NILASAILA INSTITUTE OF SCIENCE & TECHNOLOGY
SERGARH-756060, BALASORE (ODISHA)

AUTOMOBILE ENGINEERING

6TH SEMESTER

VECHICLE MAINTENANCE AND MOTOR VEHICLE ACT

BY

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CHAPTER-1 (VEHICLE MAINTENANCE)

VEHICLE MAINTENANCE:- Vehicle Maintenance means service, repair, or maintenance of any type of motor vehicle, including but not limited to: vehicle and equipment rehabilitation, mechanical repairs, painting, fueling, and lubrication.

Properly maintaining your vehicle will not only ensure its safety and dependability, but may also increase fuel efficiency as well as help maintain your vehicle's value. It is recommended to consult your vehicle's owner's manual and follow its preventive vehicle maintenance schedule.

Need of maintenance:-

OIL AND COOLANT LEVELS

Every month, or every few petrol fill-ups and especially before any long road trips, it's a good idea to get under the hood of your car and inspect both the oil and coolant levels while the engine is cool. Low levels of either can lead to engine problems if left unchecked. Refer to your owner's manual to locate both on your specific vehicle

AIR FILTER

Your engine's air filter is what regulates the air that flows into your engine and helps keep out debris and particulate. By making certain that your air filter is flowing properly, you can improve your fuel efficiency, decrease your emissions, and help ensure the life of your engine. This can be done easily at home, so check your owner's manual for instructions and how often it needs to be changed**.**

TYRE PRESSURE AND TREAD DEPTH

Since well-maintained tyres are integral to a safe, fuel-efficient ride, make it a habit to visually inspect your tyres often. Check the pressure in your tyres every month, and before long trips or carrying extra load. Don't forget the spare. A tyre pressure gauge will be needed to check your tyre pressure. Your owner's manual will tell you how much air pressure your tyre needs. You can check your tread depth using a gauge**.**

HEADLIGHTS, TURN SIGNALS, BRAKE, AND PARKING LIGHTS

It's important that the lights on your vehicle are properly functioning, but

oftentimes it can be easy item to overlook. Once a month, turn on your headlights when you're parked in front of a flat surface and check that both headlights are working properly and well-positioned. Walk around your car and visually inspect

both turn signals and your parking lights. Have a friend stand behind the car while you engage the brakes to be certain that your brake lights are functional.

OIL & FILTER

The motor oil in your vehicle's engine serves a whole slew of functions: it lubricates the moving parts, helps act as a sealant against debris, cools the engine, reduces wear and tear, and helps prevent engine corrosion. Keeping it clean is vital for good engine health. Depending on your car and what kind of oil you're using, you may need to change both the oil & oil filter as much as every 6 months or 10,000 kilometres. Many newer vehicles' owners' manuals will recommend changing your oil less frequently – often in-between 8,000 and 16,000 kilometres. Check your vehicle owner's manual and consult with a professional to be certain what is appropriate for your vehicle

.

ROTATE TYRES

Depending on your vehicle alignment, usage, and many other factors, the tread wear patterns on your tyres may vary between the front and back tyres, or even from one side of the tread to the other. Rotating your tyres will help to extend the service life of your tyres by more evenly balancing the tread wear, and helping prevent noise and vibration problems

TRANSMISSION FLUID

Much like the oil in your engine, transmission fluid is a lubricant that helps keep all of the moving parts inside of your transmission functioning properly. Whether you're driving an automatic or manual transmission vehicle, it is essential that you have your transmission fluid checked and changed when needed to avoid costly transmission damage or replacement. Follow the vehicle manufacturer's recommendations

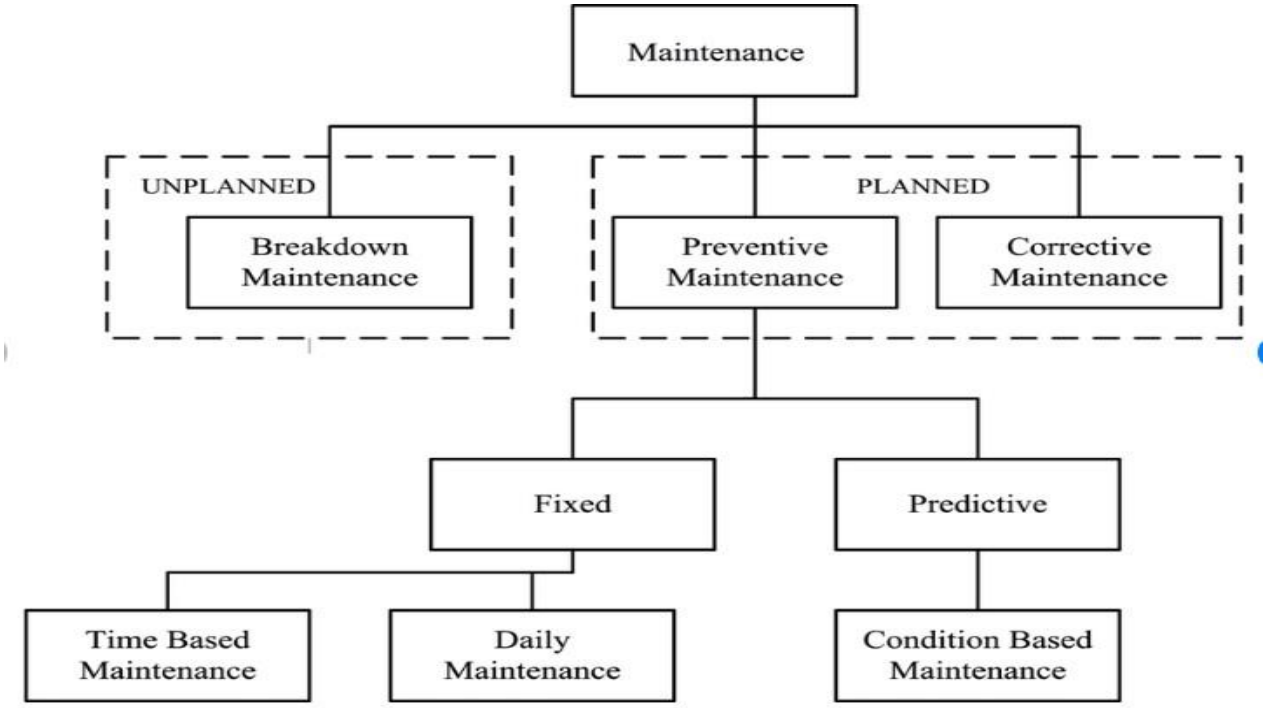
COOLANT FLUID EXCHANGE:-

The radiator in your car is a vital component that helps keep your engine cool and functioning properly. Having your coolant system flushed regularly will help get rid of contaminants that can build up inside as well as ensure that your radiator is filled to a proper level. Check your vehicle manufacturer's recommendation to find out how often your coolant should be changed**.**

SPARK PLUGS

The spark plugs in your engine ignite the gas and air mixture that ultimately powers your vehicle. If your spark plugs aren't functioning properly, your engine will lose power and won't run at optimal capacity. Have a professional check and replace any faulty spark plugs depending on vehicle manufacturer's recommendations or when you feel a decrease in your engine's power**.**

Types of maintenance systems



Types of maintenance.

Breakdown maintenance

Breakdown maintenance is maintenance performed on a piece of equipment that has broken down, faulted, or otherwise cannot be operated. The goal of breakdown-maintenance is to fix something that has malfunctioned. To the contrary, preventive maintenance is performed in order to keep something running.

Breakdown maintenance, sometimes called run-to-failure maintenance, occurs when an asset completely breaks down and needs repair to resume operation

The breakdown maintenance definition is a type of maintenance that involves using a machine until it completely breaks down and then repairing it to working order. For example, this type of maintenance would occur if you wait until a machine stops working before fixing it

Breakdown maintenance is triggered by either:

- A planned event, such as run-to-failure maintenance.
- An unplanned event, such as the need for reactive or corrective maintenance.

This type of maintenance is also used as a last-resort attempt to extend the life of equipment that has lost functional abilities. Breakdown maintenance tends to cost more than preventive maintenance.

Preventive maintenance

Preventive maintenance is the act of performing regularly scheduled maintenance activities to help prevent unexpected failures in the future. Put simply, it's about fixing things before they break.
There are three main types of preventive maintenance: Time, usage, and condition-based triggers. A variation of these types of preventive maintenance should ideally be scheduled and performed on all equipment items to prevent unplanned failure.
PM is used to anticipate and prevent the breakdown of equipment and should ideally be performed on all items of equipment to prevent age-related failure. Manufacturers often provide recommendations to maintain a piece of equipment

The exact requirement for preventive maintenance will vary depending on the equipment and the operation it is performing. Industry uses standards to help determine schedules for maintenance so that assets do not run to failure. These guidelines will also cover the type of inspection or maintenance that is needed.

Ideally, by following guidelines set down by manufacturers or standards, a PM schedule should ensure proactive maintenance rather than having to resort to reactive maintenance when something has already begun to fail.

Following this type of predictive maintenance schedule, through tasks such as condition monitoring, requires accurate recording of inspections and servicing against an understanding of the lifespan of a particular piece of equipment. These records will help determine when preventive maintenance is required.

Predictive maintenance

Predictive maintenance seeks to prevent equipment failure and downtime by connecting IoT-enabled enterprise assets, applying advanced analytics to the real-time data they deliver, and using the resultant insights to inform educated, cost-effective, and efficient maintenance protocols

Let's say you have a pump on your production line. If this pump breaks, it will stall production until you can fix or replace it, which could take hours. Your asset management system can monitor the pump's temperature. If its temperature rises past a certain threshold, you know the pump is under stress and could possibly fail soon. You can then schedule some time to perform preventive maintenance before a complete failure stops production.

Predictive maintenance software can notify the maintenance team of the stress on a specific machine. It uses predictive analytics to flag issues and let the team know to set up preventative maintenance, which helps reduce costly downtime

Total productive maintenance

Total productive maintenance (TPM) is a strategy that operates according to the idea that everyone in a facility should participate in maintenance, rather than just the maintenance team. This approach uses the skills of all employees and seeks to incorporate maintenance into the everyday performance of a facility.

It is the process of maximizing equipment effectiveness through the active involvement of all supporting department
TPM develop a maintenance-free framework by identifying the losses and eliminating them. It will lead to a considerable decrement in the maintenance cost.

Total productive maintenance (TPM) is the process of using machines, equipment, employees and supporting processes to maintain and improve the integrity of production and the quality of systems.

CHAPTER-2

SERVICE STATION

SERVICE STATION –

A service station is a place that sells things such as petrol, oil, and spare parts. Service stations often sell food, drink, and other goods. A service station is a place beside a motorway where you can buy petrol and other things, or have a meal.

A place equipped for servicing automobiles, as by selling gasoline and oil, making repairs, etc. a place that provides some service, as the repair of equipment, or where parts and supplies are sold, provided, dispensed, etc.

The automotive services industry encompasses fields such as auto parts manufacturing, automotive process assembly, and car engine machine repair. Automotive services may also specialize in brake design, clutch repair, or diesel engine repair.

Types Service station

1. Private service stations
2. Company's authorized service stations
3. Company's dealer service stations

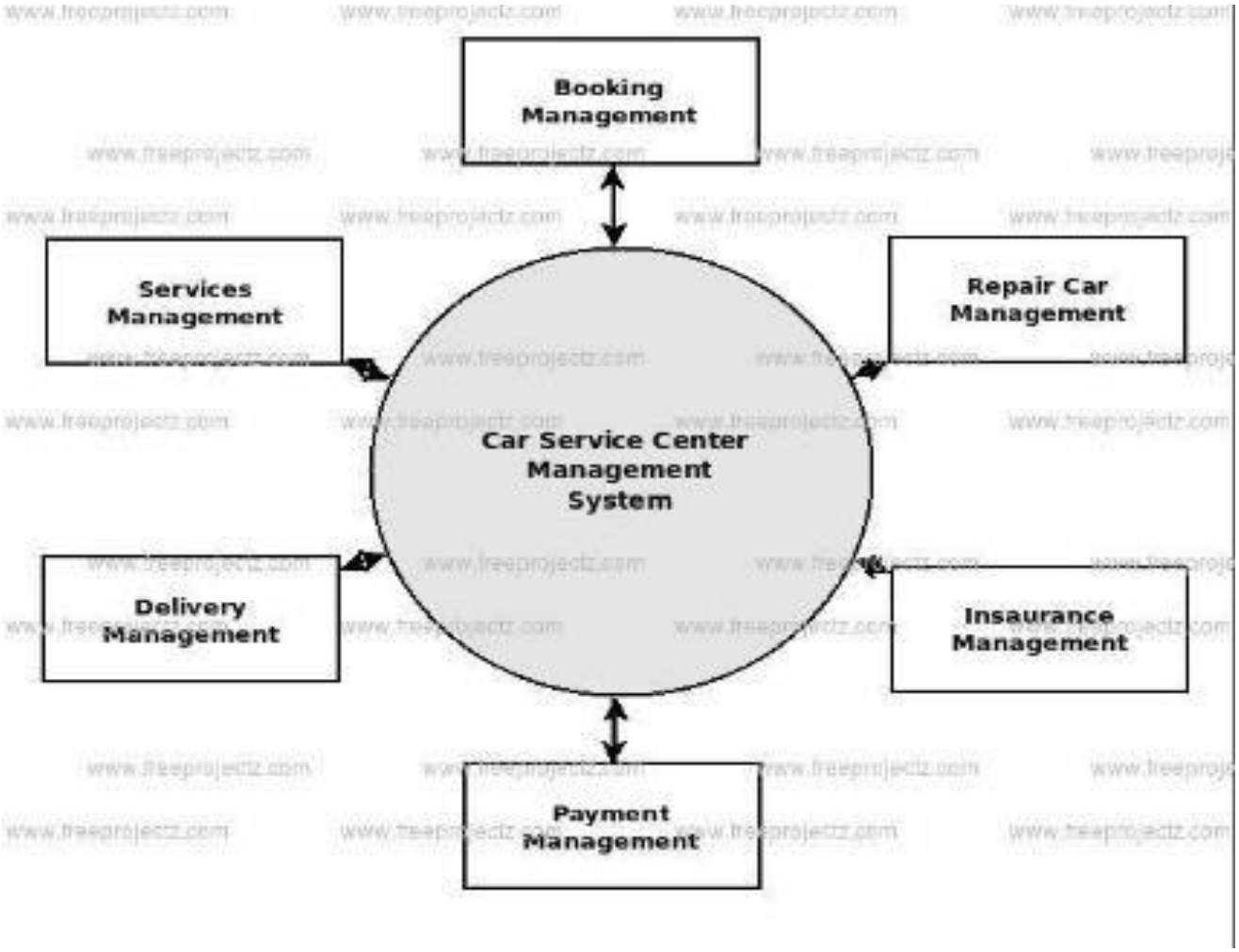
Private service stations

Automobile service stations means any establishment where motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles or approved containers, including any building used for minor automotive repair work.

A service station is a place that sells things such as petrol, oil, and spare parts. Service stations often sell food, drink, and other goods. A service station is a place beside a motorway where you can buy petrol and other things, or have a meal.

domestic service, the employment of hired workers by private households for the performance of tasks such as housecleaning, cooking, child care, gardening, and

personal service. It also includes the performance of similar tasks for hire in public institutions and businesses, including hotels and boardinghouses.



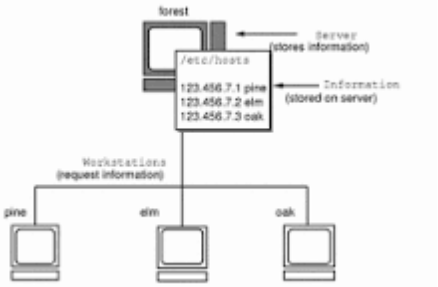
Company's authorized service stations

A place equipped for servicing automobiles, as by selling gasoline and oil, making repairs, etc. 2. a place that provides some service, as the repair of equipment, or where parts and supplies are sold, provided, dispensed, etc.

Automobile Service Station or "filling station" means a place where gasoline, kerosene or other motor fuel or lubricating oil or grease for operating motor vehicles is offered for sale to the public and deliveries are made directly into motor vehicles, including greasing and oiling on the premise

Automobile service unit are those units which runs the business of servicing of vehicles. This includes two wheeler or four wheeler servicing. Each vehicle

received for service may have unique and different problem or issue which need to be taken care while doing service.



Name services store information in a central place that users, workstations, and applications must have to communicate across the network such as: Machine (host) names and addresses.

Company's dealer service stations

Distributor is an intermediary entity between the manufacturer of a product and another entity in the distribution channel or supply chain, such as a retailer, a value-added reseller (VAR) or a System Integrator (SI). The distributor performs some of the same functions alike a wholesaler does, but generally plays an active role. Based on the association with EVNEXUS, the distributor takes the lead at district level. A district may consists of many taluks/zones/mandals. The boundary of the distributor is restricted to district(s) to which the distributor entered an agreement with EVNEXUS. The distributor has rights to appoint dealer(s)/sub-dealer(s) who abide and agree to the norms and standards for a dealer/sub-dealer put forth by EVNEXUS. EVNEXUS has all the rights to appoint a dealer(s)/sub-dealer(s) directly, bypassing the distributor, upon which the distributor has no say. It is the sole discretion of distributor to deal with dealer(s)/subdealer(s) about margin, profits, benefits etc., and EVNEXUS does not interfere in the association, unless and until, the points/norms/guidelines/conditions, whatever applicable, under dispute, breach this agreemen

Low-speed variants have a maximum speed of 25 kmph, while majority of the electric motorcycles being sold in India, come under this category. At present, EVNEXUS deals with Low-speed variants and plans to expand its base.

1.EVNEXUS will train the service personnel and supply the products and projects to distributor/dealers on regular basis as mutually agreed by both parties. EVNEXUS Page 10 of 36 intends to supply the products and projects on "Just-in-time" basis. However, based on stock availability, regulator issues, environmental catastrophes, unprecedented socio/economic/technical consequences may lead to unexpected delay. During such extraordinary situations, the Distributor/Dealer(s) need to support EVNEXUS and retain the customer with extra effort.

2. EVNEXUS will get necessary approvals from the Government with respect to appropriate agencies time to time for their product, project and service.

3. Distributor agrees to process the payment, time to time, for their purchase of product, project and service.

4. The price is subjected to revision on a regular basis, according to market demands. The same will be communicated officially to the distributor/dealer(s) as and when needed. EVNEXUS has the final say, in terms of deciding the price, margin and profits for the product, service and project undertaken.

5. EVNEXUS has the sole and absolute ownership of the brand names and the distributor, dealer and sub-dealers and any party outside this agreement do not have any claim on the same.

6. Price and cost of the product, project and service (E-Scooter, E-bikes, E-Rickshaw & ECart) and setting up the charging station and battery swapping station will be fixed by EXNEXUS from time to time based on market conditions and demand-supply ratio. No rights are held by the Distributor/Dealers to increase or decrease the price of the products, service and projects irrespective of the reasons, without approval of EVNEXUS Private Limited.

7. Distributor has to make 100% advance payment through NEFT/RTGS/Cheque Payment to EVNEXUS Private Limited on the date of placing the order. No other mode of payment is accepted by EVNEXUS private Limited. Particularly, no cash transaction is entertained at EVNEXUS for any scenario behind.

8. In case of high-speed vehicle sales, Regional Transport Office (RTO) registrations will have to be handled by the Distributor/Dealer(s) who need to facilitate the service at actual cost required by the respective agencies/agent.

9. Distributor/Dealer(s) has an obligation to meet i.e., they have to retain the distributorship/dealership for a total of 60 months from the date of entering this agreement. Further, the distributor/dealer(s) has to pay EVNEXUS, a caution deposit of 3,00,000 INR (Rs. Three Lakhs only) upfront through Online transfer/Cheque. In case, if the distributor/dealer(s) does not complete the tenure of 60 months, the Caution Deposit of 3,00,000 INR (Rs. Three Lakhs only) will not be refunded to the Distributor/Dealer(s) at any cost. If the distributor/dealer initiates the termination of this agreement after the successful completion of 60 months from the date of entering this agreement with EVNEXUS private limited, 2, 00,000 INR (Two Lakhs rupees only) will be refunded to the distributor/dealer(s) through online transfer / cheque after 14 business days of termination of the agreement on mutual terms. EVNEXUS is entitled to retain 1,00,000 INR (One Lakhs rupees only) and the distributor/dealer(s) cannot claim this, then or anytime in the future. If the distributor/dealer(s) wishes to extend the association with EVNEXUS and continues with the same agreement, the caution deposit of 3,00,000 INR (Rs. Three Lakh only) will be retained until the termination of this agreement on mutual terms. Caution deposit paid to EVNEXUS private limited is not entitled to interests in any form during the entire tenure of this agreement.

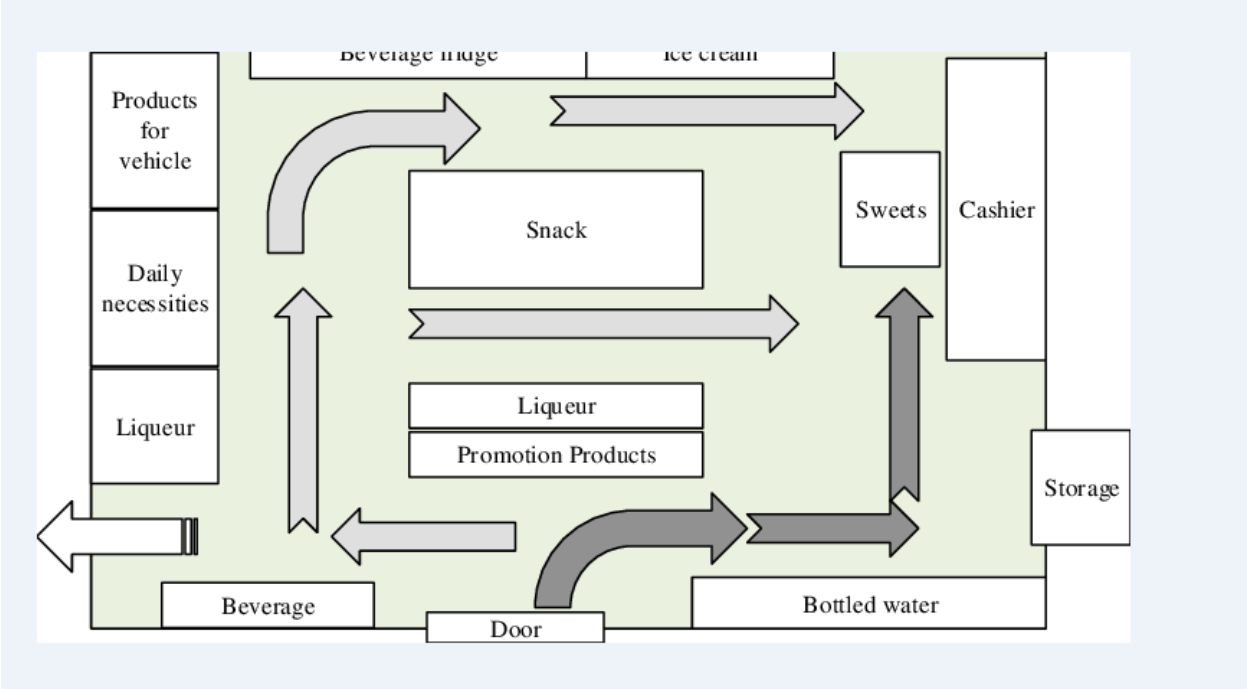
10. EVNEXUS has tie-ups with many Banks and Non-Banking Finance companies through which vehicle loans can be arranged to the customer via Equated monthly installment (EMI) scheme. However, the sanctioning of the loan to a customer is solely decided by the Banker/Financial Company. EVNEXUS does not guarantee the loan neither run any EMI schemes. Further, if the distributor/dealer(s) assure loan-facility

Criteria for service station

(i) Drive the vehicle with care every day
(ii) Be patient during the accident or breakdown of a vehicle, call helpline number of vehicle
(iii) Buy petrol from reputed and trustworthy service stations
(iv) Do not fill up fuel if your vehicle is parked around an oil tanker
(v) Car keychain should be light
(vi) Preserve the car during long-term storage
(vii) Clean the inside too
(viii) Clean dash gauges carefully
(ix) Preserve door and window seals
(x) Do not carry too much load
(xi) Use upholstery cleaners on soiled seats
(xii) Place a towel under baby seats
(xiii) Protect car paint from the sun by parking it in a spot that is out of direct sunlight. You can also apply high-quality wax as it prevents sun damage to car paint from ultraviolet radiation
(xiv) Maintain proper tire inflation
(xv) Check for uneven wear
(xvi) Rotate your tyres
(xvii) Get wheel alignment checked
(xviii) Top off brake fluid
(xix) Care for anti-lock brakes
(xx) Check engine oil at every other fill-up
(xxi) Change oil frequently
(xxii) Do not mix coolants
(xxiii) Avoid hose hassles
(xxiv) Check drive-belt tension
(xxv) Clean your engine
(xxvi) Keep the AC functional, even occasionally during winters

(xxvii) Maintain your car's battery
(xxviii) Seal a leaky radiator
(xxix) Dilute your coolant

Workshop layout



Workshop documents and records

(i) Job card and its filling procedure
(ii) Washing of vehicle and Washing Procedure
(iii) Engine minor tune up
(iv) Oil replacement
(v) Checking of battery — electrolyte level and top-up
(vi) Clutch and brake-free play and their adjustment
(vii) Lighting system, its various parts and their checking
(viii) Identification of greasing points of wheelers and procedure of greasing
(ix) Checking of tyre inflation and procedure of inflation

Job card and its importance

When a vehicle owner enters the service centre, he or she is attended by the supervising engineer. The customer informs about the vehicle defect. After getting feedback from the vehicle owner or driver regarding defects of the vehicle, the supervising engineer in a service station or workshop inspects 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 signs the job card before the repairs on the vehicle are started. Work is then assigned to the concerned person to carry out repairs and the supervisor signs the job card too. The work order or job card is prepared in duplicate.

Contents of a Standard Job Card

(i) Job card number

(ii) Name, address and phone number of the service centre

(iii) Name, address and phone number of the customer

(iv) Details of vehicle, such as make, model, registration number, chassis number, engine number, date of sale, kilometres' reading, receiving date and time, delivery date and time by the service centre

(v) Checklist before trial

(vi) Customer's observation

(vii) Job to be done

(viii) Estimated cost in rupees for the customer and insurance company

(ix) Labour required

(x) Name of the mechanic

(xi) Name and signature of the supervisor

(xii) Customer's authorisation for repair and their signature

(xiii) Acknowledgement

Filling the Job Card

Almost all the information must be properly filled in the job card (Fig. 6.8) by the supervisor with their signature and the customer also needs to sign on the authorisation for work column. Then the repairing or servicing job on the vehicle is taken over.

A standard job card is shown below. The student must practise to fill the same

JOB CARD NO. 14050

One to One Service

SETCO

09/2-A, Industrial Area, Nazafgarh Road, Near Hans Motors, Behind Moti Nagar Bus stand, New Delhi-110 015
Tel. : 011-64644400, 9268564445
Branch 1 : 947/2, Main Mata Chowk, Vasant Vihar Road, Mahipalpur, New Delhi-110 037
Tel. : 011-64644401, 9268573335
Branch 2 : C-240, Near Radha Krishna Mandir, Pandav Nagar, Delhi-110 092
Tel. : 011-22483501, 9268573337
E-mail : services@setco.biz

Name : .....
Address : .....
.....
Phone : Res. : .....
Office : .....
Mobile : .....

Model : .....
Regn. No. : .....
Chassis No. : .....
Engine No. : .....
Date of Sale : .....
Kms. Reading : .....
Receiving Date & Time : .....
Delivery Date & Time : .....

Free Service No. ☐
Coupon No. ☐
Protection Plus ☐ Paid ☐ Warranty ☐ FOC ☐ Accidental ☐ Complain ☐

CHECK LIST	OK	Not OK	Customer's Observation	Job to be Done	Estimated Cost Rs.
Check Before Trial					
Engine : Idle RPM	☐	☐			
Engine Oil Qty.	☐	☐			
Electrical : Battery	☐	☐			
Horn	☐	☐			
Type Pressure :					
Front / Rear ..... PSI	F/R	F/R			
Clutch Lever Free Play	☐	☐			
Brake Lever Free Play	☐	☐			
Brake Pedal Free Play	☐	☐			
Damage & Shortages-Yes / No					
Lights (HL/TL/BL/Win/Pilot)					
Rear View Mirror (L/R)					
Dent (D) / Scratches (s) :					
Choke Cap : Yes/No					
Tool Kit : Yes/No					
Accessories :					
Fuel Level (E F)					
Others (if any) :					
				LABOUR	
				TOTAL	

Note : 1) Please advice Customer on "Not OK" points.
2) Please verify Customer Observation.

Mechanic Name : **Supervisor's Sign :**

CUSTOMER AUTHORIZATION

I hereby Authorise the above jobs to be done & parts, if required it will be at my cost. Any additional jobs or parts required shall be at my cost. Vehicle is stored, repaired, tested and driven at my risk. Estimate given above for the labour charges and parts is only approximate.

Customer Signature

Date : .....

Job Card No.

SETCO

09/2-A, Industrial Area, Behind Moti Nagar Bus Stand Tel. : 011-64644400, 9268564445
Branch 1: 947/2, Mahipalpur,
Tel. : 011-64644401, 9268573335
Branch 2 : C-240, Pandav Nagar
Tel. : 011-22483501, 9268573337
E-mail : services@setco.biz

Acknowledgment

Date .....

Regn. No. : ..... Chassis No. .....

Receiving Date ..... Delivery Date/Time .....

Model : .....

Supervisor's Signature

CHAPTER-3

TOOLS AND EQUIPMENTS

Equipment is a general time with a broader definition compared to tools and equipment. It refers to a set of tools needed to perform a specific task. People often use the word equipment as the plural form of tool. In this case, a collection of tools will be called equipme

Computers, trucks and manufacturing machinery are all examples of equipment. They are tangible because they have a physical form—unlike intangible assets (such as patents, trademarks or copyrights) that do not.

List of tools

Pliers
Hammer
Tape measure
Spirit level
Chisel
Screwdriver
Utility knife
Wrench
Axe
Hacksaw
Mallet
Circular saw
Drill
Scissors
Adjustable spanner
Saw
Ladder
Nail
Shovel
Chainsaw
Spade
Electricity

Screw

List of equipments

Blender
Computer
Microscope
Thermometer
Mixer
Excavator
Refrigerator
Helmet
Microwave
Beaker
Test Tubes
Electricity
Stethoscope
Weighing scale
Nebulizer
Main battle tank
Bunsen burner
Centrifuge
Toaster
Pipettes
Kitchen stove
Erlenmeyer flask
Tripod
Microphone

Double ended open jaw spanner(fix spanner)

Double Open Ended Spanner is generally used for tightening and loosening of rotary fasteners such as nuts and bolts

Ring spanners are often double-ended and usually with offset handles to improve access to the nut or bolt. A double-ended tool with one end being like an open-end wrench or open-ended spanner, and the other end being like a box-end wrench or ring spanner

The number of brands available in the market are committed to providing their customers with the best double ended spanner set which supports a long, durable life. These brands deliver top-notch quality **double end open jaw spanner** sets at an affordable price. Some of the renowned brands that manufacture these products

Double ended ring spanner

Double ended ring spanner, also known as a double-ended wrench, is a tool designed for tightening or loosening nuts and bolts.
Their offset shanks provide clearance for knuckles or obstructions alongside the nut. They may also be used where there is an obstruction close to the sides of a nut.

Combination spanner

Combination spanner is a tool which is used to provide grip for mechanical purposes. used for fastening nuts and bolts.

Combination Spanners. A toolbox must-have, these spanners combine two of the most common spanners in one double-ended tool. Combination spanners have an open end on one side and a ring spanner on the other. They are often sold in multi-piece sets with different sizes and head types.

Contains standard combination spanner sizes; Metric 6mm, 7mm, 8mm, 9mm, 10mm, 11mm, 12mm, 13mm, 14mm, 17mm, 19mm, 22mm, 24mm, 26mm. Imperial 1/4”, 5/16”, 11/32”, 3/8”, 7/16”, 1/2”, 9/16”, 5/8”, 11/16”, 3/4".

Combination spanner - A combination spanner is **a metallic tool with two handles supporting pins which turn to execute a thread**.

Socket or box spanner

What is a socket spanner?

A socket wrench (or socket spanner) is a type of spanner (or wrench in North American English) that uses a closed socket format, rather than a typical open wrench/spanner to turn a fastener, typically in the form of a nut or bolt.

It is strictly forbidden to use the ring wrench with cracks and serious wear of the inner hole. Function of box spanner: box spanner is easy to be put on the nut and not easy to slip off. It is suitable for loosening the nut at the beginning or locking the nut at the end.

What is the use of a socket?

Sockets are useful for both stand-alone and network applications. Sockets allow you to exchange information between processes on the same machine or across a network, distribute work to the most efficient machine, and they easily allow access to centralized data.

Screw driver

Screwdrivers are a type of hand tool used for the insertion and removal of screws. They are available in a multitude of variations to correspond to the correct screw drive. The drive or head of a screw has a shaped cavity and protrusion that fits the screwdriver tip.

A screwdriver is a tool that is used for turning screws. It consists of a metal rod with a flat or cross-shaped end that fits into the top of the screw.

Types of screw

1. Countersunk **Screw**. · 2. Pan Head **Screws**. · 3. Self Drilling **Screws**. · 4. Set **Screws**. · 5. Threaded **Screw**. · 6. Wood **screws**. · 7. Weld **screws**. · 8. Hex cap **screws**.

Types of screw drivers

1. **Flat Head (or Slotted Head) Screwdriver**
2. **Phillips Screwdriver**
3. **Pozidriv Screwdriver**
4. **Robertson or Square Screwdriver**
5. **Torx Screwdriver**
6. **Hex Screwdriver or Hexagon Screwdriver**

Torque wrenches

A torque wrench is a tool used to control and apply a specific torque to a fastener such as a bolt or a nut. It is a fundamental element in general mechanics, tire changing operations and industrial maintenance & repair industries, to ensure customers' safety.
A **torque wrench** is a tool used to apply a specific torque to a fastener such as a nut, bolt, or lag screw

There are four basic types of torque wrenches, each with slightly different operating principles: beam or deflection, dial indicator, clicker, and digital

Pliers

A plier-like tool designed for cutting wires is often called diagonal pliers. Some pliers for electrical work are fitted with wire-cutter blades either built into the jaws or on the handles just below the pivot.
What is a plier used for?

Pliers are made in various shapes and sizes and for many uses. Some are used for gripping something round like a pipe or rod, some are used for twisting wires, and others are designed to be used for a combination of tasks including cutting wire.

Allen keys

An Allen key or Allen wrench is also known as Hex key. This is a small handheld tool used for turning bolts and screws which have hexagonal sockets

There is a variety of Allen keys available in today's market. L-shaped Allen Key: the basic hex key can be used for a variety of applications, including bicycle adjustments and furniture assembly. T-shaped Allen Key: this type of hex key offers a higher grip and is ideal for car and motorcycle maintenance and repairs.

Hammers

Hammers are used for general carpentry, framing, nail pulling, cabinet making, assembling furniture, upholstering, finishing, riveting, bending or shaping metal, striking masonry drill and steel chisels, and so on. Hammers are designed according to the intended purpose.

Apart from the sledge hammer and claw hammer, you can also buy a ball peen hammer, cross peen hammer, dead blow hammer, drilling hammer, dry-wall hammer, lineman hammer, machinist hammer, Mason's hammer, and/or a speciality hammer on online sites and get them delivered to your home without any hassle

Hammers consist of multiple parts: face, eye, neck, throat, crown, and claw. The striking face is what makes contact with a material or object. Crowed hammer faces drive nails without leaving marks on a surface. A hammers throat is attached to the neck and allows for power striking.

Chisels

Chisels are one of the most commonly used tools in the history of woodworking. They are made up of a steel blade attached either to a wooden or plastic handle. Chisel hammers and wooden mallets are the tools we use to strike the end of the handle to allow you to split, chop and pare wood.

chisel, cutting tool with a sharpened edge at the end of a metal blade, used—often by driving with a mallet or hammer—in dressing, shaping, or working a solid material such as wood, stone, or metal

Cold chisels are used for cutting metal. They are made from high - carbon steel, hardened and tempered at the cutting end. The opposite end, which is struck by the hammer, is not hardened but is left to withstand the hammer blows without chipping. The cross-section of chisels is usually hexagonal or octagonal.

Files

Files are cutting tools used to remove/smooth rough and sharp edges from cut metal. They are also used to file metal to shape or size. For each type of material there is an ideal tooth form that gives the most efficient cutting action.

Types of File Tools

- Flat file.
- Round file.
- Half-round file.
- Triangular file.
- Square file.
- Hand file.
- Knife file.

Hacksaws

A hacksaw is a hand-powered, small-toothed saw used for cutting metal pipes, rods, brackets, etc. Hacksaws can also cut through plastic. The hacksaw has a U-shaped frame and a handle at one end. Hacksaws have small pins at each end of the frame that receive a blade.

A hacksaw is a type of hand tool designed specifically for cutting through materials such as plastic, steel, and other metals. They are a variant of the traditional hand saw, typically used for cutting wood, and have become a staple tool for professionals and hobbyists alike.

What are the types of hacksaw?

Types of Hack Saw Blades

- Course Grade Hack Saw Blade.
- Medium Grade Hack Saw Blade.
- Fine Grade Hack Saw Blade.
- Superfine Grade Hack Saw Blade.
- Ail Hard Blade.
- Flexible Blade.

Wire brush and scraper

The wire brush is primarily an abrasive implement, used for cleaning rust and removing paint. It is also used to clean surfaces and to create a better conductive area for attaching electrical connections, such as those between car battery posts and their connectors, should they accumulate a build-up of grime and dirt.

Scrapers are typically formed by chipping the end of a flake of stone in order to create one sharp side and to keep the rest of the sides dull to facilitate grasping it. Most scrapers are either circle or blade-like in shape.

Taps and dies

Both taps and dies are used to create screw threads. Some sets are used as cutting tools, and others to form the threads. Taps cut or form the female of a mating pair or nut, while the die cuts or forms the male, or bolt. Tapping is the tap-process of cutting or forming threads, and the die-process is called threading.

tap, a screwlike tool that has threads like a bolt and two, three, or four longitudinal flutes or grooves and that is used to cut screw threads in a nut or a hole.

Drill bits

What is a drill bit?

Drill bits are cutting tools used to create cylindrical holes, almost always of circular cross-section. Drill bits come in many sizes and have many uses. Bits are usually connected to a mechanism, often simply referred to as a drill, which rotates them and provides torque and axial force to create the hole.

Drill bits are primarily used for creating circular holes in materials from drywall and wood to metal and masonry. They might create a hole for an anchor or fastener, or a passage to feed wiring. Bits are sold individually and in multi-sized sets, commonly called drill indexes

Reamer

A **reamer** is a type of rotary cutting tool used in metalworking.

Reamer tools are radially symmetrical tools with either straight, slightly twisted, or spiral fluted cutting surfaces that are ground to a very precise diameter. They are used to finish holes that have been drilled, end-milled, or punched, leaving them with very accurate dimensions

Chucking Reamers are the most widely used reamer and commonly used in lathes to enlarge smooth holes. Morse Taper Reamers are used to finish morse taper holes or sleeves. Automotive Reamers are used to ream steel for car parts such as steering arms, ball joints, and tie rod ends in vehicles.

Measuring tools

Rulers and scales are two common types of measuring tools. Measuring tools can be very precise, but low quality ones can lead to faulty measurements.

- **Vernier Calipers**

- **Micrometers**

- **Dial Gauges**

- **Height Gauges**

- **Depth Gauges**

- **Inner Diameter Measuring Instruments**

- **Gauges**

- **Squares**

- **Scales**

- **Tape Measures**

- **Weighing Instruments**

- **Goniometers**

- **Optical Devices**

- **Level Gauges**

- **Magnet-Related**

- **Surface Plates**

- **Tally Counters**

- **Gas Measuring Instruments / Detectors**

- **Stopwatches/Timers**

- **<u>Tension Gauges</u>**

- **Pressure Gauges**

- **Thermometers/Hygrometers**

- **Environment Measuring Instruments**

- **Microscopes**

- **Hardness Meters**

- **Vibration Meters / Tachometers**

- **Water Quality / Moisture Measuring Instruments**

- **Electric Measuring Instruments / Testers**

- **Viscometers**

- **Film Thickness Gauges / Detectors**

- **Flow Meters**

- **Eccentricity Measuring Instruments**

- **Surface Roughness Testers**

- **Sound Detectors**

- **Data Measurement Equipmen**

Valve spring compressors

A valve spring compressor apparatus and method for compressing cylinder valve springs for the removal and installation of their locks or keepers and for replacement of valve stem seals or broken springs on an internal combustion engine, while the cylinder head is mounted on the engine or supported on a work bench.

The function of an internal combustion engine valve spring is to provide sufficient force throughout the engine cycle to maintain the tappet in contact with the cam at all speeds within the engine speed range.

A valve spring is a helical compression spring used in closing valves or keeping valves closed.

Piston ring compressor

A piston ring compressor is a compressor that features pistons fit inside of a cylinder using compression rings that seal between the piston and cylinder wall. The piston moves up and down by use of a connecting rod attached from the piston to a crankshaft

Piston Ring Compressor. The piston ring compressor is a special tool that is specifically designed for compressing the piston rings when a piston is re-installed. This is accomplished by opening the piston ring compressor enough so that the piston will slide into the opening.

With a piston air compressor, the type of material involved refers to the metal used in the pump or shaft that surrounds the piston. These compressors are typically constructed of one of two materials

Oil filter wrenches

An oil-filter wrench is **a tool for removing spin-on type oil filters**. Chain-type oil-filter wrench. The chain is wrapped around a spin-on oil filter

An oil-filter wrench is a tool for removing spin-on type oil filters.

Claw-type tools are great because they adjust to fit any size oil filter, all you need is a socket wrench. Made of aluminium, this example will be ideal for stuck oil filters.

Puller

A puller is a tool used to remove parts such as bearings, pulleys or gears from a shaft. They have legs, typically two or three which circle around the back or inside of a part and they also have a forcing screw which centres up against the end of a shaft.

What are the sizes of puller?

- Puller Micro. 12,5 cm x 1,5 cm. Perfect for: Toy Terrier, Chihuahua, Griffon, Spitz, Rabbit Dachshund, Yorkie. ...
- Puller Mini. 18 cm x 2 cm. Perfect for: Miniature Schnauzer, Miniature Pinscher, Yorkshire terrier, Dachshund, Pug. ...
- Puller Midi. 20 cm x 3 cm.

Coil spring compressor set

A coil spring is mounted in a compressed state around the strut between a lower spring seat integral with the strut and an upper spring seat fastened to the upper end of the piston of the shock absorber. Such a suspension subassembly is assembled separately and then mounted as a unit in a vehicle body.

Made of wound metal, coil springs are designed support the vehicle's weight. They compress and absorb road impacts, allowing the frame and body of the vehicle to experience minimal disturbances when riding over bumps such as railroad tracks or dips such as potholes.

Tyre levers

They are little levers that are used for getting tyres off a wheel. A set of levers are one of the cheapest and most essential bits of cycling equipment. Everyone should carry them. Many tyres are almost impossible to get off without a set of levers.

until you find yourself on the side of the road or trail with quickly-dwindling tire pressure and a need for a new tube. Tire levers allow you to quickly—and cleanly—remove your tire from your rim with significantly less effort. They save your fingers, your tire rim, and possibly, the rest of your ride.

Tool box

A toolbox (also called toolkit, tool chest or workbox) is a box to organize, carry, and protect the owner's tools. They could be used for trade, a hobby or DIY, and their contents vary with the craft.

Purpose of toolkit

Toolkit is used by journalists, teachers, academics and business heads to have resources for team members at one place, formulate plans and coordinate faster execution of projects.

C-clamp

A clamp is a fastening device used to hold or secure objects tightly together to prevent movement or separation through the application of inward pressure.

A C-clamp or G-clamp or G-cramp is a type of clamp device typically used to hold a wood or metal workpiece, and often used in, but are not limited to, carpentry and welding.

Pneumatic tools

Pneumatic tools are powered by compressed air. Common types of these air-powered hand tools that are used in industry include buffers, nailing and stapling guns, grinders, drills, jack hammers, chipping hammers, riveting guns, sanders and wrenches.

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, sanders, spray guns, air ratchets, grinders, and many more.

Drilling machine

A drilling machine is a power tool that is used to create cylindrical holes in a workpiece. The tool bit is rotated at high speed and pressed into the workpiece to create a cylindrical hole that passes either partway (blind hole) or all the way through (through hole) the part.

A hammer drill, also known as a percussion drill or impact drill, is a power tool used chiefly for drilling in hard materials. It is a type of rotary drill with an impact mechanism that generates a hammering motion.

Drilling is the process of penetrating through the ground and extracting rocks from various depths beneath the surface for confirming the geology beneath and/or providing samples for chemical analysis.

Grinder

A grinding machine is a machine tool with an abrasive wheel that is used to achieve fine finishes or light cuts on metals and other materials. It is a machining operation that is used to improve the accuracy of a product that has previously been machined.

Grinding is used to finish workpieces that must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension.

Lubrication equipments

Lubrication equipments generally comprise of Lubrication Injectors, Lubrication Pumps, Hydraulic Pumps, Oil Injectors, Lube Oil Systems, etc. The Lubrication process is of vital importance in machine's performance and working & hence a lot of prudence is taken to ensure the lubrication devices are used right.

Lubricators and lubricating systems dispense or distribute oils and grease to mechanical devices such as bearings, conveyor chains, railroad rails, air tools, or packing glands, for the purpose of minimizing friction between moving parts

Tyre changer.

In general terms, tyre changers will fall into four main categories: manual, semi-automatic, fully automatic and super automatic

Wheel balancer

A wheel balancer prevents troublesome vibrations that cause wear on tires and suspension. If your shop has a wheel balancer handy, the most common cause of wheel vibrations—unbalanced tires—can be fixed in minutes.

Wheel balancing ensures that weight is distributed equally around the wheel and that the tyre rotates evenly. This involves adding small balancing weights to the rim which counter weight inconsistencies. If you imagine a set of balancing scales, when you add a heavy weight to one side the scales will tip.

Wheel aligner

A wheel alignment is a mechanical adjustment of your suspension system (the parts that connect your wheels to your car) to ensure that your wheels are in the correct position. It can also be called tracking or tyre alignment.
Aintaining proper wheel alignment is essential to avoid unnecessary wear on your tyres, steering, suspension and brakes. Accurate wheel alignment optimises driving stability, maximises tyre life and improves your vehicle's overall handling performance.

Brake bleeding equipments

- A tool to open the bleed valve – usually an appropriate size wrench or line wrench is best for the job. The most common bleeder valve size is 10mm.
- A catch pan to collect the drained brake fluid.
- New brake fluid to replace the old. Check your owner manual for specifics.
- A vacuum pump.
- A brake bleed kit.

High pressure compressor

High-pressure industrial air compressors intake ambient air and compress it to pressures as high as 6000 pounds per square inch (PSI) for breathing air and other applications. As the air moves through the multiple stages of compression it is cooled after each stage.

The two main high-pressure air compressor types are standard high-pressure air compressors and high-pressure air boosters. The two systems work differently to achieve high pressures. High-pressure air compressors take in ambient air through several compression stages to reach pressures as high as 6,000 PSI.

High pressure car wash machine

Although many electric pressure washers produce a pressure of about 1900 psi, you should only use a water pressure of 1500 psi or lower on your car. You'll need to look for a low-pressure machine that's a bit less aggressive than the standard.

- Bosch Aquatak 125 1500-Watt High Pressure Washer. ...

- ResQTech PW-101 High Pressure Washer. ...
- American Micronic Pressure Washer. ...
- Vantro High Pressure Washer. ...
- Karcher K 120 bar High Pressure Washer. ...
- Karcher K 2.050 HIGH Pressure CAR Washer. ...
- STARQ W3A HIGH Pressure Washer. ...
- Shakti Technology S5 High Pressure Car Washer Machine.

Engine analyser

Engine analyzers, also known as engine performance testers, were first developed in the 1960s to help tune and troubleshoot gasoline-fueled automotive engines. The engines of the time had manually-adjustable ignition (spark) timing, and required frequent repair, which necessitated a variety of information.

The AutoAnalyzer is an automated analyzer using a flow technique called continuous flow analysis (CFA), or more correctly segmented flow analysis (SFA) first made by the Technicon Corporation.

Hydraulic press

Hydraulic presses are commonly used for forging, clinching, moulding, blanking, punching, deep drawing, and metal forming operations. Hydraulic presses are also used for stretch forming, rubber pad forming, and powder compacting.

Laboratory presses are typically equipped with a hydraulic system that can generate up to 1,000 pounds per square inch (psi) of pressure. The press can be used to apply pressure to a variety of materials, including powders, sheet materials, and polymer beads.

- Hydraulic press – Commonly used to mold, punch, crush different types of objects and also form metals.
- Hydraulic lift – It is the type of machine which lifts or moves objects due to the pressure of fluid acting on it.

  The basis for all hydraulic systems is expressed by Pascal's law which states that the pressure exerted anywhere upon an enclosed liquid is transmitted undiminished, in all directions, to the interior of the container.

Spark plug tester and cleaner machine

Spark Plug Cleaner and Tester is an instrument to completely clean and test an old used spark plug which is used in petrol, gasoline and kerosene engines. Spark Plug Cleaner is an instrument which is a necessity of a well equipped modern workshop/garage to make a used spark plug to work as a brand new one.

Spark plug cleaner tool. A clean rag (clean cloth) Spark plug wrench.

As the testing unit checks the plug at the high ignition voltage and at appropriate air compression faulty plug are identified and can be eliminated.

One of the benefits of cleaning your car's spark plugs is that they can help improve your car's performance. If your spark plugs are dirty, they can cause misfires, leading to a loss of power and decreased acceleration.

Injector tester and cleaner machine

Fuel injector cleaning machines are machines used to clean the fuel injectors of the automobile's internal combustion engine.

Designed to allow the user to electronically switch a petrol fuel injector, do a full function test as well as aid injector cleaning by combining with a suitable carburettor cleaning fluid

The primary benefits of fuel injector cleaning are:

- Improved gas mileage.
- Saved money on fuel costs.
- Reduced emissions from your car.
- Protect and restore the performance of your car.
- Increased engine life and performance.

At a professional garage, they may use an ultrasonic machine to clean the injectors out. Those who have some mechanical skill can pull the injectors themselves, dissasemble them, and clean the parts in an acetone bath and wire brushes.

Battery charging and testing machine

The most simple battery tester is a DC ammeter, that indicates the battery's charge rate. DC voltmeters can be used to estimate the charge rate of a battery, provided that its nominal voltage is known **Battery charging**

The electronic and digital types are the most common ones used for testing the remaining capacity of a battery

Connecting a voltmeter to the battery's positive and negative terminals (key off and all lights and accessories off) will reveal the charge level of the battery. A reading of 12.66 volts indicates a fully charged battery. If the reading is 12.45 volts or less, the battery is low and needs to be recharged.

CHAPTER-4

SERVICE, REPAIR AND OVERHAUL

MRO in an acronym for Maintenance, Repair, and Overhaul (or administratively – Maintenance, Repair, and Operations). Simply put, MRO is any action that helps keep or restore an item to its working condition. A wide variety of NDT, RVI, and Visual Inspection techniques can be used.

However, the difference between repair and maintenance work is that repairs aim to restore functionality while maintenance looks to preserve functionality. Put simply, repairs are done after downtime to minimize losses, while maintenance is done to prevent unexpected asset

Troubles, Causes & remedies in engine

- Low or discharged battery.
- Corroded or loose battery cables.
- Starter motor relay failure.
- Ignition switch failure.
- Faulty fuel pump.
- Clogged or dirty fuel filter.
- Neglecting oil and filter changes.
- Catalytic converter failure.
    - Loose or missing gas cap
    - Worn out and damaged spark plugs or wires
    - Electronic control module failure
    - Defective distributor or coil packs
    - Emissions control fault – such as the oxygen sensor
    - Poor Fuel Quality
    - Damaged or broken thermostat
    - Dirty or low coolant level
    - Non-functioning cooling fan
    - Failed radiator hose
    - Internal or external coolant leaks
    - Defective radiator cap

cooling system

In a SI engine, cooling must be satisfactory to avoid pre-ignition and knock. In a compression ignition engine, since a normal combustion is aided, cooling must be sufficient to allow the parts to operate properly. In short, cooling is a matter of equalization of internal temperature to prevent local overheating as well as to remove sufficient heat energy to maintain a practical overall working temperature

Requirements of cooling system in the IC engine

The cooling system is provided in the IC engine for the following reasons: -The temperature of the burning gases in the engine cylinder reaches up to 1500 to 2000°C, which is above the melting point of the material of the cylinder body and head of the engine. (Platinum, a metal which has one of the highest melting points, melts at 1750 °C, iron at 1530°C and aluminium at 657°C.) Therefore, if the heat is not dissipated, it would result in the failure of the cylinder material.

-Due to very high temperatures, the film of the lubricating oil will get oxidized, thus producing carbon deposits on the surface. This will result in piston seizure. Due to overheating, large temperature differences may lead to a distortion of the engine components due to the thermal stresses set up. This makes it necessary for, the temperature variation to be kept to a minimum. -Higher temperatures also lower the volumetric efficiency of the engine.

Effect of overcooling: -

Thermal efficiency is decreased due to more loss of heat carried by the coolant

-The vaporization of the fuel is less resulting in lower combustion efficiency

-Low temperature increases the viscosity of lubricant causing more loss due to friction

There are mainly two types of cooling systems:

(a) Air cooled system

(b) Water cooled system

Air Cooled System: -Air cooled system is generally used in small engines say up to 15-20 kW and in aero plane engines.

-In this system fins or extended surfaces are provided on the cylinder walls, cylinder head, etc.

Heat generated due to combustion in the engine cylinder will be conducted to the fins and when the air flows over the fins, heat will be dissipated to air.

The amount of heat dissipated to air depends upon

(a) Amount of air flowing through the fins

(b) Fin surface area

(c) Thermal conductivity of metal used for fins

Water cooling system:

Cooling water jackets are provided around the cylinder, cylinder head, valve seats etc. The water when circulated through the jackets, it absorbs heat of combustion. This hot water will then be cooling in the radiator partially by a fan and partially by the flow developed by the forward motion of the vehicle. The cooled water is again recirculated through the water jackets.

Various types of water cooling systems

(a) Thermo-syphon cooling

(b) Forced or pump cooling

(c) Cooling with thermostatic regulator

(d) Pressurised water cooling system

(e) Evaporative cooling

Thermo-syphon cooling

This system works on the principle that hot water being lighter rises up and the cold water being heavier goes down. In this system the radiator is placed at a higher level than the engine for the easy flow of water towards the engine. Heat is conducted to the water jackets from where it is taken away due to convection by the circulating water. As the water jacket becomes hot, it rises to the top of the radiator. Cold water from the radiator takes the place of the rising hot water and in this way a circulation of water is set up m the system. This helps in keeping the engine at working temperature

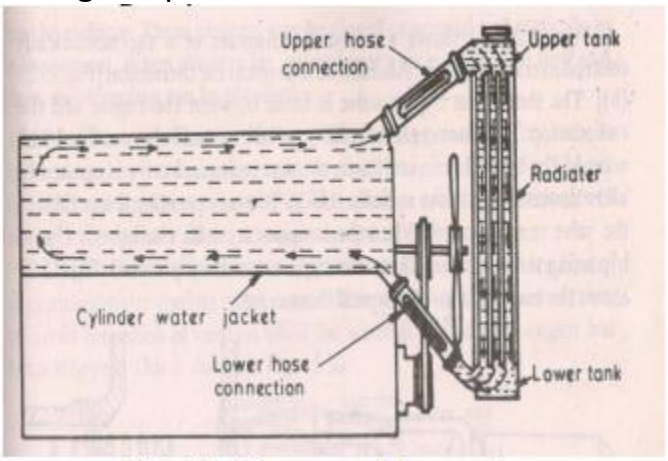


Fig. 37. Thermo-syphon cooling

Forced or pump cooling:

-This system is used in large number of vehicles like car, buses, trucks and other heavy vehicles. Here circulation of water takes place with convection currents help by a pump.

-The water or coolant is circulated through jackets around the parts of the engine to be cooled, and is kept in motion by a centrifugal pump, driven from the engine through V-belt.

Limitation

-Cooling is independent of temp.

-Engine is overcooled (when range of temp.=75-900C)

-Can be overcome by using thermosta

Cooling with thermostatic regulator:

-Whenever the engine is started from cold, the coolant temperature has to be brought to the desired warm up time to avoid corrosion damage due to condensation of acids as well as help in easy starting of the engine. This can be done by the use of thermostatic device or thermostat.

-It is a kind of check valve which opens and closes with the effect of temperature. It is fitted in the water outlet of the engine. During the warm-up period, the thermostat is closed and the water pump circulates the water only throughout the cylinder block and cylinder head. When the normal operating temperature is reached, the thermostat valve opens and allows hot water to flow towards the radiator. Standard thermostats are designed to start opening at 70 to 75°C and they fully open at 82°C. High temperature thermostats, with permanent anti-freeze solutions (Prestine, Zerex, etc.), start opening at 80 to 90°C and fully open at 92°C.

- There are three types of thermostats: (i) bellow type, (ii) bimetallic type and (iii) wax type.

Bellow type valve:

Flexible bellows are filled with alcohol or ether. When the bellows is heated, the liquid vaporises, creating enough pressure to expand the bellows. When the unit is cooled, the gas condenses. The pressure reduces and the bellows collapse to close the valve.

Bimetallic type valve:

This consists of a bimetallic strip. The unequal expansion of two metallic strips causes the valve to open and allows the water to flow in the radiator

Wax type valve:

-Can operate reliably within the specified temperature range - Heat is transmitted to wax, which has high coefficient of thermal expansion -Upon being heated, wax expands and the rubber plug presses the plunger forcing it to move vertically upwards

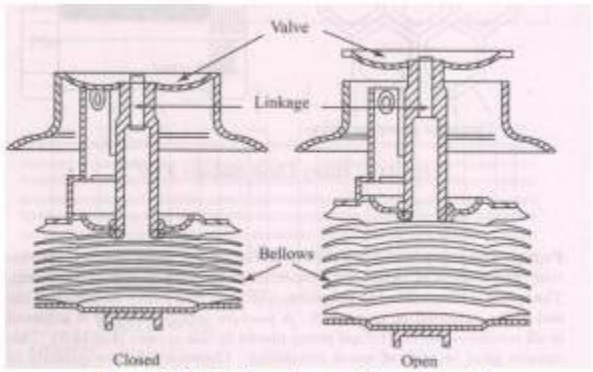


Fig. 38. Bellow type thermostat

Pressurised water cooling system:

In the case of the ordinary water-cooling system where the cooling water is subjected to atmospheric pressure, the water boils at 212°F. But, when water is heated in a closed radiator under high pressure, the boiling temperature of water increases. The higher water temperature gives more efficient engine performance and affords additional protection under high altitude and tropical conditions for long hard driving periods. Therefore, a pressure-type radiator cap is used with the forced circulation cooling system. The cap is fitted on the radiator neck with an air tight seal. The pressure-release valve or safety valve is set to open at a pressure between 4 and 13 psi. With this increase in pressure, the boiling temperature of water increases to 243°F (at 4 psi boiling tap 225°F and 13 psi boiling temperature 243°F). Any increase in pressure is released by the pressure release valve or safety valve to the atmosphere. On cooling, the vapours will condense and a partial vacuum will be created which will result in the collapse of the hoses and tubes. To overcome this problem the pressure release valve is associated with a vacuum valve which opens the radiator to the atmosphere.

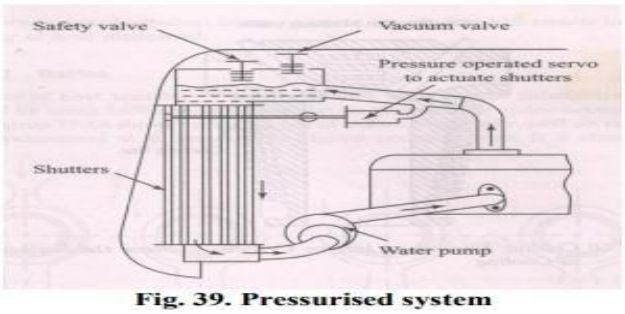


Fig. 39. Pressurised system

Evaporative cooling system:

-In this system, the engine will be cooled because of the evaporation of the water in the cylinder jackets into steams.

-The advantage is being taken from the high latent heat of vaporization of water by allowing it to evaporate in the cylinder jackets. This system is used for cooling of many types of industrial engines

LUBRICATION SYSTEM

IC engine is made of many moving parts. Due to continuous movement of two metallic surfaces over each other, there is wearing moving parts, generation of heat and loss of power in the engine. Hence, lubrication of moving parts is essential to prevent all these harmful effects.

In engine the frictional losses is attributed due to the following mechanical losses;

(i) Direct frictional losses:

-power absorbed due to the relative motion of different bearing surfaces such as piston rings, main bearings, cam shaft bearings etc.

(ii) Pumping loss:

-net power spent by the piston on the gas during intake and exhaust stroke -more in case of four stroke engine compared to two stroke engine

(iii) Power loss to drive components to charge and scavenge:

-In four stroke supercharged engine, compressor used to provide high pressure air which is mechanically driven by the engine. This is counted as negative frictional loss. -In two-stroke engine scavenging pump is used which is also driven by the engine

(iv) Power loss to drive the auxiliaries:

-Some power is used to drive auxiliaries such as water pump, lubricating oil pump, fuel pump, cooling fan, generator etc.

Function of lubrication:

Lubrication produces the following effects: (a) Reducing friction effect (b) Cooling effect (c) Sealing effect and (d) Cleaning effect.

(a) Reducing frictional effect:

The primary purpose of the lubrication is to reduce friction and wear between two rubbing surfaces. Two rubbing surfaces always produce

friction. The continuous friction produce heat which causes wearing of parts and loss of power. In order to avoid friction, the contact of two sliding surfaces must be reduced as far as possible. This can be done by proper lubrication only. Lubrication forms an oil film between two moving surfaces. Lubrication also reduces noise produced by the movement of two metal surfaces over each other.

(b) Cooling effect: The heat, generated by piston, cylinder, and bearings is removed by lubrication to a great extent. Lubrication creates cooling effect on the engine parts.

(c) Sealing effect: The lubricant enters into the gap between the cylinder liner, piston and piston rings. Thus, it prevents leakage of gases from the engine cylinder.

(d) Cleaning effect: Lubrication keeps the engine clean by removing dirt or carbon from inside of the engine along with the oil

Types of lubricants: Lubricants are at following three types.

1. Solid: graphic, mica etc
2. Semi solid: grease
3. Liquid: Lubricants are obtained from animal fat, vegetables and minerals. Lubricants made of animal fat, does not stand much heat. It becomes waxy and gummy which is not very suitable for machines. Vegetable lubricants are obtained from seeds, fruits and plants. Cottonseed oil, olive oil, linseed oil and castor oil are used as lubricant in small machines. Mineral lubricants are most popular for engines and machines. It is obtained from crude petroleum found in nature. Petroleum lubricants are less expensive and suitable for internal combustion engines.

Graphite is often mixed with oil to lubricate automobile spring. Graphite is also used as a cylinder lubricant.

-Grease is used for chassis lubrication.

Lubrication system: various lubrication system used for IC engines are,

(a) Mist lubrication system

(b) Wet sump lubrication system

c) Dry sump lubrication system

a) **Mist lubrication system:** -Used where crankcase lubrication is not suitable - Generally adopted in two stroke petrol engine line scooter and motor cycle. It is the simplest form of lubricating system. - It is the simplest form of lubricating system. It does not consist of any separate part like oil pump for the purpose of lubrication. - In this system the lubricating oil is mixed into the fuel (petrol) while filling in the petrol tank of the vehicle in a specified ratio (ratio of fuel and lubricating oil is from 12:1 to 50:10 as per manufacturers specifications or recommendations. - When the fuel goes into the crank chamber during the engine operation, the oil particles go deep into the

bearing surfaces due to gravity and lubricate then. The piston rings, cylinder walls, piston pin etc. are lubricated in the same way. -If the engine is allowed to remain unused for a considerable time, the lubricating oil separates oil from petrol & leads to clogging (blocking) of passages in the carburettor, results in the engine starting trouble. This is the main disadvantage of this system. -It causes heavy exhaust smoke due to burning of lubricating oil partially or fully -Increase deposits on piston crown and exhaust ports which affect engine efficiency -Corrosion of bearing surfaces due to acids formation -thorough mixing can fetch effective lubrication -Engine suffers insufficient lubrication during closed throttle i.e. vehicle moving down the hill.

Wet sump lubrication system: Bottom of the crankcase contains oil pan or sump from which the lubricating oil is pumped to various engine components by a pump. After lubrication, oil flows back to the sump by gravity. Three types of wet sump lubrication system

(i)Splash system (ii) Splash and pressure system (iii) Pressure feed system

Dry sump lubrication system:

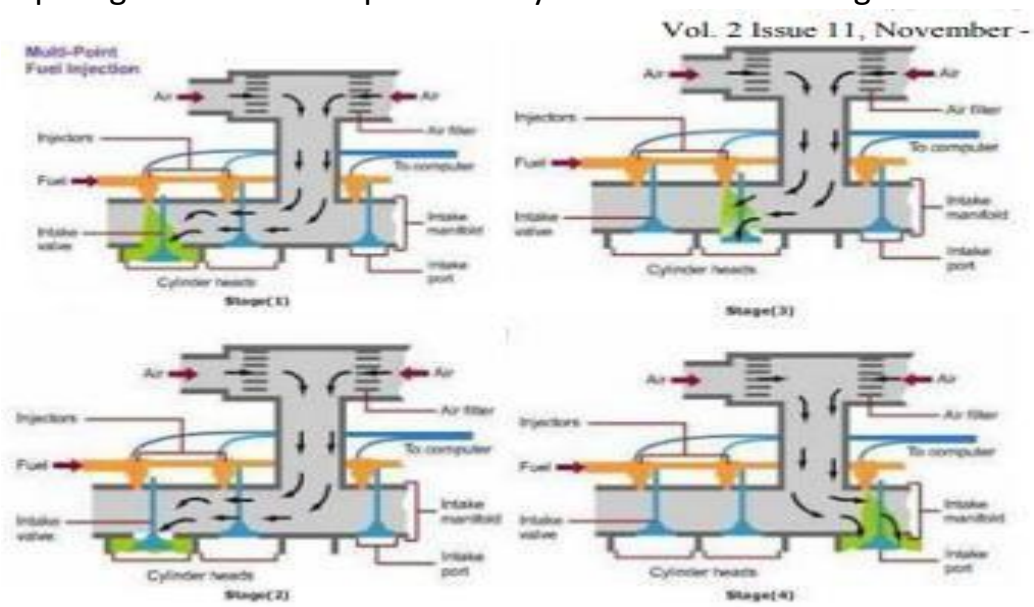
-Supply of oil is carried in external tank -Oil pump draws oil from the supply tank and circulates it under pressure to various bearings of the engine - Oil dripping from the cylinders and bearings into the sump is removed by a scavenging pump and again return to supply tank through the filter -The capacity of scavenging pump is greater than the oil pump -Separate oil cooler to remove heat from oil is used which is either cooled by air or water

Multipoint Fuel Injection System

The working of MPFI engine is somewhat similar to the carburetor engine, each cylinder is treated individually. An input is fed to the computerized system in order to calculate the amount of air and fuel is to be mixed and send to the combustion chamber. A several stages of calculations are to be made in order to judge the right amount of fuel to be mixed. After this calculation, the proper fuel is delivered at the proper instance. There are a number of sensors used in the MPFI engine. At the time when the inputs are given to the car's computer, it begins to read the given sensors. The things which can be known from the sensors are listed below

- The engine temperature of the vehicle.
- The speed at which the engine is running.
- The engine load.
- The position of the accelerator.
- The cylinder's air-fuel pressure.
- The rate of exhaust.

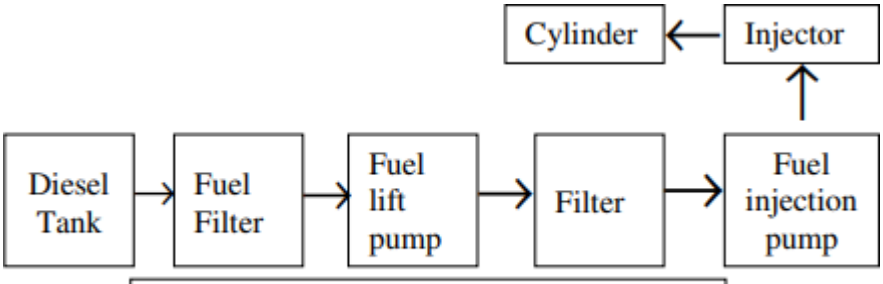
The amount of fuel to be injected into the combustion chamber is decided by analyzing the inputs given to the computerized system of the MPFI engine.



FUEL SYSTEM

During engine operation, the fuel is supplied by gravity from fuel tank to the primary filter where coarse impurities are removed. From the primary filter, the fuel is drawn by fuel transfer pump and is delivered to fuel injection pump through second fuel filter. The fuel injection pump supplies fuel under high pressure to the injectors through high pressure pipes. The injectors atomise the fuel and inject it into the combustion chamber of the engine. The fuel injection pump is fed with fuel in abundance. The excess fuel is by-passed to the intake side of the fuel transfer pump through a relief valve.

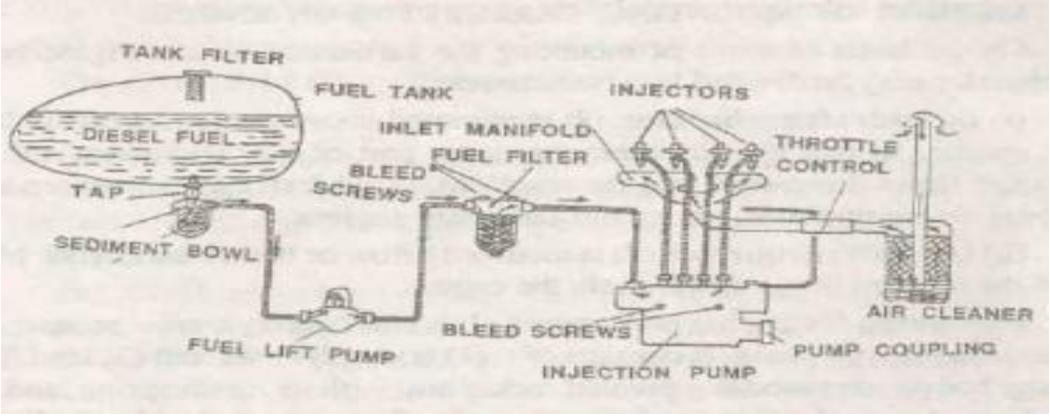
The main components of the fuel system in diesel engine are: (1) fuel filter (2) fuel lift pump (3) fuel injection pump (4) atomisers and (5) high pressure pipe.



Flow diagram of fuel in diesel tractor

Two conditions are essential for efficient operation of fuel system: (i) The fuel oil should be clean, free from water, suspended dirt, sand or other foreign matter, (ii) The fuel injection pump should create proper pressure, so that diesel fuel may be perfectly atomised by injectors and be injected in proper time and in proper quantity in the

engine cylinder. Fuel should be filtered before filling the tank also. If these precautions are followed, ninety per cent of diesel engine troubles are eliminated.



CHAPTER-5
MOTOR VECHILES ACT

Necessity for driving licence. –

1) No person shall drive a motor vehicle in any public place unless he holds an effective driving licence issued to him authorising him to drive the vehicle ; and no person shall so drive a transport vehicle [other than 7 [a motorcab or motor cycle] hired for his own use or rented under any scheme made under sub - section (2) of section 75] unless his driving licence specifically entitles him so to do

(2) The conditions subject to which sub-section (1) shall not apply to a person receiving instructions in driving a motor vehicle shall be such as may be prescribed by the Central Government.

Corresponding Law.- Section 3 (1) corresponds to section 3 (1) of the Motor Vehicles Act, 1939.

Objects and Reasons.- Clause 3, sub-clause (1), provides for the need to have a licence to drive a motor vehicle & a special authorisation to drive a transport vehicle. Sub-clause (2) empowers the Central Government to prescribe conditions subject to which a vehicle may be driven by a person receiving instructions in driving.

4. Age limit in connection with driving of motor vehicles. – (1) No person under the age of eighteen years shall drive a motor vehicle in any public place: Provided that 8 [a motor cycle with engine capacity not exceeding 50 cc] may by driven in a public place by a person after attaining the age of sixteen years . (2) Subject to the provisions of section 18, no person under the age of twenty years shall drive a transport vehicle in any public place. (3) No learner's licence or driving licence shall be issued to any person to drive a vehicle of the class to which he has made an application unless he is eligible to drive that class of vehicle under this section

Corresponding Law. - Section 4 corresponds to section 4 of the Motor Vehicles Act, 1939

Objects and Reasons. - Clause 4 provides that a person who has completed sixteen years of age may drive a motor cycle without gear. To drive a motor vehicle other than a transport vehicle, the person must have completed eighteen years of age and to drive a transport vehicle a person must have completed twenty year of age. This clause seeks to prohibit the issue of a licence to drive a motor cycle or a motor vehicle to those persons who do not satisfy the above age requirements.

Provision is mandatory – The provision that no driving licence be granted to persons under 18 years of age, held, is mandatory, the driving of a vehicle by such a person with such a licence is an offence; it is so even where such a licence has been granted

by Authority in ignorance though it may not be proper to punish the accused; Union Bank of India, Lalma Badri Prasad A.I.R. 1954 Vindh, Pra.17.

5. Responsibility of owners of motor vehicles for contravention of sections 3 and 4. - No owner or person in charge of a motor vehicle shall cause or permit any person who does not satisfy the provisions of section 3 or section 4 to drive the vehicle.

Corresponding Law. - Section 5 corresponds to section 5 of the Motor vehicles Act, 1939. Objects and **Reasons.** - Clause 5 prohibits the owner or person in charge of a motor vehicle permitting any person who does not satisfy the age requirement to drive the vehicle

6. Restrictions on the holding of driving licences. - (1) No person shall, while he holds any driving licence for the time being in force, hold any other driving licence except a learner's licence or a driving licence issued in accordance with the provisions of section 18 or a document authorising, in accordance with the rules made under section 139, the person specified therein to drive a motor vehicle.

(2) No holder of a driving licence or a learner's licence shall permit it to be used by any other person.

(3) Nothing in this section shall prevent a licensing authority having the jurisdiction referred to in sub-section (1) of section 9 from adding to the classes of vehicles which the driving licence authorises the holder to drive.

Corresponding Law. - Section 6 corresponds to section 6 of the Motor Vehicles Act, 1939

Objects and Reasons. - Clause 6 seeks to impose certain restrictions on the holding of driving licences by certain persons.

Restrictions on granting of learner's licenses for certain vehicles.

1. No person shall be granted a learner's licence--
    1. to drive a heavy goods vehicle unless he has held a driving licence for at least two years to drive a light motor vehicle or for at least one year to drive a medium goods vehicle;
    2. to drive a heavy passenger motor vehicle unless he has held a driving licence for at least two years to drive a light motor vehicle or for at least one year to drive a medium passenger motor vehicle;
    3. to drive a medium goods vehicle or a medium passenger motor vehicle unless he has held a driving licence for at least one year to drive a light motor vehicle.
2. No person under the age of eighteen years shall be granted a learner's licence to drive a motor cycle without gear except with the

consent in writing of the person having the care of the person desiring the learner's licence.

Grant of learner’s licenses.

An applicant under the age of eighteen years shall be granted a learner's license to drive a motor cycle without gear except with the consent in writing of the person having the care of the person desiring a learner's license.

FORM 2

(See Rule 10)

FORM OF APPLICATION FOR THE GRANT OF LEARNER'S LICENCE

To,

The Licensing Authority

.....

.....

I hereby apply for a licence authorising me to drive as a learner the following motor vehicle(s) :-

a) Motor cycle without gear .....

b) Motor cycle with gear .....

c) Invalid Carriage .....

d) Light motor vehicle .....

e) Transport Vehicle .....

f) Road-roller .....

g) Motor vehicle of a specified description, namely .....

Space for photograph of the size of 5 x 6 cms

PARTICULARS TO BE FURNISHED BY THE APPLICANT

1. Full Name	
2. Son / Wife / Daughter of	
3. Permanent Address (Electoral Roll/Life Insurance Policy/Passport/Pay slip issued by and office of the Central Government/State Government or a local body/Any other document or documents as may be prescribed by the State Government/Affidavit sworn before an Executive Magistrate or a First Class Judicial Magistrate or a Notary Public to be enclosed)	
4. Temporary address / Official address (if any)	
5. Duration of stay at the present address	
6. Date of Birth Birth Certificate/School certificate/affidavit sworn before an Executive Magistrate or a First Class Judicial Magistrate or a Notary Public to be enclosed	
7. Place of Birth	
8. If place of birth outside India, when migrated of India	
9. Educational Qualification	
10. Identification Mark (s)	1) 2)
11. Declaration of citizenship status (i) If deemed Citizen or Citizen by Birth (Birth Certificate and school certificate in support of Citizenship as Indian to be enclosed) (ii) If Citizenship is acquired by Descent / Registration (In case Citizenship acquired by Descent, Birth Certificate, Land property document of parent/in case of citizenship acquired by registration, certificate to be enclosed. (iii) If Citizenship by Naturalization (Certificate of Naturalization and Certificate of Registration to be enclosed) (iv) If non-Indian Citizen (Valid passport or other travel documents and such other document or authority as may be prescribed by law to enclosed)	
12. Blood Group Rh (Rhesus) factor	

13. I hold an effective driving licence to drive : Motor cycle/Light motor vehicle/trasnport vehicle with effective from	
14. Particulars of any driving licence previously held by applicant whether it was cancelled and if so, for what reason	
15. Particulars of any learner's licence previously held by applicant in respect of the description of vehicle to which the applicant has applied	
16. Have you been disqualified for holding or obtaining driving licence or learner's licence, if so, for what reasons	
17. I enclose three copies of my recent photograph (passport size photograph)	
18. I enclose medical fitness certificate dated..... Issued by..... (Doctor)	
19. I have submitted along with my earlier application for learner's licence / I enclose the written consent of parent / guardian (in case of applicant being a minor)	

20. I enclose driving certificate dated.....Issued by.....
.....(Name and address of the driving school)

21. I have paid the fee of Rs. .....

22. I am exempted from the medical test under Rule 6 of the Central Motor Vehicle Rules, 1989

23. I am exempted from the preliminary test under Rule (11(2) of the Central Motor Vehicles Rules, 1989

* Strike out whichever is inapplicable.

Date :.....
(Specimen Signature or thumb impression of Applicant)

1 ..... Signature or thumb impression of Applicant

2 .....

DECLARATION UNDER SUB-SECTION (2) OF SECTION 7 OF THE MOTOR VEHICLE ACT, 1988

Shri/Kumari.....Son/Daughter of.....who is a Minor under my care and I accept responsibility for his/her driving. If at a later date I decide not to accept responsibility of his/her driving, I shall intimate the licence authority in writing for the cancellation of the licence. I give my consent for his/her obtaining learner's License.

Signature.....
Name and full address of the Parent / Guardian

Relationship.....

(To be signed in the presence of the Licensing Authority or person authorised in this behalf by the Licensing Authority)

FOR OFFICE USE

- ☐ The applicant is exempted from the medical test under Rule 6 and the preliminary test under rule 11(2) of the Central Motor Vehicle Rules, 1989.
- ☐ Learner's Licence may be issued.
- ☐ The applicant was tested with reference of rule 11(1) of the Central Motor Vehicle Rules, 1989.
- ☐ He has passed the test. Learner's Licence may be issued.
- ☐ Learner's Licence may be refused.

* Strike out whichever is inapplicable.

Note : The application along with the scanned copies of the required documents may also be sent to be concerned Licensing Authority through Electronic Mail, if allowed by the concerned State Government/Union Territory Administration.
In such cases, the Licensing Authority shall scrutinise the application and intimate the applicant about the acceptance fany discrepancy.
In case the application is accepted, the applicant shall be intimated through Electronic Mail to report to the Authority concerned on an appointed date along with the documents for further

Signature of Licensing Authority or other Person

Documents Required for Getting a Driving License in Odisha

- Age proof (school certificate, birth certificate, PAN card, etc)
- Address proof (passport, voter's ID, LIC policy bond, etc)
- Form 4.
- Learner's license.
- Three passport size photographs.
- Form 5 in case of the application for a transport vehicle.

Certification of Registration

A registration certificate or RC is an official document stating that your vehicle is registered with the Indian government.
What is registration certificate of a company?

It is a legal document or certificate provided by the MCA to an Indian business once the registration procedure has been completed successfully. This Company Registration Certificate proves that the company has been registered with the Registrar of Companies

Necessity of registration of vehicle

The objectives of Registration are to, i) prove the ownership of the vehicle. ii) identify vehicle in the event of theft or accident of the vehicle.

Necessity of registration of vehicle. Registration –where to be made.

Regional Transport Office is a government organisation that is responsible to keep a track of all the vehicles on Indian roads. For this purpose, every vehicle in India should be registered in the nearby RTO Office. Every vehicle that is registered will be given a vehicle registration card.

Procedure for registration.

Step 1: Visit the RTO with your new vehicle.
Step 2: Submit the duly filled application forms and all relevant documents,
Step 3: The RTO official will verify the details and documents.
Step 4: Pay the registration fees and road tax at the fee collection counter and collect the acknowledgement receipt.

Condition for refusal of registration

Section 9 of the Act lists down the absolute grounds for refusal of registration. If any trademark comes under the grounds listed in this section, it cannot be registered. The absolute grounds for refusing registration are –

- Trademarks which do not possess any distinctive character. Distinctive character means trademarks which are not capable of distinguishing the goods or services of one person from those of another.
- Trademarks which exclusively contain marks or indications which serve in trade to define the kind, quality, quantity, intended purpose, values or geographical origin of goods or services rendered.
- Trademarks which exclusively contain marks or indications which have become customary in the current language or the established practices of the trade.
- Trademarks are of such a nature which deceives or cause confusion to the public.
- Trademarks which contain or comprise matter likely to hurt the religious susceptibilities of any class or sections of citizens of India.
- Trademarks which contain or comprise scandalous or obscene matter.
- If the usage of the trademark is prohibited under the Emblems and Names (Prevention of Improper Use) Act, 1950.
- Trademarks which consist of marks of the shape of goods which result from the nature of goods themselves.
- Trademarks which consist of marks of the shape of goods which is necessary to obtain a technical result.

- Trademarks which consist of marks of the shape which gives substantial value to the goods.

The Act provides for an exception with regard to the first three points, i.e. where the trademarks lack distinctiveness or which contain exclusive marks which sever in the trade to define kind, quality etc. or contains marks which have become customary in the trade practices. The exception is that the trademarks that come under the first three points shall not be refused registration if the trademark has acquired a distinctive character as a result of the use or is a well-known trademark before applying for registration.

Relative Grounds For Refusal Of Registration

Section 11 of the Act provides relative grounds for refusal of registration. This section provides exceptions to the grounds of refusal. If the exceptions are complied with, then the trademarks under section 11 can be registered. Section 11(1) states the following grounds for refusal –

- Trademarks which confuse the public as it is identical with an earlier similar trademark of goods or services.
- Trademarks which confuse the public as it is similar with an earlier identical trademark of goods or services.

An exception to this section is if there is an honest concurrent use of the trademark, the Registrar of Trademarks may allow the registration. Section 11(2) states the following grounds for refusal –

- Trademarks which would take unfair advantage of a similar or identical earlier well-known trademark in India.
- Trademarks which would be detrimental to the distinctive character or repute of a similar or identical earlier well-known trademark in India.

Section 11(3) states the following grounds for refusal –

- The usage of the trademark is bound to be prevented by the law of passing off protecting an unregistered trademark used in the course of trade.
- The usage of the trademark is bound to be prevented by the law of copyright.

The trademarks mentioned in Section 11(2) and 11(3) shall not be refused registration unless an objection is raised in opposition proceedings by the proprietor of the earlier trademark.
Section 11(4) provides an exception to all the grounds mentioned above. It states that the trademarks that fall under Section 11 can be registered if the proprietor of the earlier trademark consents to the registration. If the proprietor of the earlier well-known trademark gives his consent to register the latter trademark, the Registrar can register it.

Names Which Cannot Be Registered

Section 13 and 14 of the Act provides that trademarks containing specific names cannot be registered. Trademarks which have a word that is commonly used of any single chemical element or chemical compound in relation to a chemical substance or preparation cannot be registered.

Trademarks which falsely suggest a connection with any living person can be declined registration by the Registrar unless the consent of such living person is obtained. Similarly, trademarks which falsely suggest a connection with any dead person within twenty years of submitting the application for registration can be declined by the Registrar unless the consent of legal representatives of such person is obtained.

Temporary registration.

- Apply for temporary registration of a motor vehicle in **Form 20** to the Registering Authority in whose jurisdiction the vehicle is or to the dealer dealing in the sale of New Motor Vehicles Recognised by the Transport Commissioner
- Provide copies of Sale Certificate, Insurance Certificate and Road worthiness Certificate
- Pay tax and fee as specified in Central Motor Vehicle Rules 1989 for temporary registration

For extension of temporary registration

- You can apply for the extension of the period of temporary registration to the Registering Authority by specifying the reason and period up to which the extension is required.
- You can apply for the extension of the temporary registration for maximum two times.
- In case you have already applied for extension once and are again applying for extension, you will have to pay the penalty as per Central Motor Vehicle Rules 1989.
- Pay fee and tax for extension as specified in in Rule 81 of Central Motor Vehicle Rules 1989

Permanent registration

In India, the Central Government, or the Regional Transport Authority (RTA), or the Regional Transport Office (RTO) is responsible for the

regulation of all motor vehicles. Hence, you must register your vehicle at the RTO at your place.

The permanent registration number is an identification number that is issued by an RTO in your jurisdiction. This number is unique to your vehicle. Registration of motor vehicles is mandatory since it is linked to the details of the vehicle buyer.

- Apply for permanent registration of a motor vehicle in **Form 20** to the Registering Authority in whose jurisdiction the vehicle is
- If the vehicle has been temporarily registered then apply before the temporary registration expires
- Confirm whether the registration involves hypothecation in which case refer **Hypothecation**
- Confirm the type of registration number (Fancy number/Choice number/General number).
- Confirm about the usage requirement of HSRP/smart card
- Pay appropriate fee as specified in Rule 81 of Central Motor Vehicle Rules 1989 depending on the choice of registration number and use of HSRP/smart card
- Pay Tax as per Central Motor Vehicle Rules 1989 depending on the choice of registration number and use of HSRP/smart card

Renewal of registration certificate

- Apply for renewal of certificate of registration in **Form 25** to the Registering Authority in whose jurisdiction the vehicle is, not more than 60 days before the date of its expiry
- Pay the due taxes on vehicle, if any
- Pay appropriate fee as specified in Rule 81 of the Central Motor Vehicle Rules 1989

Documents required

- Application in **Form 25**
- Pollution under control certificate
- R.C.Book*
- Fitness certificate*
- Certificate of registration*
- Proof for the payment of up-to-date road tax paid*
- Insurance certificate*
- Copy of PAN card or **Form 60** & **Form 61** (as applicable) *

- Chassis & Engine Pencil Print*
- Signature Identification of owner*