EXCITING WORLD OF AUTOMOBILES

STUDENT WORKBOOK

Curriculum :AUTO-SRV *L1-NQ*^{2012}

Unit :AUTO-SRV *L1U1*

History and Evolution of Automobiles

Vocational Learning Material for School

PSS Central Institute of Vocational Education

Bhopal

PREFACE

Improving the parity of esteem between the general academic education and vocational education, is the policy priority of the Government of India. The National Vocational Education Qualification Framework (NVEQF) developed by the Ministry of Human Resource Development (MHRD), Government of India, is a descriptive framework that provides a common reference for linking various qualifications. It will be used for setting common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, Colleges and Universities. The NVEQF will act as a translation device to make qualifications more understandable to employers, students and institutions. It will promote transparency of qualifications and facilitate learner's mobility between different qualifications, thus encouraging lifelong learning. PSSCIVE has taken lead in development of learning material for the Automobile Sector for L-1 level in collaboration with the Automobile Skill Development Corporation (ASDC).

The present material contains activity related to Level L-1 for the Automobile service sector. This will fulfill the needs of the students willing to learn activities relating to the Automobile Service Sector. Any student/ entrepreneur willing to start an Automobile Service Sector can acquire the desired competencies with the help of this book.

The book has been written by experts but reviewed by all the members of the group. I am grateful to the authors for the development of this book and to the members of the Working Group for their candid suggestions, during the development and review. Their names are given elsewhere.

I appreciate efforts put in the by Dr. Saurabh Prakash, as the Project Coordinator of the Working Group in planning and organizing Meetings which led to the final form of this title.

I shall be grateful to receive suggestions and observations from readers, which would help in bringing out a revised and improved version of this book.

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June, 2012

This student workbook was developed, with active involvement of the Automobile Skill Development Council (ASDC) keeping in view the National Occupation Standard (NOS) for Service Technicians L4 developed by ASDC.

This project for development of the student workbook was coordinated by the PSS Central Institute of Vocational Education, a constituent unit of National Council of Educational Research and Training, which is under Ministry of Human Resource Development, Government of India.

Student Details

Student Name: _____

Student Roll Number:_____

Batch Start Date: _____

Contents

About this Workbook

This workbook is to assist students with completing the Auto Sector **L1U1-NQ2012** unit of competency: **History and Evolution of Automobiles.** Students should study the workbook in class or in their own time.

This workbook contains sessions for imparting knowledge & skills on various aspects of the unit of competency. The workbook also includes information, exercises, and assessment activities to complete. The assessment plan has been included in the workbook to assist you in scheduling your time for completing the assignments. Each assessment activity is followed by a checklist for meeting the assessment criteria. The criteria will help you to ensure that you have fulfilled all of the assessment requirements to receive a 'competency' grading/Certification by ASDC.

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 it's 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. Posters for building awareness about applications of Automobiles in day to day life.

Nominal hours: 10 hours

Elements and Performance Criteria

- Elements define the critical learning outcomes of a unit of competency.
- Performance criteria specify the level of performance required to demonstrate the achievement of the Element.

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

Relevant Knowledge and Skills

1. Relevant Knowledge

- Invention of Wheel
- Wheel cart and its type
- Animal Powered carts -Bullock cart , horse carriage
- Invention of engine and automobile
- History of automobiles
- History of automobiles –post World War II

2. Skills

- Use and handling of wheels
- Identifying traditional carts
- Identifying and Listing of various automobile models associated with different stages of evolution of modern automobiles.

Assessment Plan

Session No.	Assessment method	Due Date	Completion Date
1.	Fill in the Blanks		
2.	Fill in the Blanks		
3.	Fill in the Blanks		

Introduction

You must have heard the word ***Automobile***. Meaning of an automobile can be 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. The word automobile comes from the Ancient Greek word αὐτός (*autós*, "self") and the Latin *mobilis* ("movable"); therefore automobile means *a vehicle that moves itself*. The alternative name *car* is believed to originate from the Latin word *carrus* or *carrum* ("wheeled vehicle"), or the Middle English word *carre* ("cart") (from Old North French). These words in turn are said to have originated from the Gaulish word *karros* (a Gallic Chariot).

Fig.: NANO from India

Most definitions of the term specify that Automobiles are designed to run primarily on roads, to have seating for one to eight people, to typically have four wheels, and to be constructed principally for the transport of people and goods.

In this Unit, you will develop an understanding of the concept of wheel and role of wheel cart. You will also learn various stages of development over several hundred years that made possible the invention of an Automobile as we know it today. You will understand how various automobiles were developed in past.

Session 1: Invention of Wheel

Relevant Knowledge

The Wheel is considered as one of the most important mechanical inventions of all time. 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.

The invention of the Wheel was perhaps in the late Neolithic age. It is likely that it happened along with other technological advances that gave rise to the early Bronze Age.

4500 BC: Invention of the potter's wheel, Chalcolithic (Ubaid period)
4500–3300 BC: Chalcolithic, earliest wheeled vehicles, domestication of the horse
3300–2200 BC: Early Bronze Age
2200–1550 BC: Middle Bronze Age, invention of the spoked wheel and the Chariot

Invention of Wheel

Since the industrial revolution, the Wheel has been a basic element of nearly every machine constructed by mankind. While the exact time and place of the invention of the wheel has been disputed but its beginnings can be seen across ancient civilizations.

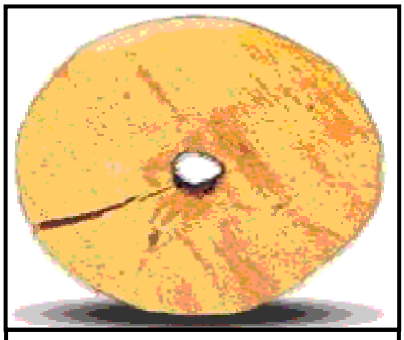

Fig : Wheel

History tells us that WHEEL was most likely invented in Mesopotamia (modern day Iraq) around 3500 BC. This means that the Wheel is about 5,500 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 3,000 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 seems to have started in Europe by 1400 BC.

Wheel and its structure

It's hard to imagine any mechanized system that would be possible without the wheel or the idea of a symmetrical component moving in a circular motion on an axis. From tiny watch gears to automobiles, jet engines and computer disk drives, the principle is the same.

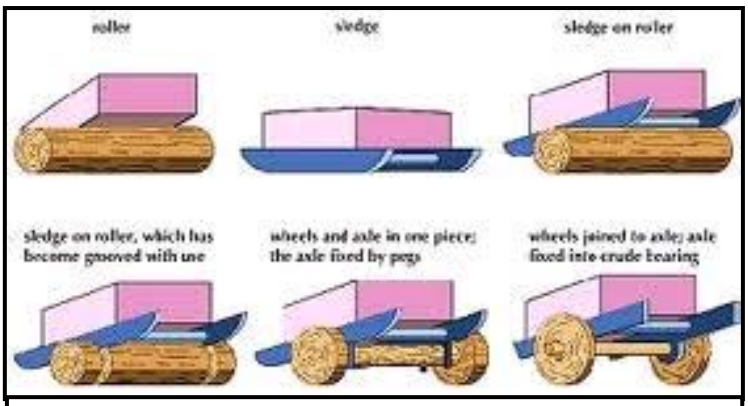

Fig : Use of Wheel

Early wheels were simple wooden disks with a hole for the axle. Because of the structure of wood, a horizontal slice of a tree trunk is not suitable, as it does not have the structural strength to support weight without collapsing; rounded pieces of longitudinal boards are required.

The oldest known example of a wooden wheel and its axle were found in 2003 in the Ljubljana Marshes some 20 km south of Ljubljana, the capital of Slovenia. According to the radiocarbon dating, it is between 5,100 and 5,350 years old. It has a diameter of 72 centimetres (28") and has been made of ash wood, whereas its axle has been made of oak.

The spoked wheel was invented more recently, and allowed the construction of lighter and swifter vehicles. In the Harappan civilization of the Indus Valley and North Western India, we find 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, already in the second half of the 3rd millennium BC.

The earliest known examples of wooden spoked wheels are in the context of the Andronovo culture, dating to ca 2000 BC. Soon after this, horse cultures of the Caucasus region used horse-drawn spoked -wheel war chariots for the greater part of three centuries. They moved deep into the Greek Peninsula where they joined with the existing Mediterranean peoples to give rise, eventually, to classical Greece after the breaking of Minoan

dominance and consolidations led by pre-classical Sparta and Athens. Celtic Chariots introduced an iron rim around the wheel in the 1st millennium BC. The spoked wheel was in continued use without major modification until the 1870s, when wire wheels and pneumatic tires were invented.

The invention of the wheel has also been important for technology in general, important applications including the water wheel, the cogwheel (see also antikythera mechanism), the spinning wheel and the astrolabe or torquetum. More modern descendants of the wheel include the propeller, the jet engine, the flywheel (gyroscope) and the turbine.

Therefore we see that a **wheel** is a circular component that can rotate on its centre. Wheels, in conjunction with axles, allow heavy objects to be moved easily while supporting a load. The wheel is the main component of the wheel and axle assembly. Wheel and axle were used in the first carriages. We shall learn about these later.

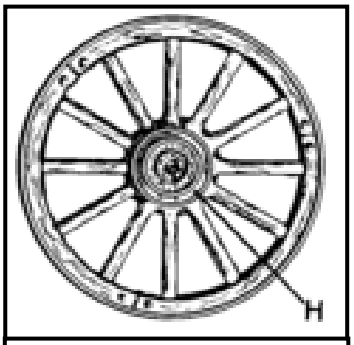

Fig : Wheel

A wheel greatly reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity, or by application of another external force.

The wheel is a device that enables efficient movement of an object across a surface where there is a force pressing the object to the surface. Common examples are a cart pulled by a horse and the rollers on an aircraft flap mechanism.

The low resistance to motion (compared to dragging) is explained as follows:

- the normal force at the sliding interface is the same.
- the sliding distance is reduced for a given distance of travel.
- the coefficient of friction at the interface is usually lower.

The classic spoked wheel with hub and iron rim was in use from about 500 BC (Iron Age Europe) until the 20th century AD. We can see the importance of wheel in various places and its role. Our national flag also contain a circle like wheel. Wheel is very important in our daily life. Some of important drawings of wheel are given herewith.

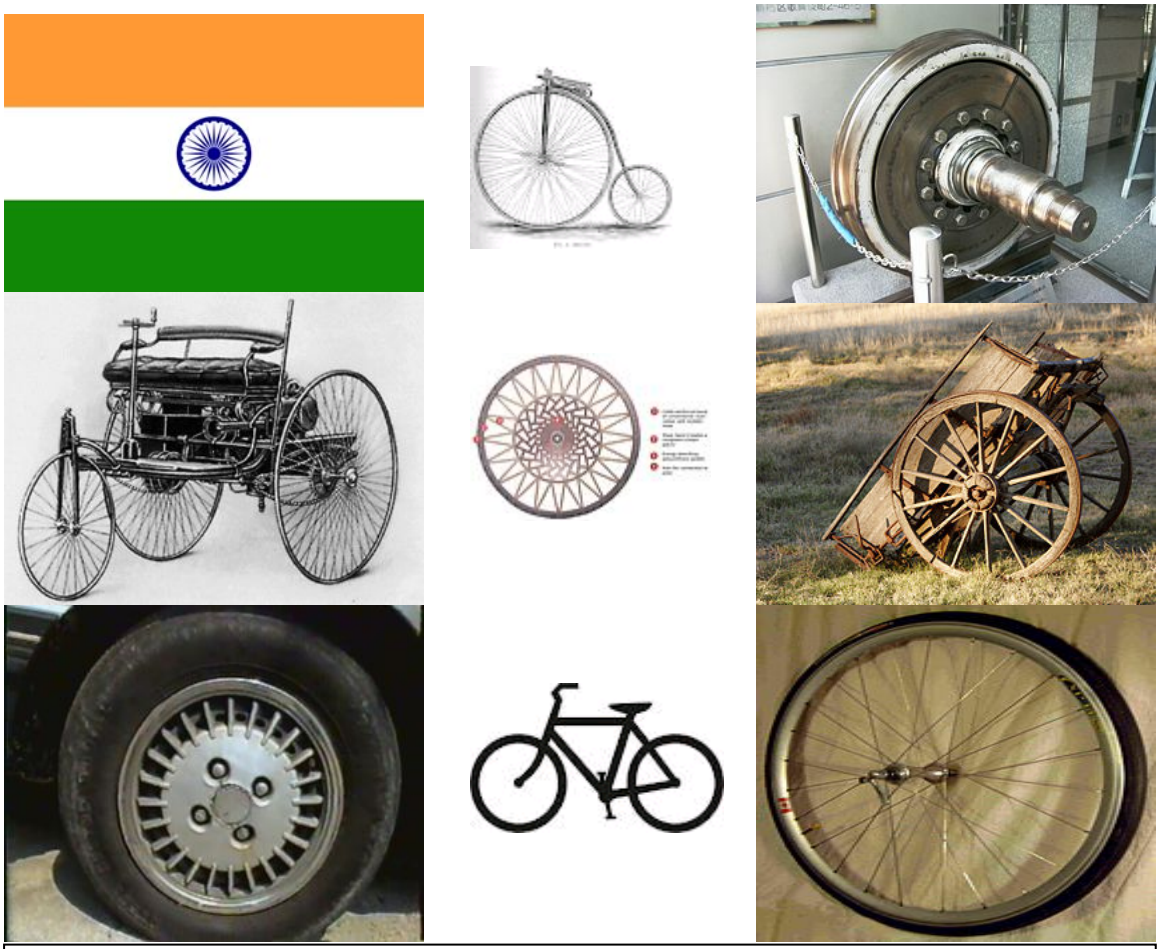

Fig : Photograph of Wheel and its type

Session 1: Invention of Wheel

Exercise: Assignment

1. List the items where wheel has been used in machinery:

S.No.	Items	No. of wheels
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

2. Observe and identify two types of wheels in your school and draw their diagrams

Session 1: Invention of Wheel

Answer the following questions

(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. _____, *is considered as one of the most important mechanical inventions of all time*.

2. Wheel was invented in _____ around 3500 BC which is _____ years back
3. A wheel is a _____ component that can rotate on its centre.
4. Wheel is a _____ that enables efficient movement of an_____ across a surface where there is a force pressing the object to the surface.
5. The coefficient of friction at the interface of wheel is usually _____.

Session 1: Invention of Wheel

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for Assessment Activity.

Part A

- Differentiated between different types of wheel.

Part B

Discussed in class the following:

- What is wheel?
- Components of a wheel
- Materials of wheel
- Design of the wheel

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to draw a wheel and label its parts		
Able to identify wheel		

Session 2: Wheel Cart

Relevant Knowledge

Fig : Use of Wheel Cart

Wheel cart is a vehicle designed for transport, using two wheels. A handcart is pulled or pushed by one or more people. However, from history we learn that animals instead of men were used for pulling the cart. Animals can provide more power. Normally a cart was pulled by a pair of draught animals. The draught animals used for carts may be horses or ponies, mules, oxen, water buffalo or donkeys, or even smaller animals such as goats or large dogs.

Carts have been mentioned in literature as far back as the second millennium B.C. All of you have heard about the Indian sacred book Mahabharat which depicts Lord Krishna as the sarathi the Charioteer of the Rath; the Chariot carrying Pandav prince Arjuna, in the battle field of Kurukshetra. In the Mahabharata war all the leaders used a 'rath' for fighting in the war.

Fig : Different types of cart

Types of carts

Larger carts may be drawn by animals, such as horses, mules, or oxen. They have been in continuous use since the invention of the wheel, in the 5th millennium BC. Carts may be named for the animal that pulls them, such as horse cart or oxcart. In modern times, horse carts are used in competitions. A dogcart, however, is usually a cart designed

to carry hunting dogs: an open cart with two cross-seats back to back; the dogs could 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 still used today where modern vehicles are too expensive or the infrastructure does not favour them.

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 passengers 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?

Experiments were conducted to get answer to this interesting question. 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 the cart. This led to the development of a Horse Carriage.

Session 2: Wheel Cart

Exercise: Assignment

List the different types of carts you have seen in your area:

S.No.	Items	No. of wheels
1		
2		
3		
4		
5		
6		

7		
8		
9		
10		

Session 2: Wheel Cart

Answer the following questions

(Use additional sheets of paper if necessary)

Fill in the blanks

1. Cart are driven by_____
2. In Mahabharata, chariot was pulled by_____.
3. A bullock cart or ox cart is a _____ pulled by oxen (draught cattle).
4. An average _____ men were needed to equal the power of one horse.

Session 2: Invention of Wheel

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for Assessment Activity.

Part A

- Differentiated between different types of Carts.

Part B

Discussed in class the following:

- What is a Cart?
- Different types of Carts
- Materials of Cart
- Importance of Horsepower

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to draw figure of a wheel cart and label its parts		

Session 3: Invention of Automobiles

Relevant Knowledge

Till now we have learnt how wheel was used in carts and horse powered carriages for transportation of goods and people. Engineers kept on improving the Horse Carriage design bit by bit. Parallerly, man was 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.

Fig: Cugnot Steam trolley (Jonathan Holguinisburg)

In the year 1672 the very first such model was developed in the form of a toy. This was actually a steam engine. In this 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 cars powered by an internal combustion engine appeared. The fuel used for running this was 'fuel gas' instead of 'steam'. Of course, the process of using Fuel Gas is different than the process required for using 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 can not often be used immediately by general public. One reason is that the cost of developing new technology is very high. Also, the first models usually do not have any comfort features. However, when more people demand the new models, the cost starts to come down. More features can also be added for making it attractive for general consumers.

Fig: First practical car model

Karl Benz a brilliant German engineer designed and patented the first practical model 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.

An automobile powered by his own four-stroke cycle gasoline engine was built in Mannheim, Germany by Karl Benz in 1885 and granted a patent in January of the following year, under the auspices of his major company, Benz & Cie., which was founded in 1883.

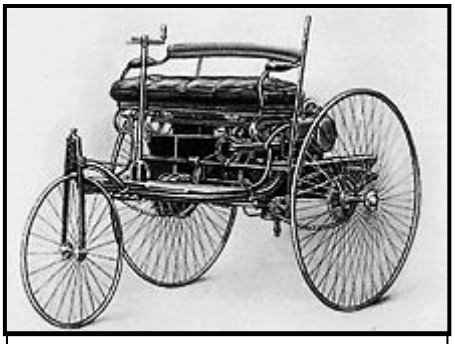

Fig: Photograph of the original Benz Patent-Motorwagen, first built in 1885 and awarded the patent for the concept given here)

It was an integral design, without the adaptation of other existing components and included several new technological elements to create a new concept. He began to sell his production vehicles in 1888.

In 1879, Benz was granted a patent for his first engine, which had been designed in 1878. Many of his other inventions made the use of the internal combustion engine feasible for powering a vehicle. His first *Motorwagen* was built in 1885, and he was awarded the patent for its invention, basis his application on January 29, 1886. Benz began promotion of the vehicle on July 3, 1886, and about 25 Benz vehicles were sold between 1888 and 1893, when his first four-wheeler was introduced along with a model intended for affordability. They also were powered with four-stroke engines of his own design. Emile Roger of France, already producing Benz engines under license, now added the Benz automobile to his line of products. Because France was more open to the early automobiles, initially more were built and sold in France through Roger, than Benz sold in Germany. (Bertha Benz, the first long distance automobile driver in the world in the photograph given here)

Fig: Bertha Benz, the first long distance automobile driver in the world

In August 1888 Bertha Benz, wife of Karl Benz, undertook the first road trip by car, to prove the road-worthiness of her husband's invention. During the last years of the nineteenth century, Benz was the largest automobile company in the world with 572 units produced in 1899.

Towards the end of 19th century, many automobile companies came up in Europe and America. They started producing different models. But these automobiles were very expensive and very few rich people could afford them like Kings, Queens and Rajas in India.

An average person could only dream but could not afford to own a car. Many attempts were being made in Europe and America for reducing costs. The large-scale, production-line manufacturing of affordable automobiles was started by Ransom Olds at his Oldsmobile factory in 1902 based on the assembly line techniques pioneered by Marc Isambard Brunel at the Portsmouth Block Mills, England in 1802. 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. In 1914, an assembly line worker could buy a Model T with four months' pay of some two hundred American car makers in existence in 1920.

Fig: Car Ford Model T

In Europe much the same happened. Morris set up its production line at Cowley in 1924 and soon outsold Ford, while beginning in 1923 to follow Ford's practice of vertical integration. They bought Hotchkiss (engines), Wrigley (gearboxes), and Osberton (radiators), for instance, as well as competitors, such as Wolseley: in 1925, Morris had 41% of the total British car production. Most British small-car assemblers, from Abbey to Xtra had failed. Citroen did the same in France, coming to cars in 1919. Between them Renault's 10CV and Peugeot's 5CV, they produced 550,000 cars in 1925 and Mors, Hurtu, and others could not compete. Germany's first mass-manufactured car, the Opel 4PS *Laubfrosch* (Tree Frog), came off the line at Russelsheim in 1924, soon making Opel the top car builder in Germany, with 37.5% of the market.

Between the 1st and the 2nd World Wars a lot of attention of the Automobile industry went towards development of defence vehicles. As a result several new vehicles like battle Tanks and Jeeps were developed. The tank became very popular in the war field. It is a very versatile vehicle, which can run in any road conditions i.e., in cross country terrain, hills, deserts and tranches etc.

Fig: 1926 Austin 7 Box

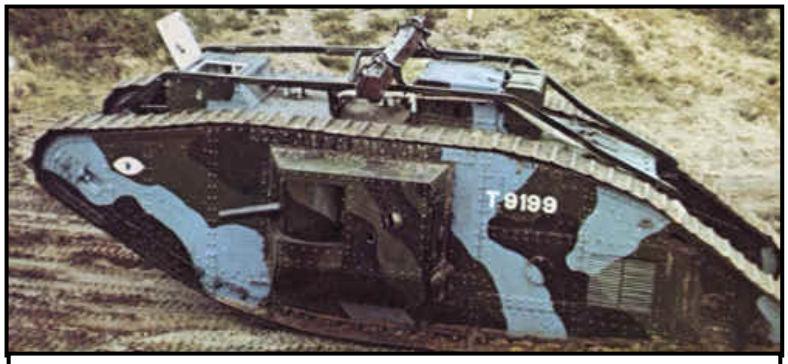

Fig: Mark V Tank

However, during this period, there were some very interesting designs in the passenger segment also. Volkswagen in Germany developed a car in the 30s, which looked like a crawling creature and was therefore called “Beetle” This model has the engine at the back and front bonnet was used as luggage compartment. The car was very convenient to drive and also good looking and stylish. It became very popular in Europe.

Fig : Jeweled one-millionth VW Beetle

By 2002, over 21 million Type 1s had been produced, but by 2003, annual production had dropped to 30,000 from a peak of 1.3 million in 1971. Volkswagen announced the end of production in June 2003. However, the opinion in the United States was not very good. Perhaps because of the characteristic differences between the American and European car markets. Henry Ford II the grandson of original Henry Ford, once described the car as “a little box.”

Fig:1946 GAZ-M20 Pobeda one of the first mass produced car with ponton

Session 3: Invention of Automobile

Exercise: Assignment

1. Make a list of automobile vehicles developed in history.

S.No.	Type of vehicle	Model
1.		
2.		
3.		
4.		
5.		

2. Collect the photograph of any vintage car seen in any magazine.

Session 3: Invention of Automobile

Answer the following questions
(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. In the year _____ the very first such model was developed in the form of a toy.
2. In year 1806, the first cars powered by _____ appeared.
3. Karl Benz a brilliant _____ designed and patented the first practical model in 1885.
4. Volkswagen in _____developed a car in the 30s which looked like a crawling creature and was therefore called _____.

Session 3: Invention of Automobile

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for the Assessment Activity.

Part A

- Differentiated between various types of wheel invention.

Part B

Discussed in class the following:

- When was the first vehicle invented?
- Who was inventor of the first patented car?
- Why development was made in vehicles?
- Who was first rider of the car?
- Name the important manufacturers of the car.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to list important invention of automobile		

Session 4: Invention of Automobiles (Post World War II)
Relevant Knowledge

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. Automobile Industry started on rapid modernization in the 50s and 60s.Many new models of cars were introduced like Edsel, Chevrolet etc.

In USA, road network was built after the second War. This road network was very modern with long highways stretching across the length and breadth of the country. It is good to note that USA has a very big land mass and vast geography. This 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 industry namely General Motors, Ford & Chrysler set about to design big fast moving cars for the American roads. Edsel, Buick, Pontiac Firebird, Chevrolet Impala etc were some of the big cars that came on American highways in the 50s and 60s.It may also be noted that these models used large amounts of petrol or gasoline as it is called in US. But, petrol consumption was not the main issue in those happy days. So, each car maker was competing with the other in making bigger & bigger designs with more luxuries added for comfort. All this made owning and maintaining a car quite costly. Still, more and more Americans were buying 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 USA. Actually, after the devastation of their country during the WW II, several Japanese companies came into

existence like Toyota, Mazda, Mitsubishi, Suzuki etc. Some of these like Mazda, were using American Technology. But, these companies were also developing their own Research capabilities. As a result when the 1973 oil crisis occurred, these companies were very well positioned to roll out smaller, compact, economical models in USA.

Since then, companies like Toyota, Honda have been steadily increasing their market presence worldwide. The modern era is normally defined as the 25 years before the current year. However, there are some technical and design aspects that differentiate modern cars from antiques. Without considering the future of the car, the modern era has been one of increasing standardisation, platform sharing, and computer-aided design.

- 1966–present Toyota Corolla — a simple small Japanese saloon/sedan that has come to be the best-selling car of all time.
- 1970–present Range Rover — the first take on the combination of luxury and four-wheel 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.
- 1973–present Mercedes-Benz S-Class — electronic Anti-lock Braking System, supplemental restraint airbags, seat belt pretensioners, and electronic traction control systems all made their debut on the S-Class. These features would later become standard throughout the car industry.
- 1975–present BMW 3 Series — the 3 Series has been on the Car and Driver magazine's annual Ten Best list 17 times, making it the longest running entry in the list.
- 1977–present Honda Accord saloon/sedan — this Japanese sedan became the most popular car in the United States in the 1990s, pushing the Ford Taurus aside, and setting the stage for today's upscale Asian sedans.
- 1981–1989 Dodge Aries and Plymouth Reliant — the "K-cars" that saved Chrysler as a major manufacturer. These models were some of the first successful American front-wheel drive, fuel-efficient compact cars.

- 1983–present Chrysler minivans — the two-box minivan design nearly pushed the station wagon out of the market, and presaged today's crossover SUVs.
- 1984–present Renault Espace — first mass one-volume car of non-commercial MPV class.
- 1986–present Ford Taurus — this mid-sized front-wheel drive sedan with modern computer-assisted design dominated the American market in the late 1980s, and created a design revolution in North America.
- 1989–1999 Pontiac Trans Sport — was one the first of the one box cars.
- 1997–present Toyota Prius — launched in the Japanese market, in September 2010 reached worldwide cumulative sales of 2.0 million units, becoming the most iconic hybrid electric vehicle in the world.
- 1998–present Ford Focus — one of the most popular hatchbacks across the globe, that is also one of Ford's best selling world cars.
- 2008–present - Tata Nano — The Tata Nano is an inexpensive(₹100,000), rear-engine, four-passenger city car built by the Indian company Tata Motors and is aimed primarily at the Indian domestic market.
- 2010–present, Nissan Leaf and Chevrolet Volt — an all-electric car and a plug-in hybrid correspondingly, were launched in the U.S. and Japanese markets in December 2010, becoming the first mass production vehicles of their kind.

Indian Automobile Scenario

We should now look at the Automobile industry in India. It started with import of cars for Royal families. Perhaps the first cars imported in India were in 1920s.

For many years India did not have any manufacturing capability of its own. Hindustan Motors is one of the original car manufacturers in India, founded in 1942 by Mr. B.M. Birla; it was a leader in car sales until the 1980s, when the industry was opened up from protection. It is the producer of the

Ambassador car, widely used as a taxicab and as a government limousine. This car is based on the Morris Oxford, a British car that dates back to 1954.

Fig : Ambassador Car

Another India company Premier Automobiles was founded in 1944. The company first launched production by building vehicles under license from Dodge and Plymouth. In 1951, they began producing versions of the Fiat 500 for the Indian market. This was followed by the Fiat 1100 in 1954. In 1973, the 'Premier' was used on their vehicles for the first time the Premier President, based on the Fiat 1100 as Premier Padmini. Ambassador and Fiat/ Padmini were the two dominant models of cars on the Indian roads till 1983.

Fig : Fiat Car

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

Fig : Maruti Car

By the end of 90s several other global multinational car makers also started manufacturing their models in India. Among them were, General Motors, Ford, Hyundai etc.

In just a few years the Indian market for cars has become a hot spot of global automotive activity.

As we see, Indian Auto industry started with import of cars in the 20s. Then the first manufacturing started in the 40s. With continued progress many Indian companies like Maruti, Tata, Mahindra have become very big global names. Now, they are not merely manufacturing to European/American or Japanese designs. But, they are doing so with their own research & development capabilities. As a result, Nano model was developed by TATA Motors. This is the cheapest car in the world with all convenient and quality features. India is now also exporting nearly 12% of manufactured cars to Europe, USA 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. India's passenger car and commercial vehicle manufacturing industry is the sixth largest in the world, with an annual production of more than 3.7 million units in 2010.[1] According to recent reports, India is set to overtake Brazil to become the sixth largest passenger vehicle producer in the world, growing 16-18 per cent to sell around three million units in the course of 2011-12. In 2009, India emerged as Asia's fourth largest exporter of passenger cars, after Japan, South Korea, and Thailand. In 2010, India became Asia's third largest exporter of passenger cars, after Japan and South Korea beating Thailand.

As on 2010, India is home to 40 million passenger vehicles. More than 3.7 million automotive vehicles were produced in India in 2010 (an increase of 33.9%), 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 more than 9 million by 2020. By 2050, the country is expected to top the world in car volumes with approximately 611 million vehicles on the nation's roads.

The majority of India's car manufacturing industry is based around three clusters in the south, west and north. The southern cluster near Chennai is the biggest with 40% of the revenue share. The western hub near Maharashtra is 33% of the market. The northern cluster is primarily Haryana with 32%. Chennai, is also referred to as the "*Detroit of India*" with the India operations of Ford, Hyundai, Renault and Nissan headquartered

in the city and BMW having an assembly plant on the outskirts. Chennai accounts for 60% of the country's automotive exports. Gurgaon and Manesar in Haryana form the northern cluster where the country's largest car manufacturer, Maruti Suzuki, is based. The Chakan corridor near Pune, Maharashtra is the western cluster with companies like General Motors, Volkswagen, Skoda, Mahindra and Mahindra, Tata Motors, Mercedes Benz, Land Rover, Fiat and Force Motors having assembly plants in the area. Aurangabad with Audi, Skoda and Volkswagen also forms part of the western cluster. 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. Kolkatta with Hindustan Motors, Noida with Honda and Bangalore with Toyota are some of the other automotive manufacturing regions around the country.

Session 4: Invention of Automobile (Post World War II)

Exercise: Assignment

1. List the models of car running in your area.

S.No.	Name of model
1	
2.	
3.	
4	
5	
6	
7	
8	
9	
10	

2.Observe a car and draw its diagram

Session 4: Invention of Automobile (Post World War II)

Answer the following questions
(Use additional sheets of paper if necessary)

Fill in the blanks

1. One very popular model from FORD was named _____.
2. Big Three of car industry namely General Motors, Ford & Chrysler set about to design big fast moving cars for the _____ roads.
3. First cars imported in India were in _____.
4. Ambassador and Fiat/ Padmini were the two dominant models of _____ on the Indian roads till 1983.
5. In 1983, Government of India started Maruti Udyog in collaboration with _____ of Japan.
6. First Cheapest Indian car name is _____.

Session 4: Invention of Automobile (Post World War II)

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for Assessment Activity.

Part A

- Discuss the automotive industry of India

Part B

Discussed in class the following:

- When were cars imported in India?
- Manufacturers of Indian Car
- Development of Automobiles in India.
- Cluster of auto in India.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to make a list of Indian automobile manufactures.		

Suggested Reading

Books

Title	Author	Publisher
Automobile Engineering Vol I	Kirpal Singh	Standard Publishers
Automobile Engineering, Vol II	Kirpal Singh	Standard Publishers
Text Book of Automobile Engineering	R. K. Rajput	Laxmi Publications
Automobile Engineering	R. K. Singal	S. K. Kataria and Sons
Automobile Engineering Theory	Kapil Dev	Computech Publications
Automobile Engineering,	K. M. Moeed	S. K. Kataria and Sons

Websites

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www.wikipedia.com

www.tatamotor.com

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