innovations are as given below.

Engine development:



FIG7.7 DEVELOPED ENGINE

In the last two years, carbon emissions have become an issue of contention for new and used car owners. Motorists are being encouraged by both politicians and the media to down size their vehicles and reduce their carbon footprint.

Many manufacturers have changed their engine and reduced carbon dioxide emissions tailpipe emission. BMW, Mini Cooper Diesel, Mercedes, Mercedes Benz and many more have adopted new technology in their engine.

Convenience and Safety:

Automatic Parking:

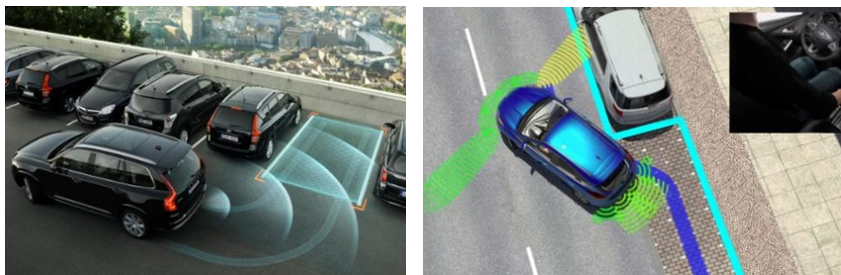


FIG7.8 AUTOMATIC PARKING

The wheel-scoffer's dream will soon be available on a whole range of luxury cars. Simply drive along a row of parked cars and the system is able to detect a space big enough for your vehicle to squeeze into. Feeling lazy, you take your hands and feet off everything, and watch in astonishment as the car parks itself.

Pre-scan technology:

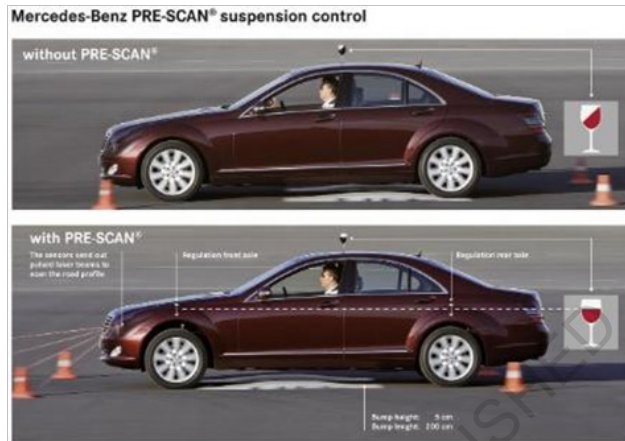


FIG7.9 PRE-SCAN TECHNOLOGY

This technology was also showcased in the Mercedes F700 concept, where lasers scan the road surface before the car drives over it. This prepares the suspension to react to the terrain accordingly and ensures peerless ride comfort. Saab Alco Key:



FIG7.10 SAAB ALCO KEY

Saab wants to help reduce the number of alcohol-related road incidents with this device by fitting it as standard - apparently, one in three traffic accidents in Europe is alcohol related. This fully integrated system requests the driver to blow into a wireless hand-held unit before driving the car. The breath is then analyzed and if the blood-alcohol limit is exceeded, a red LED will appear and the engine will not start.

Volvo Sleep Detection:

Volvo has introduced both Driver Alert Control (DAC) as well as a Lane Departure Warning (LDW) system. LDW uses cameras located between the wind-screen and the rear-view mirror and monitors the car's position between the road markings.

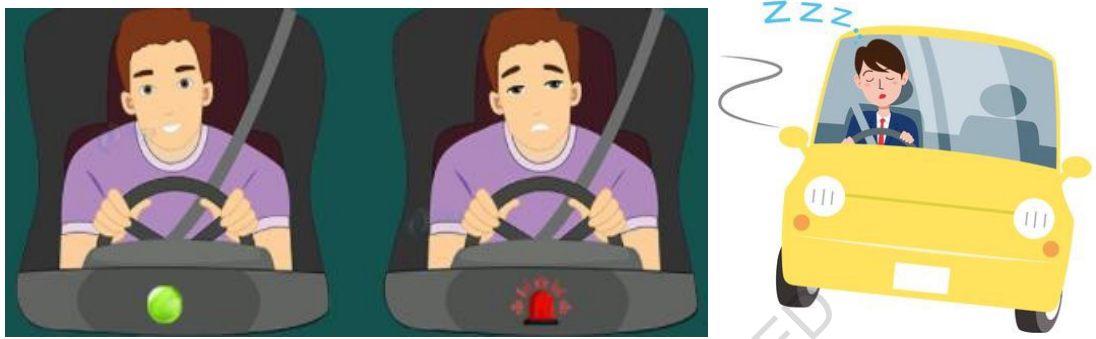


FIG7.11 SLEEP DETECTION

Only after a certain speed is reached does the system become active, if the car then wanders across any lane markings without using an indicator, the driver is audibly alerted.

Collision Warning System:

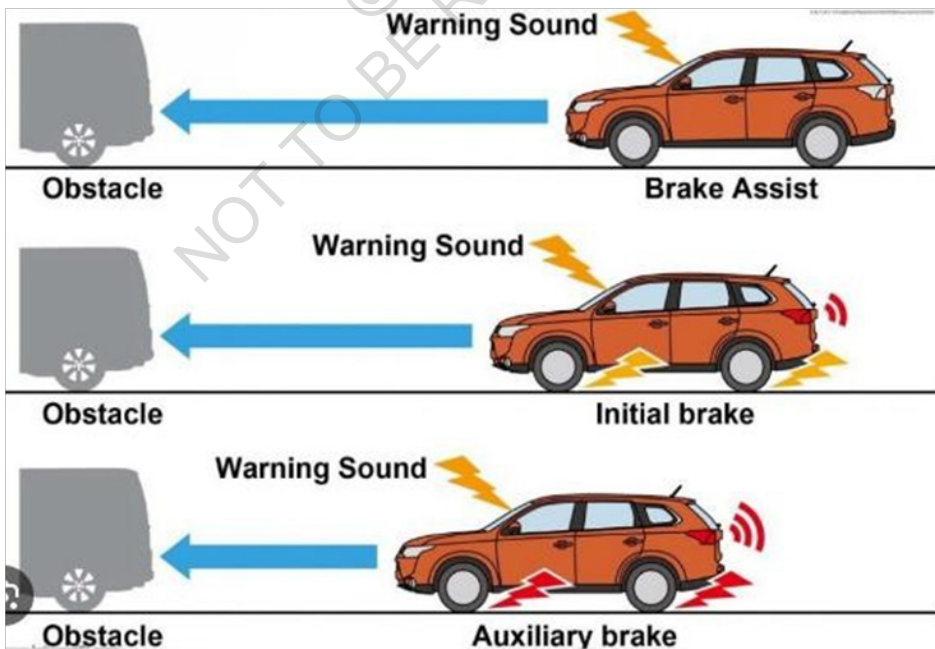


FIG7.12 COLLISION WARNING SYSTEM

Swedish car maker Volvo is also developing a Collision Warning system which uses radar technology with a wide-angle search area to detect objects in front of and around the car. If the car approaches a pedestrian, a red warning light comes on the windscreen's head-up display and a warning signal sounds. This helps the driver to react and, in most cases, avoid an accident.

If the risk of a collision increases, assisted panic braking is activated to provide more pressure when the brakes are applied, but if the driver still doesn't brake and a collision is imminent, the car's brakes are activated automatically.

Vehicle to Vehicle Technology:

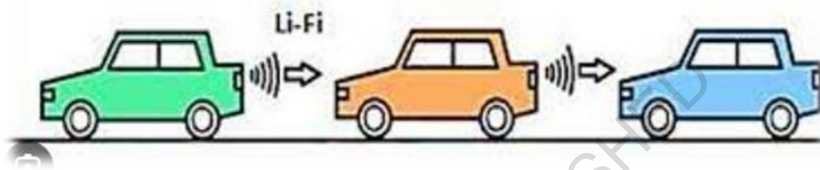


FIG7.13 V-V TECHNOLOGY

This hi-tech system is being developed by General Motors and uses wireless technology to allow a driver in one car to receive information from another car further ahead on the same road - perhaps that other driver has come across an obstacle or has slammed on the brakes. This system would allow the other driver to receive this information in sufficient time to react and therefore avoid any accident.

Driverless cars:

These 'intelligent vehicles' are capable of taking a person from one point to another without any driver. Providing a "taxi-like" experience to the passengers, these vehicles would navigate the roads on their own. Also called as auto pilot, Autonomous vehicle or auto-drive car, these vehicles are expected to be fully functional by 2020.



FIG7.13 DRIVER LESS CAR

An example of such smart cars is the 2getthere passenger vehicle that is based on the FROG navigation technology that originated in The Netherlands, DARPA Grand Challenge (from USA) and AGRO research project (from Italy).

Emission Standards:

With the help of automotive technologies, a check can be put on the emission of harmful pollutants such as NO₂, particulate matter (PM) or soot, carbon monoxide (CO) or volatile hydrocarbons. As a result, it would be easier to lower down the pollution level and save the planet from global warming.

Suspension technology:

The suspension system comprises of springs, shock absorbers and linkages. This system connects the vehicle to its wheels. The main function of a suspension system is to minimize jerks and provide comfort to the occupants of the vehicle. With the advancement of technology, gas-filled shock absorbers have come to being which are much more responsive than the spring absorbers. Apart from the above Mentioned technologies, steering technology and safety technologies have also helped the automotive industry in a big way to reach great heights.

Innovative Car Safety Technologies in New Honda City:

Car safety technologies have gained prominence in the recent years with the growing number of road accidents. Modern day cars are well equipped with safety devices compared to their old siblings. The New Honda City recently launched by Honda Sail Cars India in the Indian car market is a perfect epithet of safety.

Trinity of Braking System:

Trinity of braking system is one of the most significant safety systems in the new Honda City. The trinity comprises the Antilock Braking (ABS), Electronic Brake force Distribution (EBD) and Brake Assist. The combination of these advanced safety technologies sets a new standard in car safety feature.

ABS uses a system of sensors, an electronic control unit and a hydraulic control unit. All these work in association with each other to monitor the movement of car wheels and prevent wheel lock up.

The introduction of EBD with the ABS holds its own significance in improving safety standards. The system works in conjunction with the anti-lock brakes to electronically distribute the braking pressure between front and rear wheels.

The Brake Assist system also plays a key role in ensuring faster and safer

braking in association with other two members of the trinity. This system monitors the use of brake pedal and automatically senses the need to stop the car in case of an approaching accident or as a result of panic.

G- Force Control Technology (G-CON):

G-CON or the G-force control technology is one of Honda's best innovations designed in response to the need to control or absorb the crash force in event of an unavoidable accident

This technology helps to reduce the impact of collision from all directions on the car body.

Pedestrian Safety:

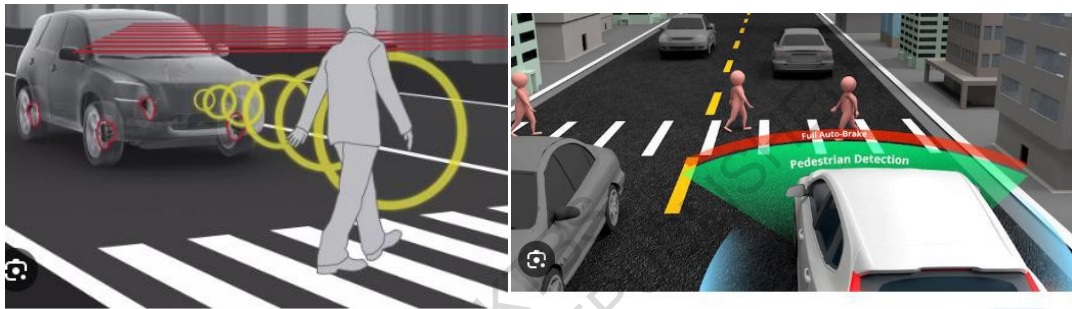


FIG7. PEDISTRIAN SAFETY

Honda's commitment to safety also includes the safety of common people who walks on roads. Safety of pedestrians has always been a key concern for Honda. With this concern, the company first studied the dynamics of pedestrian collision according to which when a person is stuck by an oncoming car, he or she is thrown up onto the car hood before rolling on the street.

Suggested Activity:

ACTIVITY

1. List the important innovations in automobile.
2. Visit a vehicle sales unit and discuss the various latest innovation of individual vehicle.
3. Create a group and choose particular models of car and find the features of that particular car.

Learning outcome:

SL. No	Expected Outcome for students
01	<i>Students able to Understand the importance of innovation in automobile.</i>
02	<i>Able to know the Important innovations in automobile.</i>

I. Fill in the blanks.

1. Innovations are important for_____.
2. New car innovation have concept of hybrid car_____.
3. New technology helps in_____..
4. Old technology vehicle are out dated because they are more_____.

II. Multiple choice questions

1. Up to how many kms can solar energy-based cars travel in a day?
(a) 80 km (b)30km (c)40 km (d)60km
2. The vehicle which combines an internal combustion engine and electric motors is a
(a) hybrid vehicle (b) electric car
(c) Fuel cells car (d) biomass fuel car
3. The full form of ABS is
(a) Anti-lock Bike System (b)Anti-brake System
(c)Anti-lock Braking System (d) None of the above
4. Which of these personalities were a former President of India and a strong advocator of jatropha cultivation for production of biodiesel?
(a) Mrs. Pratibha Devi Patil (b)Drk R Naraynan
(c)Dr Abdul Kalam (d)Mr. Pranab Mukherjee

III. Answer the following questions.

1. Why innovation is required?
2. What are the different types innovation used in automobile?
3. What is a hybrid vehicle?
4. What is the use of ABS?
5. What are advantages of using new innovations?