LECTURE NOTES

ON

Sub: Vetronics

SEM: 5th Semester

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Automobile Fundamentals

The Engine:-

Automobiles engines are complicated mechanisms that are made up of several internal parts that work like clockwork to produce that power that moves your vehicle. In order for the engine to operate properly it needs all of its parts to be in good condition. One fault can be disastrous.

Main parts of Engine Block:-

The block is the main part of the engine. All other parts of the motor are essentially bolted to it. Inside the block is where the magic happens, such as combustion.

Piston:- Piston pump up and down as the spark plugs fire and the pistons compress the air/fuel mix. This reciprocating energy is converted to rotary motion and transferred to the tires by the transmission, via the drive shaft, to make them spin.

Cylinder head:- The cylinder head is attached to the top of the block to seal the area to prevent the loss of gases. The spark plugs, valves and other parts are fitted to it.

Crank shaft:- Located near the bottom of the engine block, this is the part that converts energy from reciprocating to rotary.

Cam shaft:- The cam shaft opens and closes the valves in perfect timing with the rest of the parts.

Lubrication system:- The job of lubrication system is to distribute oil to the moving parts to reduce friction between surfaces which rub against each other.
Also used for cooling (heat generated by friction)

Types of Lubrication system

1. Mist lubrication system
2. Wet sump lubrication system.
   - → Splash system
   - → Splash pressure lubrication system
   - → Full pressure lubrication system.
3. Dry sump lubrication system.

1) Mist lubrication system:-

→ This system use where sump (below the crank) is not possible like in two stroke engine.
→ In two stroke engine the lubrication oil fill with fuel which is mixed together.

2) Wet sump lubrication system:-

→ This system reequired a larged capacity oil tank sump at the base of cranke chamber.
There are 3 types of wet sump lubrication system.
1. splash lubrication system.
2. Splash pressure lubrication system.
3. Full pressure lubrication system

Dry sump lubrication system :—

- In this type system the sump is dry, we will not store the the lubricating oil it is use for temporcary storage of oil.
- Used mainly in racing car.

Fuel feed system :—

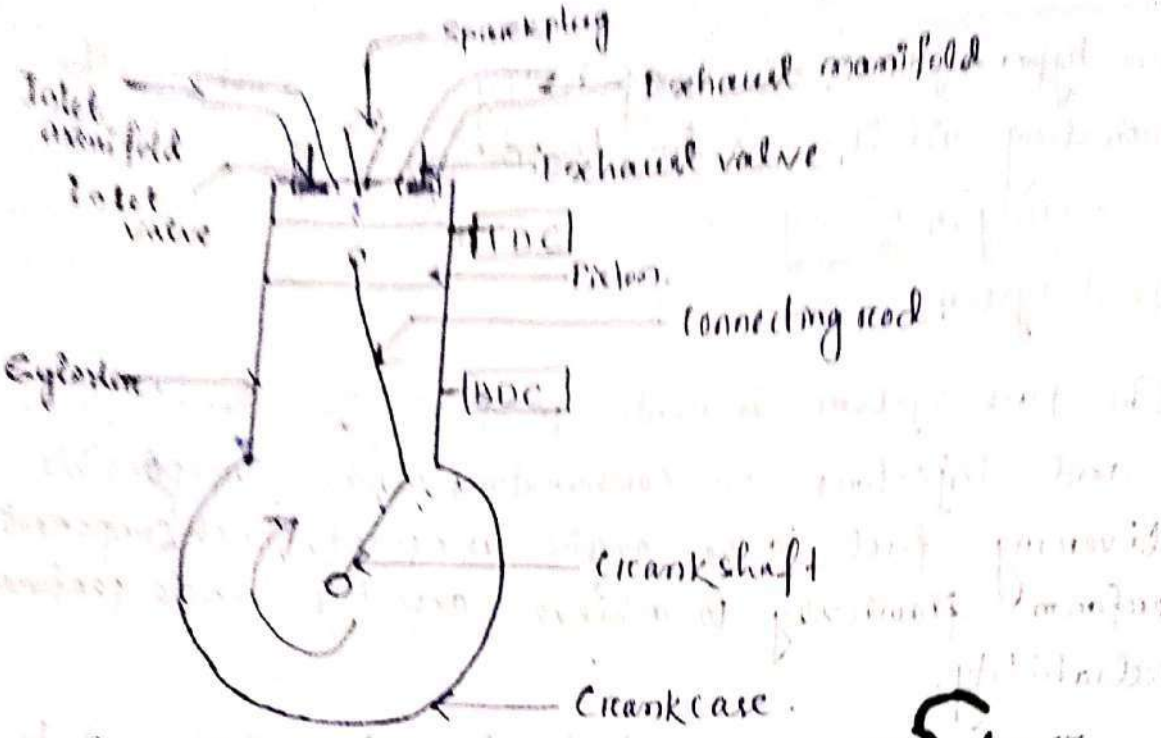
The fuel system is made up of the fuel tank, pump, filter, and injectors or carburators, and is responsible for delivering fuel to the engine as needed. Each component must perform flawlessly to achieve expected vehicle performance and reliability.

The main purpose of the fuel feed system is to control the fuel supply to the engine. To supply the fuel from the fuel tank to the engine cylinders,

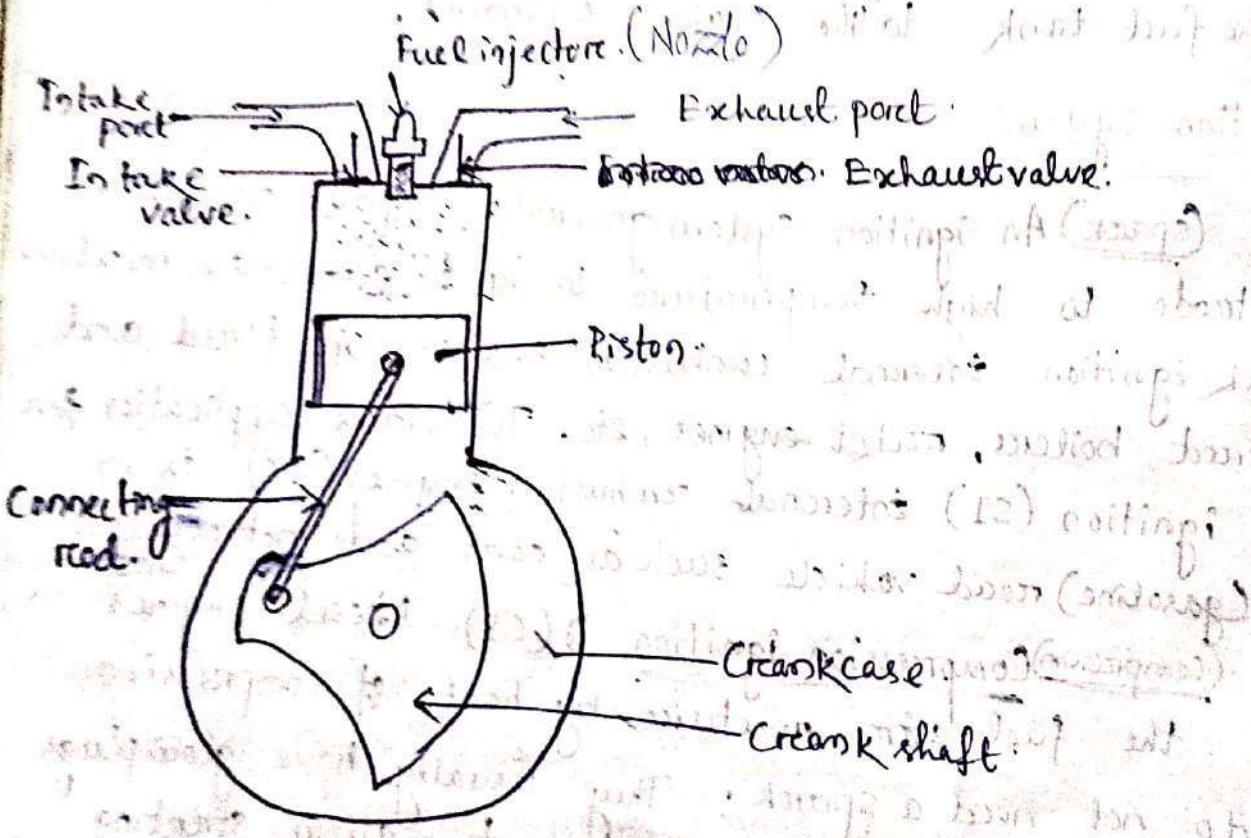
Ignition system :—

(Spark) An ignition system generates a spark or heats an electrode to high temperature to ignite a fuel-air mixture in spark ignition internal combustion engines, oil-fired and gas-fired boilers, rocket engines, etc. The widest application for spark ignition (SI) internal combustion engines (IC) is in petrol (gasoline) road vehicle such as cars and motorcycles.

(Compression) Compression ignition (CI) Diesel engines ignite the fuel-air mixture by heat of compression and do not need a spark. They usually have glow plugs that preheat the combustion chamber to allow starting in cold weather. Other engines may use a flame, or a heated tube, for ignition.



SI Engine



C.I Engine

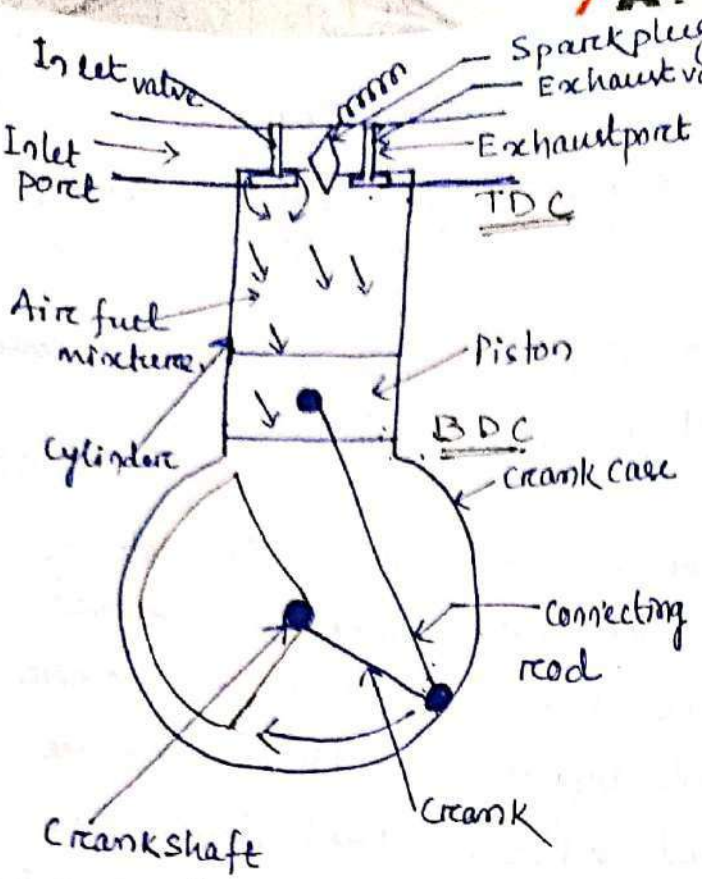
Four stroke, Otto cycle, spark Ignition Engine:-

In a four-stroke Otto cycle engine, spark ignition engine, the four strokes are

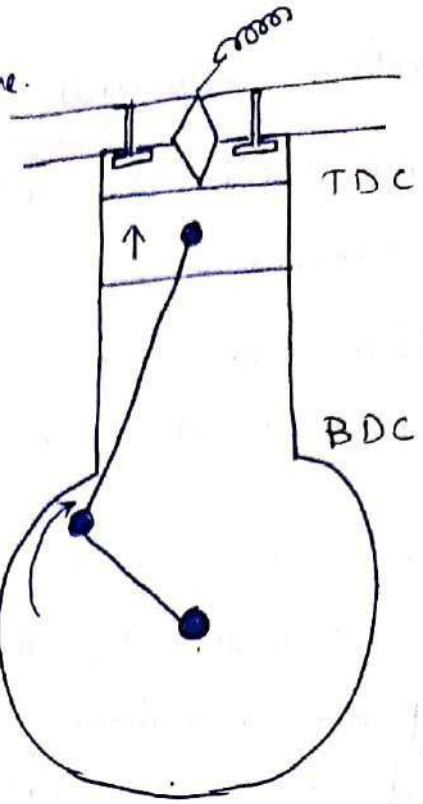
1. Suction stroke
2. Compression stroke
3. Working, Power or Expansion stroke.
4. Exhaust stroke.

Suction Stroke:- During suction stroke, the piston is moved downward by the crankshaft, which is revolved either by the momentum of the flywheel or by the power generated by the electric starting motor. The inlet valve remains open and the exhaust valve is closed during this stroke. The downward movement of the piston sucks air-fuel mixture in the cylinder from the carburettor through the open inlet valve. Here the fuel is petrol mixed with air.

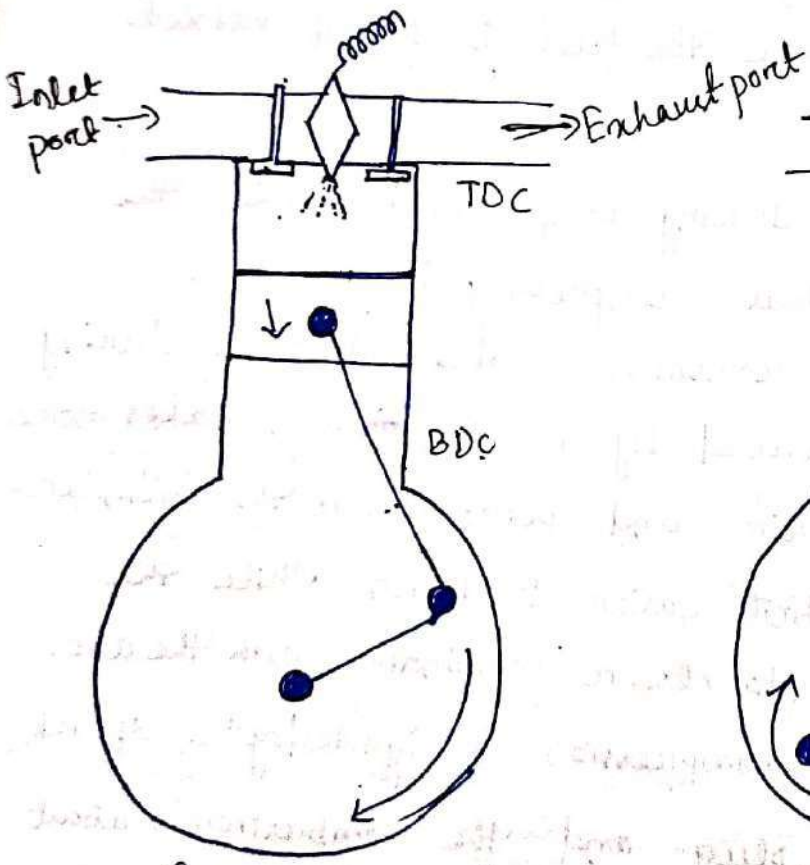
Compression stroke:- During compression stroke, the piston moves upward, thus compressing the charge. Ignition and much of the compression also take place during this stroke. The heat produced by the compression makes more homogeneous mixture of air and petrol inside the cylinder. The heat makes the petrol easier to burn while the compression forces it into closer combination with the air. The mixture, under compression is ignited by the spark produced by a spark plug and the combustion is about half-completed when the piston is at top dead centre. Both the inlet valve and exhaust valve remain closed during this compression stroke.



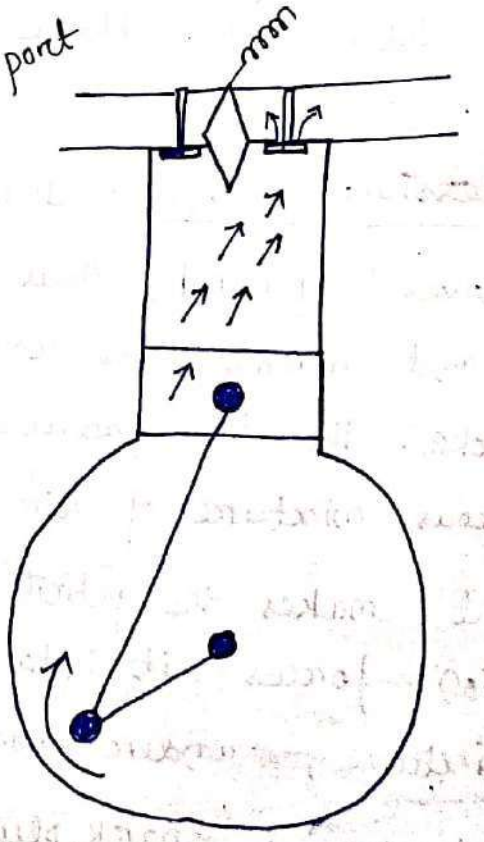
(Suction stroke)



(Compression stroke)



(Power stroke / Expansion stroke / Working stroke)



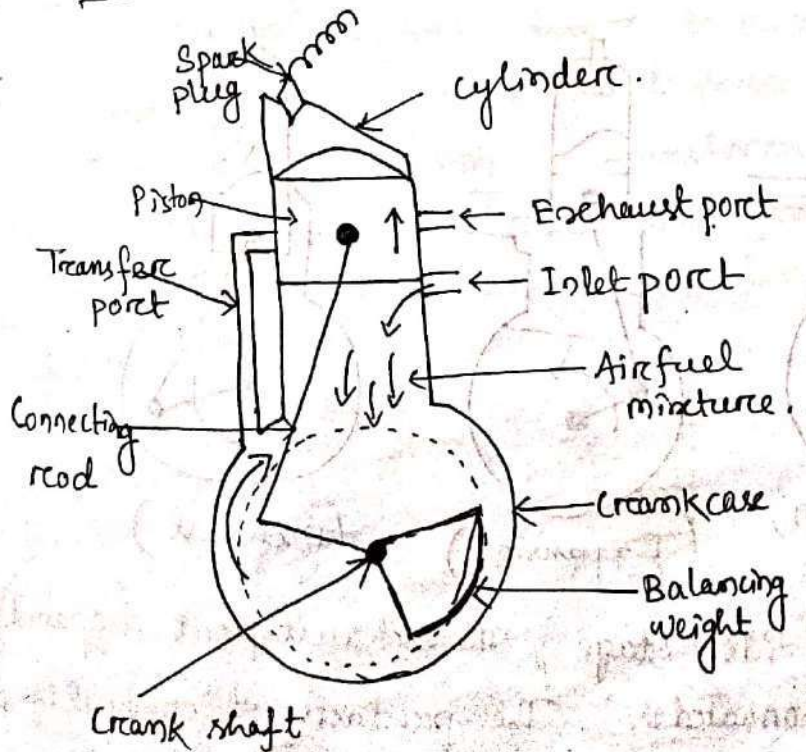
(Exhaust stroke)

Working, Power or Expansion stroke:- The expansion of the gases due to the heat of combustion exerts a pressure on the cylinder and piston. Under this impulse the piston moves downward thus doing useful work. Both the valve remain closed during this stroke.

Exhaust stroke:- During this stroke, the inlet valve remains closed and the exhaust valve opens. The greater part of the burnt gases escapes because of their own expansion. The piston moves upward and pushes the remaining gases out of the open exhaust valve.

Thus, in this type of engine, four strokes of the piston are required to complete the cycle, and the four strokes make two revolutions of the crankshaft.

Two-stroke cycle, Spark Ignition Engine



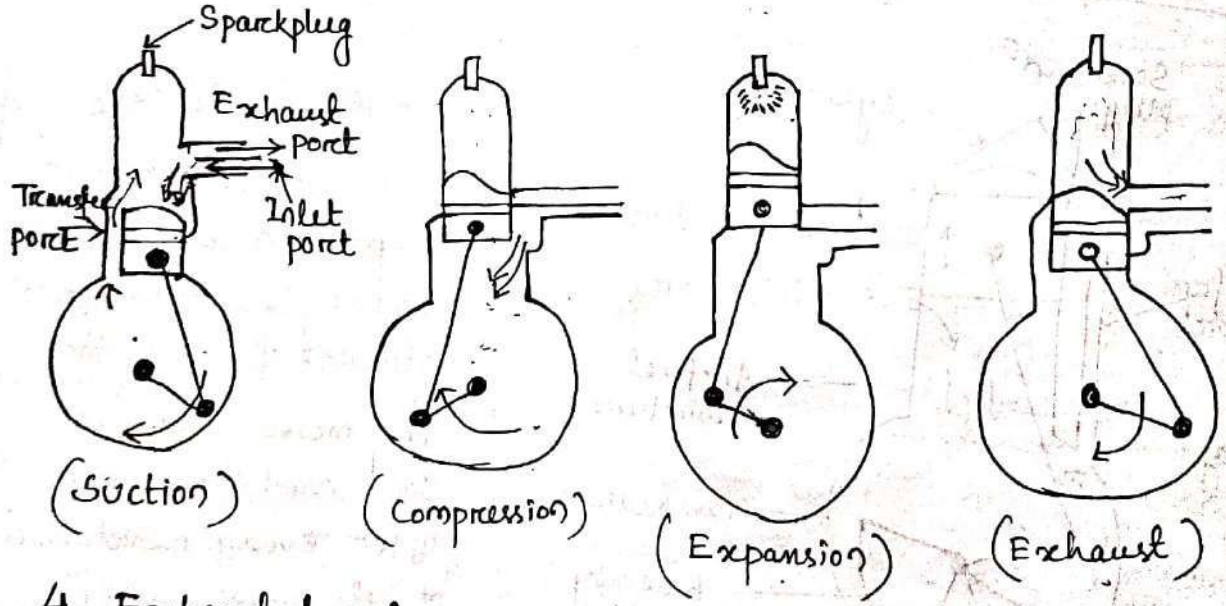
In this cycle, the suction, compression, expansion and exhaust takes place during two strokes of the piston. It means there is one working stroke after every revolution of the crank shaft. A two stroke engine has ports instead of valves.

1. Suction stage:- In this stage, the piston, while going towards BDC, uncovers both the transfer port and the exhaust port. The fresh fuel-air mixture flows into the engine cylinder from the crank case.

2. Compression stage:- In this stage, the piston, while moving up, first covers the transfer port and then exhaust port. After that the fuel is compressed as the piston moves upward.

~~2. Compression stage:~~

3. Expansion stage:- Shortly before this piston reaches the TDC (during compression stroke), the charge is ignited with the help of spark plug. It suddenly increases the pressure and temperature of the products of combustion. Due to rise in the pressure, the piston is pushed downwards with a great force. The hot burnt gases expanded due to high speed of the piston. During this expansion, some of the heat energy produced is transformed in to mechanical work.



4. Exhaust stage:- In this stage, the exhaust port is opened as the piston moves downwards. The products of combustion from the engine cylinder are exhausted through the exhaust port in to the atmosphere.

This completes the cycle and the engine cylinder is ready to suck the charge again.

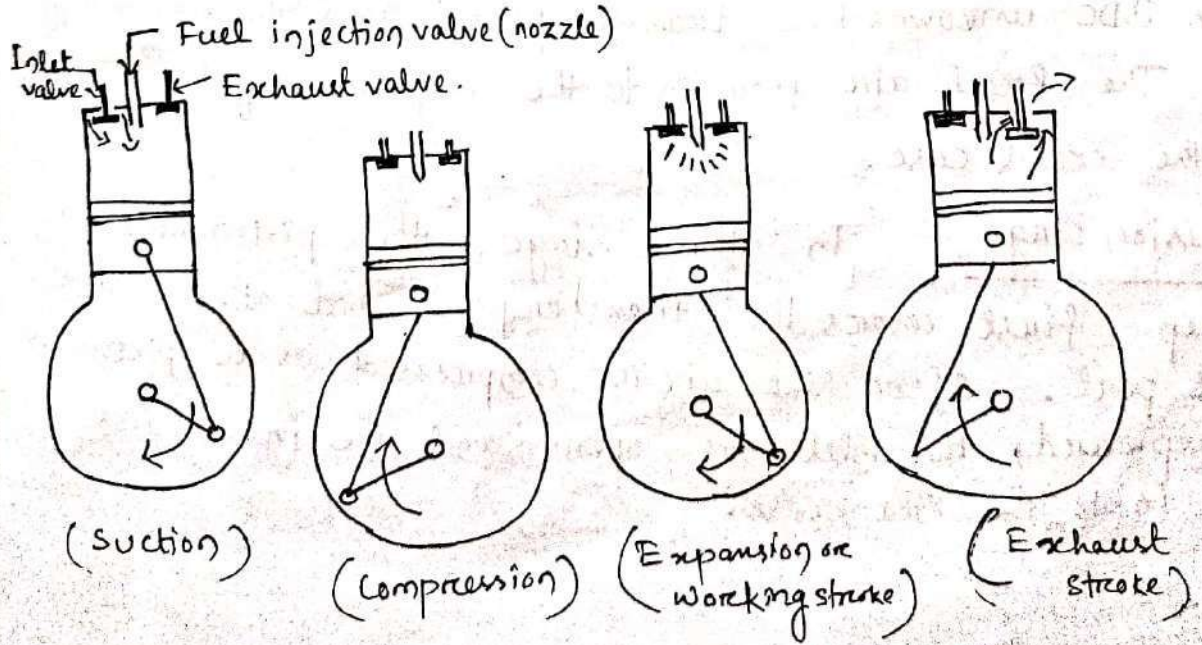
Four-Stroke cycle Diesel Engine:—

It is also known as compression ignition engine because the ignition takes place due to the heat produced in the engine cylinder at the end of compression stroke.

1. Suction or charging stroke:— In this stroke, the inlet valve opens and pure air is sucked into the cylinder as the piston moves downwards from the top dead centre (TDC) to the bottom dead centre (BDC).

2. Compression stroke:— In this stroke, both the valves are closed and the air is compressed as the piston moves upwards from BDC to TDC.

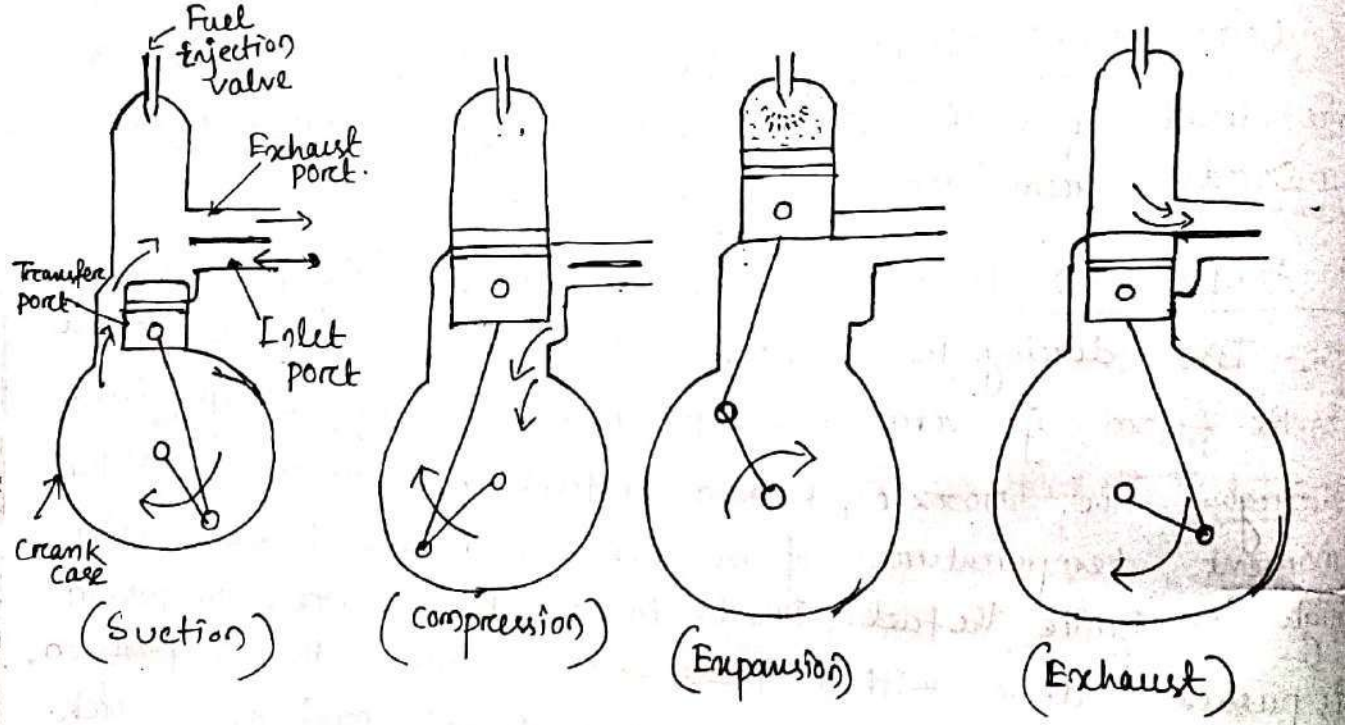
3. Expansion stroke:— Shortly before the piston reaches the TDC (during the compression stroke), fuel oil is injected in the form of very fine spray into the engine cylinder, through the nozzle, known as fuel injection valve. At this moment, temperature of the compressed air is sufficiently high to ignite the fuel. Due to increased pressure, the piston is pushed down with a great force. During this expansion, some of the heat energy is transformed into mechanical work. Both the valves are closed and the piston moves from TDC to BDC.



4. Exhaust stroke :— In this stroke exhaust valve is open a the piston moves BDC to TDC. This movement of the piston pushes out the products of combustion from the engine cylin through the exhaust valve into the atmosphere.

This completes the cycle and the engine cylind is ready to suck the fresh air again.

Two- Stroke cycle Diesel Engine :—



Suction stage :— In this stage the piston will going down towards BDC uncovers the transfer port and the exhaust port. The fresh air flows in to the engine cylinder from the crank case.

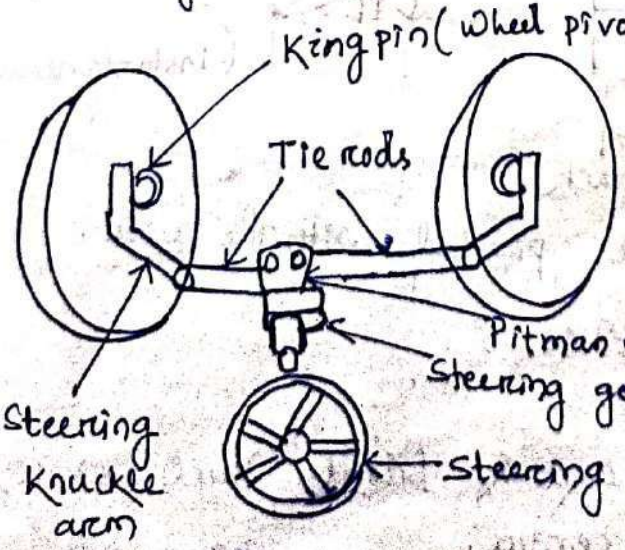
Compression stage :— In this stage, the piston while moving up, first covers the transfer port and then exhaust port. After the air is compressed as the piston moves upwards the inlet port opens and the fresh air enters in to the crankcase.

3. Expansion stage :- Shortly before the piston reaches the TDC, the fuel oil is injected in the form of very fine spray into the engine cylinder through the nozzle. The fuel oil is assumed to be burnt at constant pressure. Due to increased pressure, the piston is pushed with a great force. The hot burnt gases expanded due to high speed of the piston. During this expansion, some of the heat energy produced is transformed into mechanical work.

4. Exhaust stage :- In this stage, the exhaust port is opened and the piston moves downwards. The products of combustion from the engine cylinder are exhausted through the exhaust port into the atmosphere.

This completes the cycle, and the engine cylinder is ready to suck air again.

Steering System :- The function of the steering system is to convert the rotary movement of the steering wheel into angular turn of the front wheels. The steering system also absorb a large part of the road shocks, thus preventing them from being transmitted to the driver.



Steering mechanisms :-

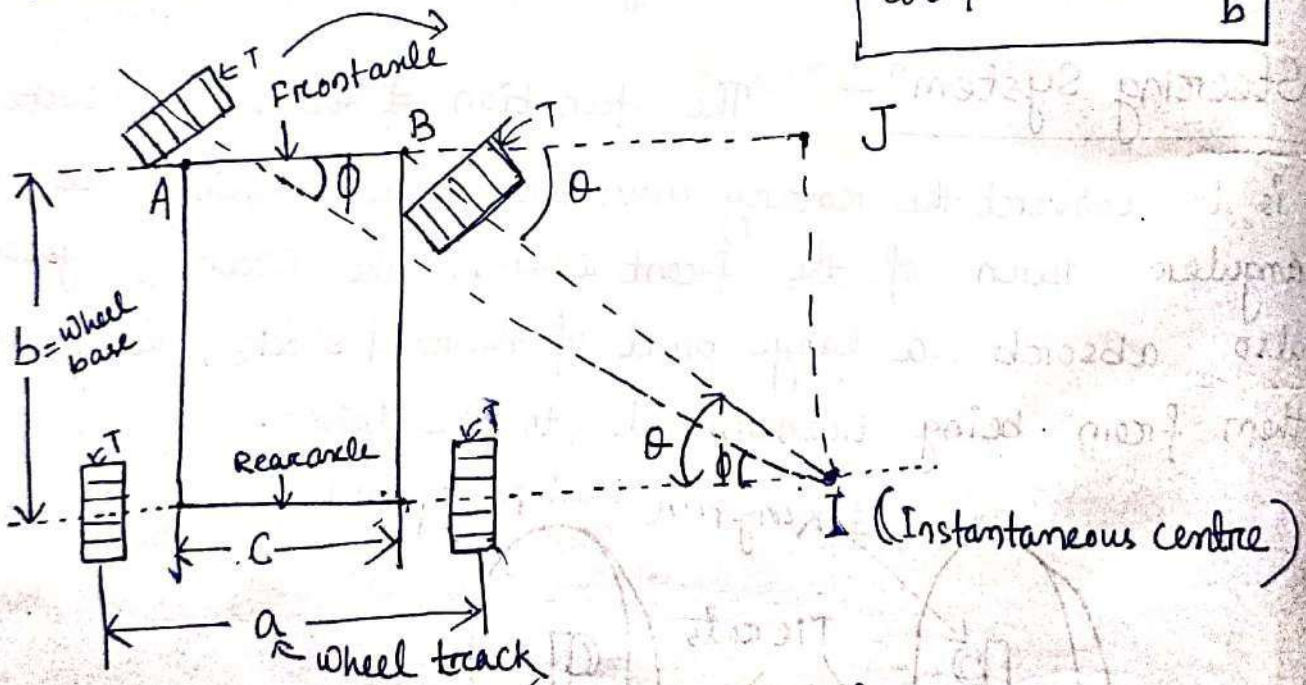
There are two types of steering gear methanisms

1. Davis steering gear
2. Ackerman steering gear

The main difference between the two steering gear mechanisms ~~are~~ is that the Davis steering gear has sliding pairs, where as the Ackermann steering gear has only turning pairs. The sliding pair has more friction than the turning pair, and wear out quickly so the Ackermann steering gear is ~~preff~~ preferred more.

Ackerman steering mechanism :-

$$\cot\phi - \cot\theta = \frac{c}{b}$$



A & B pin point pivoted with the axle.

C = distance bet^n A & B =

Right turn

Rear wheel axis & front wheel axis intersect each other with one centre.

Inner wheel make larger angle, 'θ'

Outer " " smaller " , 'ϕ'

~~Cot θ = B~~

In $\triangle BJ$ A , $\cot\theta = \frac{BJ}{IJ}$

" $\triangle$ IAJ , $\cot\phi = \frac{AJ}{IJ}$

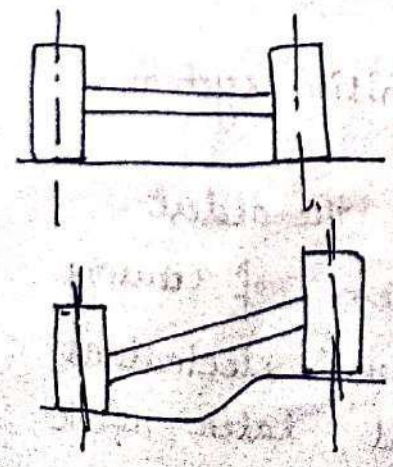
$$= \frac{AB + BJ}{IJ} = \frac{AB}{IJ} + \frac{BJ}{IJ}$$

$$\Rightarrow \cot\phi = \frac{c}{b} + \cot\theta$$

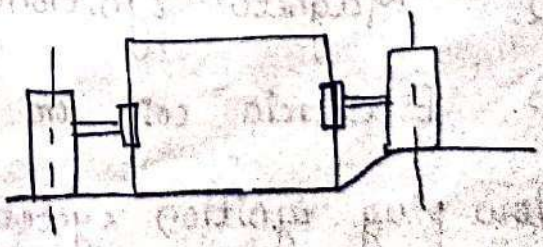
$$\Rightarrow \boxed{\cot\phi - \cot\theta = \frac{c}{b}} \quad \text{(Proved)}$$

This steering equation is proved. So this equation should follow so that the vehicle must not skid when it turns.

Suspension system :—



Dependent system



Independent system

The suspension system maximizes the friction between the tires and the road to provide steering stability and good handling. The suspension system also provides comfort for passengers to limiting the impact of particular road conditions. Suspension is the system of tires, tire air, springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two. Suspension systems must support both road holding / handling and ride quality.

Electronic Ignition system:—

The electronic ignition system is the type of ignition system that uses electronic circuits, usually by transistors controlled by sensors to generate electric pulses which in turn generate the better spark that can be even burn the lean mixture and provide better economy and lower emission.

Various types of ignition systems were used before that are

1. Glow plug ignition system
2. Magneto ignition system
3. Electric coil or Battery ignition system.

Glow plug ignition system :— It is the oldest ignition system, which has a problem of causing uncontrolled combustion due to the use of electrode as a ignition source, which is solved later after the introduction of magneto ignition system.

Magneto Ignition system:- It depends on the engine speed, so it shows starting problem due to low speed at the starting of the engine. Which is later solved by battery coil ignition system.

Electric coil ignition or battery ignition system:- It shows some limitations also

- Less efficient with the high speed engines
- High maintenance require due to mechanical and electrical wear of the contact breaker points.

So, in the modern automobile new technologies are introduced and it is found that use of sensors and electronic component gives more effective and accurate outputs than that of mechanical components, so the use of sensors with electronic controlled unit becomes essential to fulfill the needs of modern high power and high speed automobiles, so to fulfil the need of high performance, high mileage and greater reliability has led to the development of electronic ignition system.

It have 1- Battery (the power house of the ignition system)

2- Ignition switch (which governs the ON & OFF of the system)

3- Ignition control module or control unit of ignition system

Chapter 2.0 - Storage Battery, Charging and Lighting System

Def^n

Lead acid cell :- The battery which uses sponge lead and lead peroxide for the conversion of the chemical energy into electrical power, such type of battery is called lead acid battery. The lead acid battery is most commonly used in the power stations and substations because it has higher cell voltage and lower cost.

Construction of Lead Acid Battery :-

1) **Container** - The container of the lead acid battery is made of glass, lead lined wood, ebonite, the hard rubber of bituminous compound, ceramic materials or moulded plastics and are seated at the top to avoid discharge of electrolyte. At the bottom of the container, there are four ribs, on two of them rest the positive plate and others support the negative plates.

2) **Plate :-** The plate of the lead-acid cell is of diverse design and they all consist some form of a grid which is made up of lead and the active material. The grid is essential for conducting the electric current and for distributing the current equally on the active material. The grids are made up of an alloy of lead and antimony. The grid for the positive and negative plates are of the same design, but the grids for the negative plates are made lighter because they are not as essential for the uniform conduction of the current.

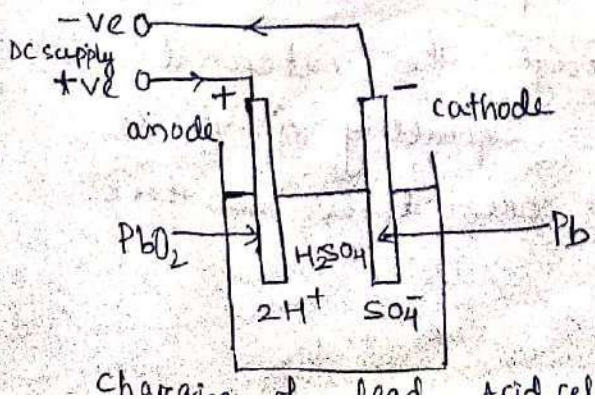
3) Active material:- The active elements of the lead acid are
a) Lead peroxide (PbO_2) (colour - dark chocolate) (+ve plate)
b) Sponge lead (colour - grey) (Pb) (Negative plate)
c) Dilute Sulfuric Acid (H_2SO_4) (electrolyte)

4) Separators:- The separators are thin sheets of non-conducting material made up of chemically treated leadwood, porous rubbers, or mats of glass fibre and are placed between the positive and negative to insulate them from each other.

5) Battery terminals:- A battery has two terminals positive and negative.

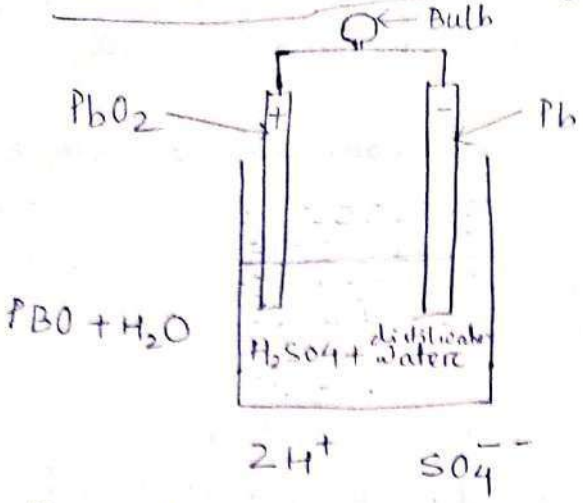
Working principle of Lead Acid Battery:-

When the sulfuric acid dissolves, its molecules breakup into positive hydrogen ions ($2H^+$) and sulphate negative ions (SO_4^-) and move freely. If the two electrodes are immersed in solutions and connected to DC supply then the hydrogen ions being positively charged and moved towards the electrodes and connected to the negative terminal of the supply. The SO_4^- ions being negatively charged moved towards the electrodes connected to the positive terminal of the supply main (i.e anode). Each hydrogen ion takes one electron from the cathode, and each sulphates ions takes the two negative ions from the anodes and react with water and form sulfuric and hydrogen acid.



Charging of lead acid cells

Chemical reaction during discharging :—



H_2SO_4 Electrolyte.
38% solphuric acid + Distilled water 62% H_2O.

At anode

$PbO_2 + 2H \rightarrow PbO + H_2O$

$PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$

At cathode

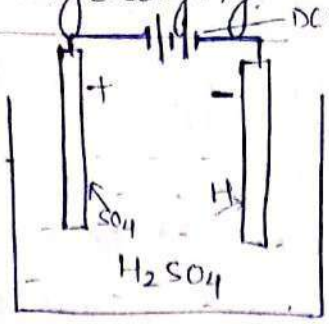
$Pb + SO_4 \longrightarrow PbSO_4$

Chemical reaction during discharging — A load is ~~added~~ connected, externally between this plate. The molecules of H_2SO_4 splits in to $(2H_2 + SO_4)$ +ve hydrogen ion and -ve solphate ion. The Hydrogen(H^+) move to the lead peroxide plate and reaching the PbO_2 & become Hydrogen atom (2H). It again attached to the PbO_2 & forms PbO & when the PbO react with the H_2SO_4 which form $PbSO_4$ & H_2O.

SO_4 ion reaching to the Pb plate and gives two electron and it create $Pb + SO_4 \longrightarrow PbSO_4$ (whitish)

+ve Hydrogen ions take electron from $PbSO_4$ plate & -ve sol-phate ions gives electron to the Pb plate their could be inequality of electron between these plate. Hence there would be a flow of current through the external load between these plate for balancing these equallity of these electron. The potential difference is created between these plates.

Chemical reaction during charging:-



$PbSO_4 + 2H_2 + SO_4$

↓

$PbO_2 + 2H_2SO_4$

$2H^+$ SO_4^{--}

$PbSO_4 + 2H$

↓

$Pb + H_2SO_4$

The anode and cathode are connected to the DC supply. H^+ ion moves towards the -ve terminal & each Hydrogen ion recieve electron & form hydrogen atoms & it ~~form~~ react with the $PbSO_4$ ion & form $Pb + H_2SO_4$ (lead+sulphuric acid)

-ve SO_4 ~~ion~~ moves towards the electron to the +ve terminal & they give their extra electrons & become radical solphate & react with anode & form $PbO_2 + 2H_2SO_4$ (Lead peroxide + Sulphuric acid).

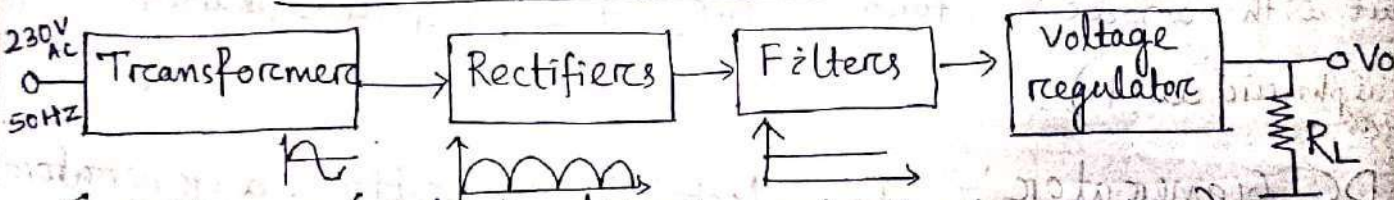
DC Generator:- In electricity generation, a generatore is a device that converts motive power (mechanical energy) into electrical power for use in an external circuit. Sources of mechanical energy includes steam turbines, gas turbines, water turbines, internal combustion engines, wind turbines and even hand cranks. The first electromagnetic generator, ~~the~~ was invented in 1831 by British scientist Michael Faraday. Generators provide nearly all of the power for electric power grids.

Alternator:- An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current.

Difference between Alternator & Generator:-
Both alternator and generator converts mechanical energy in to electrical energy. But An alternator converts mechanical energy into AC electrical energy. A generator is a mechanical device which converts Mechanical energy to either AC or DC electrical energy. A alternator always includes an alternating current, A generator can generate either alternating or direct current.

Electro mechanical regulators:- In electromechanical regulators, voltage regulation is easily accomplished by coiling the sensing wire to make electromagnet.

Voltage regulators



Transformer → Step up (output voltage is greater than the input voltage)
→ Step down (Output voltage is less than input voltage)

Rectifier:- → Halfwave rectifier
→ Centre tapped fullwave rectifier
→ Bridge rectifier (efficiency is more)

f? → To convert AC to pulsating d.C

Filter → convert pulsating d.C to pure d.C

Voltage regulator:- F? - To maintain the constant output voltage. Ex:1) change in input
Ex:2) Load changes

Def?:- A voltage regulator is an electronic circuit that provides a stable DC voltage independent of the load current, temperature and AC line voltage variations.

What is voltage Regulator? A voltage regulator may use a simple feed forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design; it may be used to regulate one or more AC or DC voltages.

→ Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements.

→ In automobile alternators and central power station generator plants, voltage regulators control the output of the plant.

→ In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers ~~recie~~ receive steady voltage independent of how much power is drawn from the line.

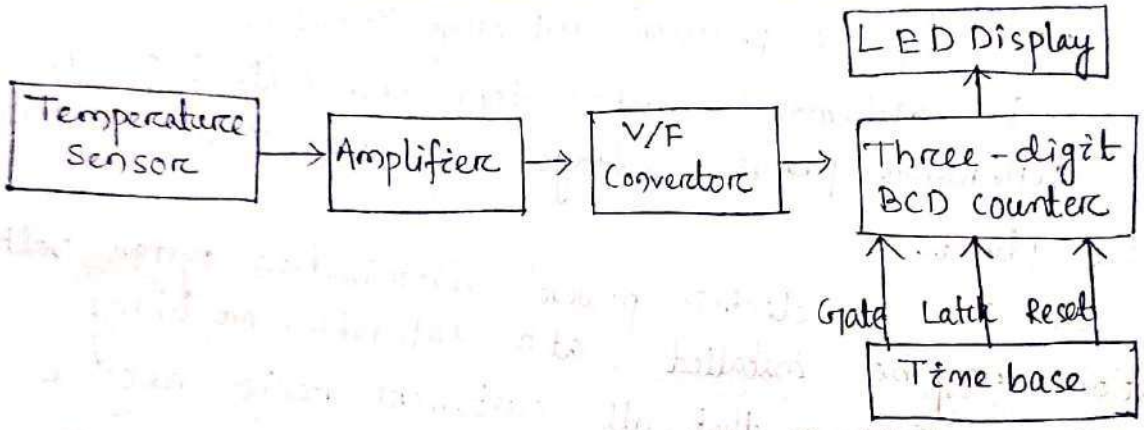
LED Lighting system:-

Def?:- A Light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, as Recent development have produced high-output white light LEDs suitable for room and outdoor area lighting.

LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching.

Block diagram of LED Lighting System



Static and Dynamic Bending Light (Head lamp)

The headlamp systems of today are designed especially to pass legal requirements all over the world. The new improved quality headlamp system is called AFS (Advanced Front Lighting Systems) and it relied to dynamic changing of light distributions depending of traffic area and condition.

Chapter 3.0

SENSORS AND ENGINE MANAGEMENT SYSTEMS

Introduction to Sensors and Transducers :-

Transducer :- In a measurement system all the quantities being measured, could not be displayed as such. In such situation, the accurate measurement of a quantity is usually done by converting the related information or signal to another form which is more conveniently or accurately displayed. This is achieved with the help of a device which is known as transducer.

Sensor :- A sensor senses the condition, state and value of the process variable which reflects the output of the instrument.

A TRANSDUCER is a device, which transforms energy from one form to another. The transducer may be mechanical, electrical, magnetic, optical, chemical, thermal or a combination of among of two or more.

Types of Sensors

Air flow rate sensor :- It is also called mass flow sensor. (MAF) sensor

A mass (air) flow sensor is a sensor used to determine the mass flow rate of air entering a fuel injected internal combustion engine.

The air mass information is necessary for the engine control unit (ECU) to balance and deliver the correct fuel mass to the engine. There are two common types of mass air flow sensors used in automotive engines such as

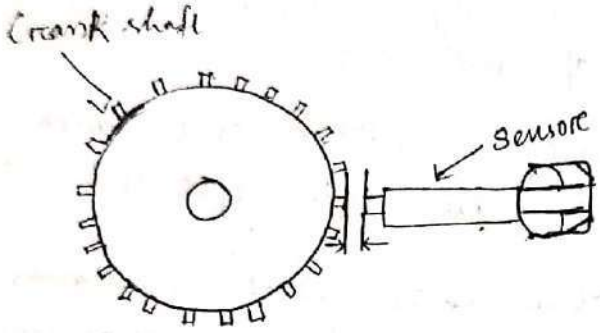
- → Vane meter
- → hot wire (Modern cars)

Neither design employs technology that measures air mass directly. However, with additional sensors and inputs, an engine's ECU can determine the mass flow rate of intake air.

Engine crankshaft angular position sensor :—

A crank sensor is an electronic device used in an internal combustion engine, both petrol and diesel, to monitor the position or rotational speed of the crankshaft.

Types → Hall effect Sensor
→ Inductive type "
→ Optical type "

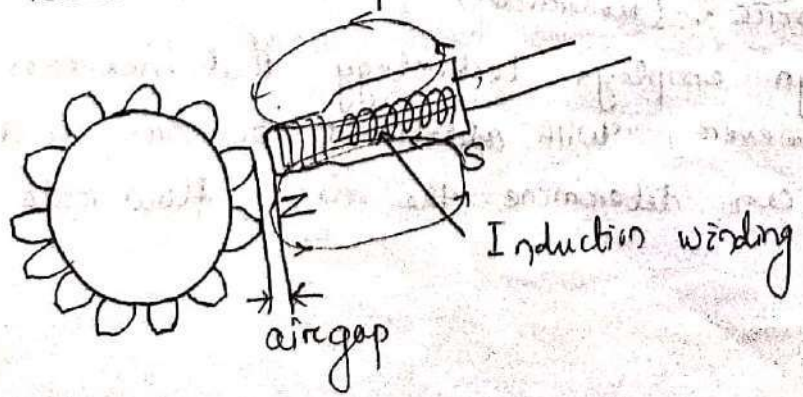


→ ECU
→ Postion of piston

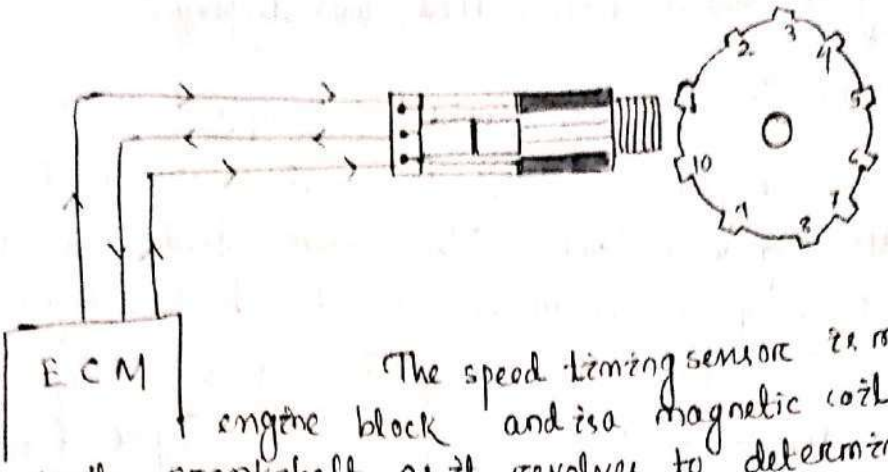
distance - (1 ± 0.4) mm

Engine Speed Sensor :—

Engine speed sensors, which are not to be confused with a vehicle speed sensor, are sensors that are attached to the crankshaft of a car's engine. The purpose of an engine speed sensor is to assess the speed at which the crankshaft spins. These speed sensors are electronic control devices whichare used in automotive internal combustion engines. This component sends crucial information to the engine control module (ECM). Crankshaft sensors are used to measure the speed of the crankshaft rotation.



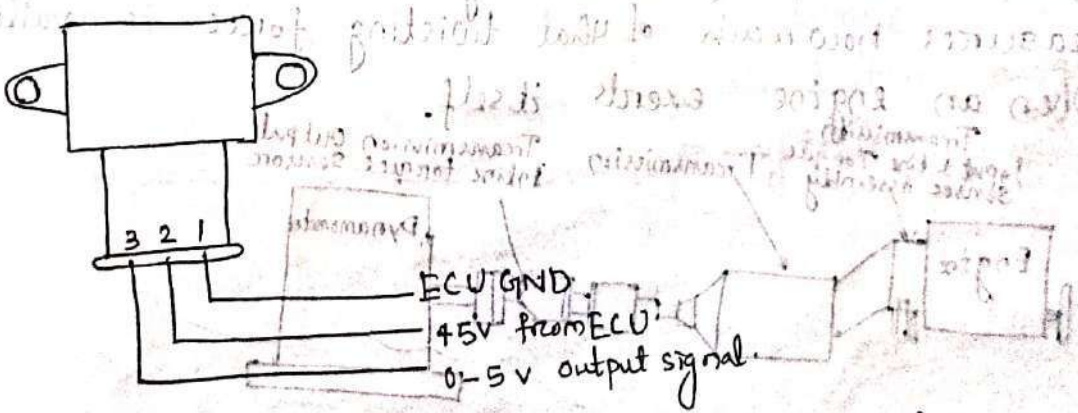
Timing Sensor (Crankshaft / cam shaft position sensor)



The speed timing sensor is mounted to the engine block and is a magnetic coil. It reads the teeth on the crankshaft as it revolves to determine the speed of the rotation. It then sends that information to the engine control module to report how the engine is performing.

Throttle angle position sensor :— (TPS)

A throttle position sensor is a sensor used to monitor the air intake of an engine. The sensor is usually located on the butterfly spindle / shaft, so that it can directly monitor the position of the throttle and transmits the information to the ECM. This sensors monitors how ~~air~~ fast down the accelerometer pedal is pused and gives the output current determing the position of the pedal. The position of the pedal controls the airflow of the engine.

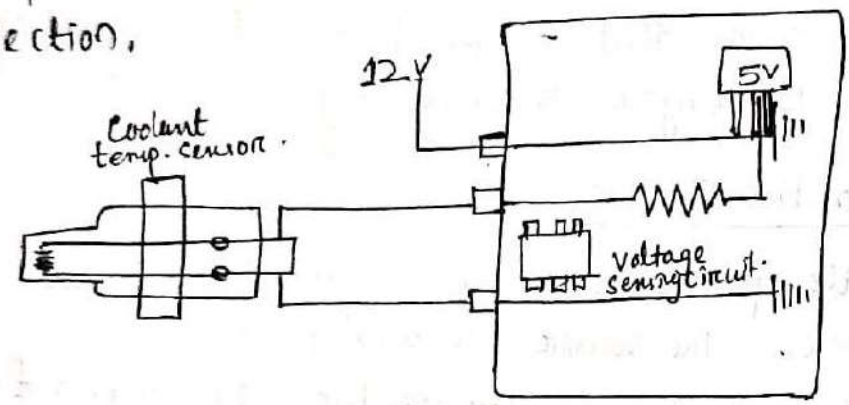


Pressure Sensor :— Pressure is an expression of force exerted on a surface per unit area. We commonly measure the pressure of Liquids, air, and other gases, amongst other engines. A pressure sensor simply monitors the pressure and can display it in one of the several units such as pascal, Bar, PSI etc.

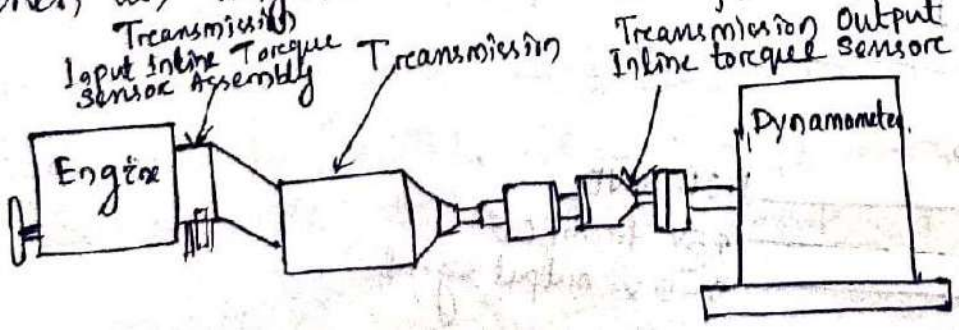
The pressure of the air in your tire is a great example of pressure and how it is measured.

A pressure sensor converts the pressure to small electrical signal that is transmitted and displayed.

Temperature Sensor:- A coolant temperature sensor is confined to the engine of a vehicle and measures the temp. of the vehicle's engine coolant. The sensor feeds this information back in the form of an electrical current to the engine control unit (ECU). The ECU then responds to a change in the temperature difference and readjusts the engine fuel injection.



Engine torque Sensor:- In a rotary torque sensor, the strain gauge is bonded to the rotating shaft that slightly deforms when torque is applied. Torque is a twisting force that speaks to the engine's rotational force and measures how much of that twisting force is available when an engine exerts itself.



Sub - Vetronics

chap-4 Fuel Delivery System

1. Introduction of fuel system

All internal combustion engines need three things to run... Air, fuel and Spark. The fuel system is critical in storing and delivering the gasoline or diesel fuel your engine needs to run.

Basic components of fuel system —

1) Fuel tank — In fuel tank the fuel is filled.

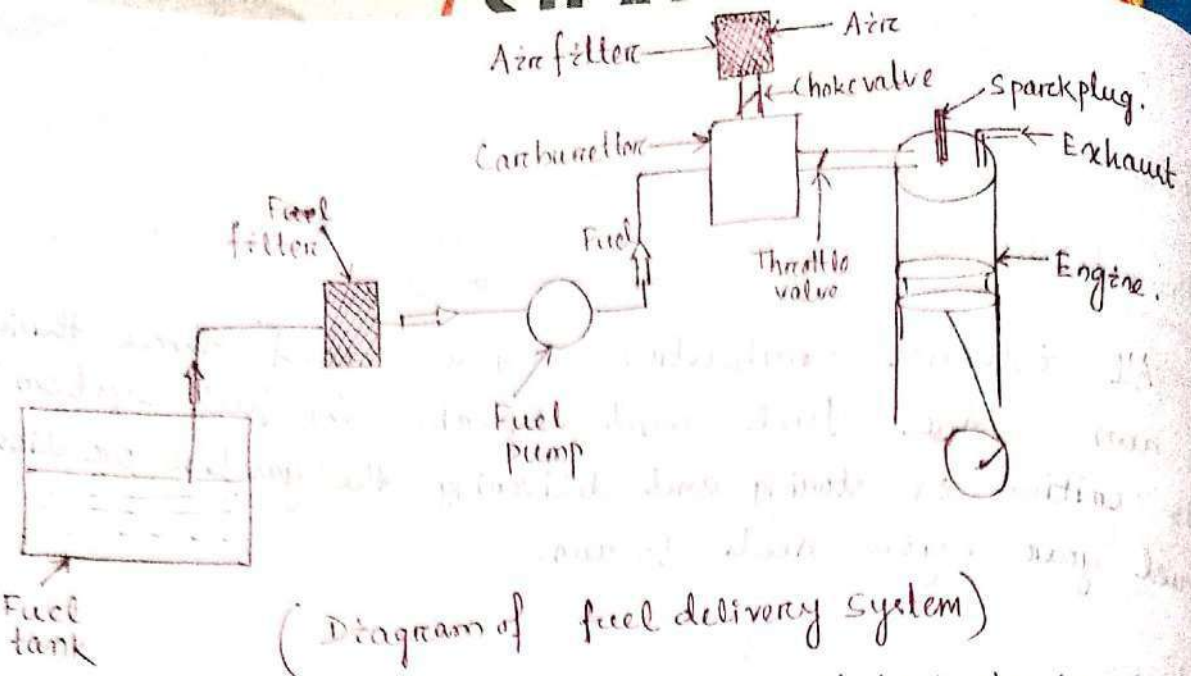
2) Fuel filter — From the fuel tank fuel is supply. through the fuel filter.

3) Fuel pump — From the fuel filter the fuel is supplied to the fuel pump.

4) Carburettor — From the fuel pump the fuel is supplied to the carburettor. In the carburettor two things were mixed (air & fuel). (Carburettor is used in S.I engine only.)

5) Air filter — One air filter also provided which remove the dust particle from the air and supply it to the carburettor. And the amount of air controled by the choke valve.

6) Engine — From the carburettor air fuel mixture flow to the engine by the help of throttle valve. Throttle valve help to flow the correct amount of air fuel mixture to the engine.



(Diagram of fuel delivery system)

In an automobile, generally fuel tank is placed far from engine for safety and convenience purpose. Generally fuel tank placed at lower level compared to carburettor and therefore fuel pump is required to lift the petrol from fuel tank to carburettor.

(*In two wheeler, fuel tank placed above the carburettor so fuel pump is not required.)

* In C.I engine fuel pump is essential for injecting the fuel with very high pressure while in S.I engine fuel pump is required only to left the fuel from fuel tank to carburettor.

A single pump with diaphragm can be used for this purpose. Diaphragm moves up and down, create necessary suction to suck the petrol from the fuel tank. Diaphragm may be operated mechanically (mechanical pump) or etc.

Fuel from fuel pump enters to the carburettor and air from atmosphere passes through air cleaner and then enters to the carburettor via choke valve. Choke valve will reduce the flow of air during starting to make rich mixture so that engine will easily start.

In carburettor, fuel and air mix with each other (known as charge) in proper proportion and than supply to the engine. The quantity of mixture supply to the engine is controlled by throttle valve according to the requirement of power (therefore S.I engine are known as quantity governing engine)

Central locking system

Def^{n} – A system by which all the doors of a motor vehicle can be locked simultaneously when the driver's door is locked.

Power door locks (also known as electric door locks or central locking) allow the driver or front passenger to simultaneously lock or unlock all the doors of an automobile or truck, by pressing a button or flipping a switch.

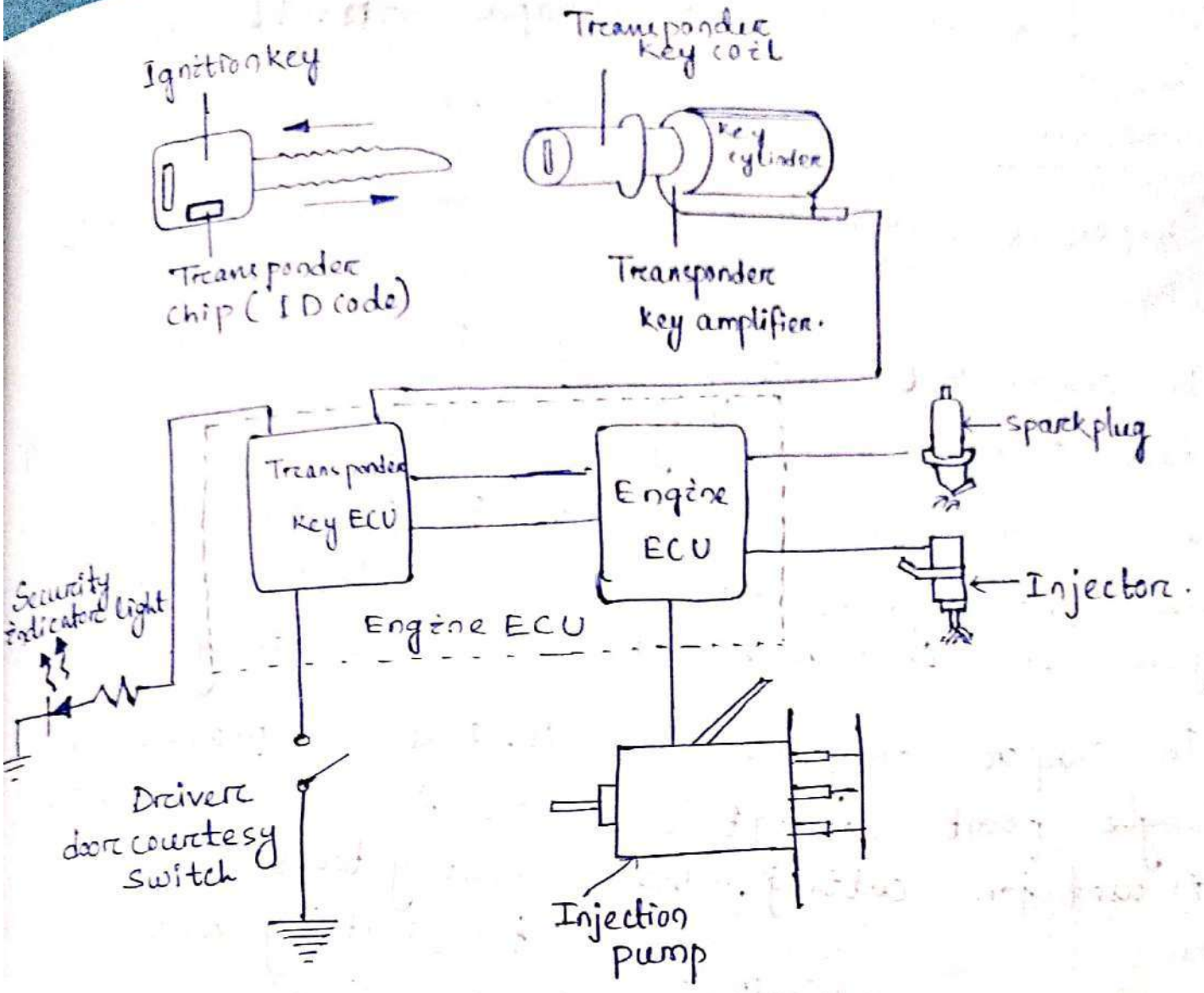
Importance of central locking system

The very fact that the central locking system of the car prevents the vehicle from starting by turning on the engine's immobiliser is reason enough to protect your vehicle with it.

How central locking system works :—

Each vehicle key has a distinct code that synchronises with the alarm system of the vehicle. Once the vehicle is locked using the key, the engine immobiliser goes off. The system will come back up only when the same code is received from the key.

When the driver's door is locked, a switch moves in the master driver unit. This unit then transmits a signal to the drive units that assist in moving the link rods. This process ~~unlocks~~ unlocks or locks the other doors as well.



1- Remote button sends a signal to the door lock relay.
2- The lock relay activates the lock actuator inside the door.
3- The lock opens and grants access to the vehicle.

CNG Hybrid electric Vehicle :-

(i) CNG is promoted as a better fuel alternative than petrol or diesel.

(ii) CNG is cheaper & greener compared to petrol or diesel.

(iii) The CNG vehicles come with a CNG Kit installed that works in simultaneously with the petrol engine onboard a vehicle in the CNG vehicle a CNG tank is position at the backup the vehicle inboot space.

(iv) The petrol engine is design a manner that it works with both petrol & CNG at one time.

(v) CNG is known as the compress natural gas. The burning of CNG create less toxic gasses than the petrol diesel, LPG etc

(vi) As the natural gas is provided it give less risk in the case of leak compressed to other liquids.

Properties of CNG :-

(i) CNG is an odourless, Colourless & tasteless compound with non-corrosic & non-toxic properties.

(ii) Mithane is main component of CNG.

(iii) It is very healthy as it is easily scatters into the air.

(iv) CNG is derived mainly form natural gas, wells, coal wells bed mithane wells & oil wells.

Advantages of CNG :-

(i) It is cheaper than the diesel & petrol used to run bushes & other automobiles.

(ii) Comparision with the vehicles operating on diesel & petrol, the cost of maintance of vehicle running on CNG is low.

(iii) It is more environmental friendly as it releases less toxic & unnecessary gasses than other fuel.

(iv) It extends the life of lubricating oil as the crankcase oil doesnot really dilute & contaminants.

(v) It requires higher temprature upto 540°C. for auto ignition.

Disadvantages of CNG :-

(i) As the CNG vehicle needs a CNG kit, So it will installed in the boot space & the space is reduced.

(ii) Decrease power o/p than the petrol & diesel.

(iii) CNG needs frequent services intervals.

(iv) Long waiting for refueling.

(v) Every 3 years the cylinder needed hydro tested.

Hybrid electric Vehicle :-

Introduction :-

(i) A hybrid electric vehicle (HEV) augments an electric vehicle (EV) with a second source of power referred to as the alternative power unit (APU)

(ii) A hybrid can achieve the cruising range and performance advantages of conventional vehicles with low-noise, low-exhaust emissions, and energy independence benefits of electric vehicles.

(iii) Accordingly the hybrid concept where the alternative power unit is used as a second source of energy is gaining acceptance and is overcoming some of the problems of pure electric vehicles.

Hybrid Car's Characteristics :-

* Better fuel efficiency upto 80% theoretically possible
* Less CO_2 emission and pollution
* Lower maintenance

Parallel Hybrid :-

(i) Fuel tank, which supplies gasoline to the engine.
(ii) Set of batteries that supplies power to an electric motor
(iii) Both the engine & the electric motor can turn the transmission at the same time and the transmission then turns the wheels.

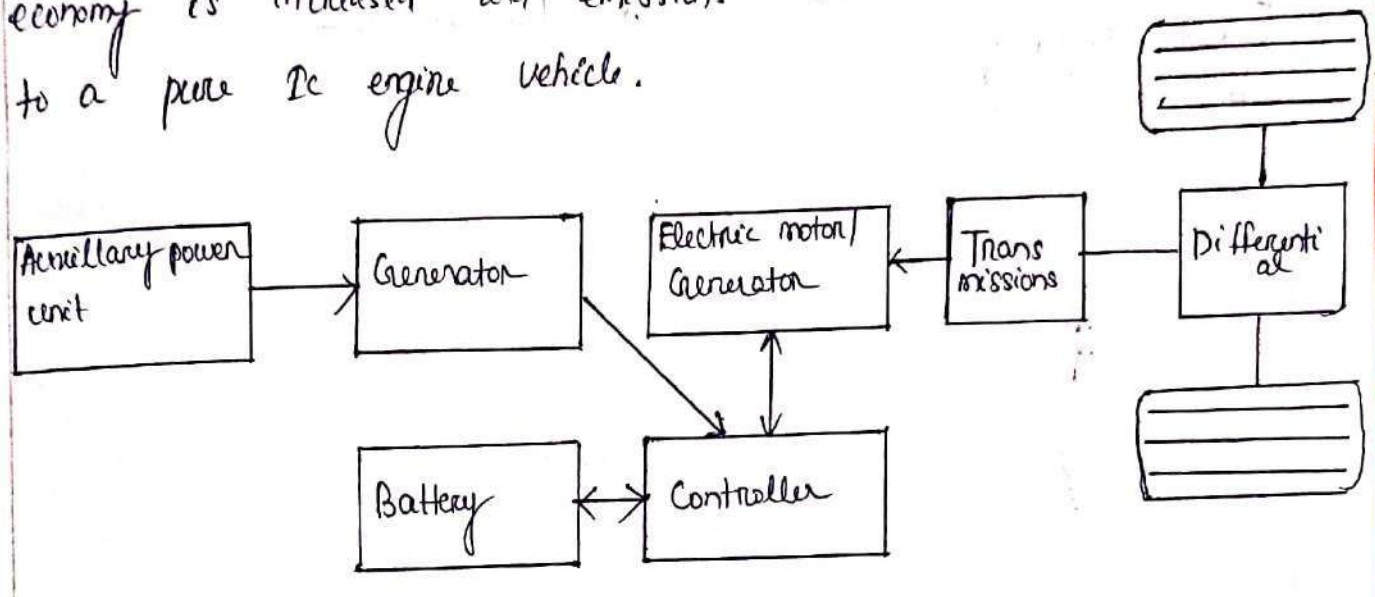
Series Hybrid :-

(i) Similar to an electric vehicle with an on-board generator.
(ii) The vehicle runs on battery power like a pure electric vehicle until the batteries reach a predetermined discharge level
(iii) At that point the APU turns on and begins recharging the battery.
(iv) The APU operates until the batteries are charged to a predetermined level
(v) APU never directly powers the vehicle

Series (CONTD.) :-

i) The length of time the APU is on depends on the size of the batteries and the APU itself.

ii) Since the APU is not directly connected to the drive train, it can be run at it's optimal operating conditions, hence fuel economy is increased and emissions are reduced relative to a pure IC engine vehicle.



Vision based Autonomous road Vehicle :-

→ An autonomous vehicle can sense it's environment & navigate without human intervention.

→ An autonomous vehicle is a vehicle that without the driver

→ Vehicles are transitioning into robots when can sense the environments, also take decisions & it can helpful the human being.

Benefits of autonomous Vehicle :

→ Reduction of human error prone accidents

→ Drop in harmful emission

→ Eliminate human error prone traffic congestions.

→ Improved fuel economy

→ Increased lane capacity

→ Consumer saving

Challenges :

Cost sensors are expensive

Weather conditions

Traffic conditions and laws

Regulation

Accident liability

Cyber security

Enablers

→ Vehicle to vehicle communication

→ Sensors : Active & passive

→ Advanced environmental mapping

→ Complex processing system

→ Infra structure