

SME →

Page No.		
Date		

UNIT THREE →

VIMP

i) Automobile →

Automobile is a vehicle driven by an IC engine and it is used for transportation of passengers and goods on the ground.

Classification →

i) Based on fuel used →

1) Petrol engine V →

AM Powered by a petrol engine  
eg → Scooters, Cars, motorcycles

2) Diesel engine V →

AM Powered by a diesel engine  
eg → Trucks, busses, Tractors.

3) Gas Electric Vehicles →

Electric cars, busses.

X 4) Gas Vehicles →

V that use gas turbine as a power source.

Eg → Turbine powered cars

ii) Based on no. of wheels →

1) Two wheelers →

[axles]

motorcycles, Scooters

2) Three →

Tempo, auto rickshaws

3) Four →

Car, Jeep, Bus, truck

4) Six →

Buses and trucks have six tires.

X 5) out of which Ten / Fifteen wheelers →

Big trucks containing containers.

iii) Based on Load →

1) Heavy transport vehicle (HTV) →

Motor Bus, truck, tractor

(HTV)

2) Light transport vehicle (LT) →

Motor Car, jeep, Scooter, motorcycle

(LT)

iv)

- Based on body →
- 1) closed Cars →  
Ex → Swift, nano
  - 2) open Cars →  
Sports cars, Jeep
  - ~~3) special styles → such as estate cars.~~
- v) Type of transmission →
- 1) Manual transmission →  
AM whose gear ratios have to be changed by driver.
  - 2) Automatic →  
AM that are capable of changing gear ratios automatically as they move and used epicyclic gearbox with torque converters.
  - 3) Semi automatic →  
Vehicles that facilitate manual gear changing with a automatic clutch control.

vi)

- Based on purpose →
- 1) Passenger → Vehicles carry passengers  
ex → Buses, cars, passenger trains
  - 2) Goods → Vehicles carry goods from one place to another.  
Ex → Tempo, truck, tractor
  - 3) Special purpose →  
Ex → Ambulance, Fire engines, Army vehicles

vii)

- Side of driver →
- 1) Left-Hand drive → steering wheel fitted on L.H.S  
Ex → American cars, Indian army trucks.
  - 2) Right Hand drive → steering wheel fitted on R.H.S  
Ex → Indian cars.

viii) Use →

- i) Mopeds → Two wheeled vehicle with pedals having engine capacity under 50cc and speed less than 50 km/hr.
- ii) Motorcycles / scooters → Two wheeled vehicles with gears having engine capacity above 50cc and speed above 50 km/hr.
- iii) Car / Jeeps → Four wheeled passenger vehicle with capacity one to eight seats.
- iv) Buses and trucks → Four wheeled passenger vehicles with capacity more than 10 seats and for transporting vehicle.

VIMP [q has came]

2) Cost analysis of vehicle →

CA of Vhcl deals with calculating the avg cost of using the vehicle per year or per km of use.

To calc. the avg. cost of Vhcl per year or per km, it is necessary to consider the various types of cost.

- Types of cost →

i) Fixed cost :

It is the cost which will continue irrespective whether the vehicle is in use or not.

ii) Depreciation cost →

Decrease in value of vehicle over the period of time due to use.

iii) Interest cost →

It is the interest on the loan for purchasing the vehicle.

iv) Registration and vehicle taxes →

It is the amt of spent on registration and paying vehicle taxes.

iv) Insurance Cost →

It is premium paid for vehicle and third party insurance.

ii) Variable Cost →

Costs which vary with the use of vehicle.

If vehicle is not used variable costs are eliminated.

i) Maintenance and repair cost

ii) Fuel and oil cost

iii) Parking and toll cost

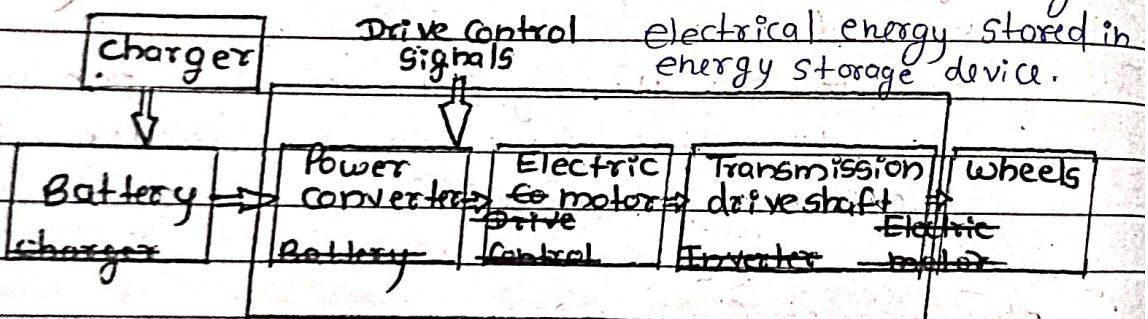
iv) Driver cost

### 3) Battery electric vehicles (BEV's) →

BEV is powered only by rechargeable battery and there is no IC engine.

An electric vehicle is an automobile that is propelled by one or more electric motors.

~~Block diagram~~ Layout → by one or more electric vehicles, using



• Working →

- Battery used can be of lead based, lithium based and the most recently lithium ion battery.
- The battery gets energy from the electric plug point outside the vehicle.
- It provides high current energy to inverter.
- Inverter converts high current DC signal to high current AC signal.
- motor generates mechanical torque to power the outside wheels for propagation.
- Speed of motor is varied by varying the

Voltage across the motor smoothly and sleeplessly through the accelerated.

### • Advantages →

- i) EV's are simple in design with limited parts.
- ii) The running cost of electric vehicles is much less than the running cost I.C engine powered vehicles.
- iii) The EV's operate with less noise compared to I.C engine powered conventional vehicles.
- iv) The EV's have very good accn compared to conventional vehicles.
- v) The EV's operate with less noise compared to conventional vehicles.

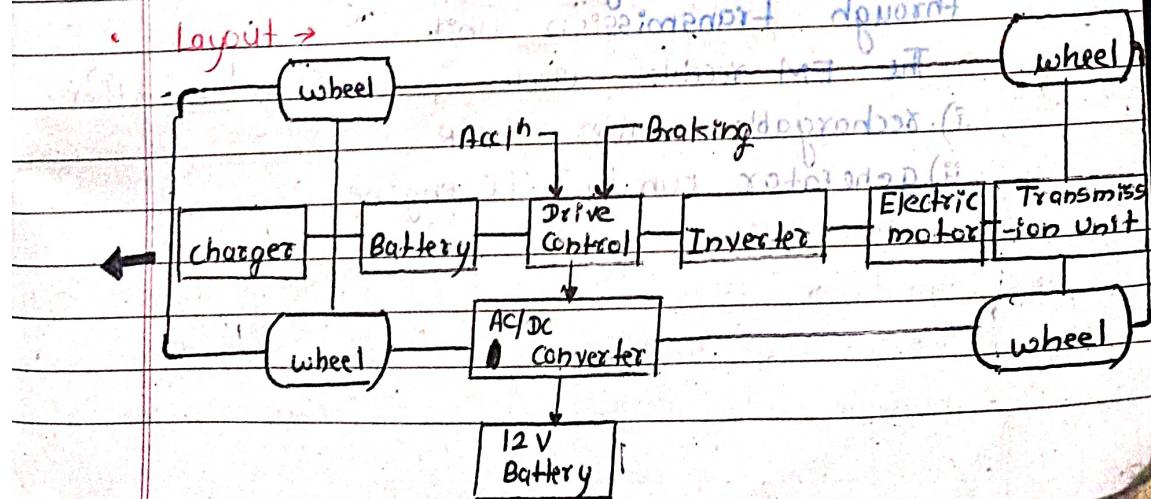
### • Limitations →

- i) Due to limited battery capacity EV's can travel only about 100 to 150 km on a single charge.
- ii) EV's need frequent battery replacement.
- iii) Non-availability of network of charging stations.
- iv) Because of large capacity battery, the initial cost of electric vehicles is high.
- v) Low Speed → maximum 60 km/hr.
- vi) Silence may be fatal.

### • Ex →

- i) Hyundai Isona electric
- ii) Mahindra E-Verito
- iii) Nissan Leaf.

### • Layout →



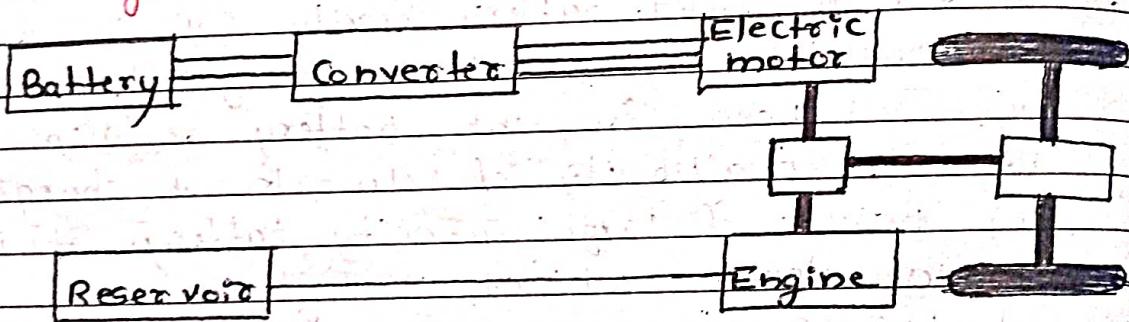
## i) Hybrid electric vehicles →

In HEV, two or more power source are used to for propulsion.

- i) Electric motor driven by rechargeable battery
- ii) IC engine

Hybrid electric vehicle is a progressive transformation from conventional automobile vehicle powered by only IC engine to battery electric vehicle powered by only electric motor. HEV minimizes the drawbacks of conventional IC engine powered automobile vehicle and retains advantages of conventional IC engine powered automobile vehicle.

### DT • Block diagram → required



### • Types →

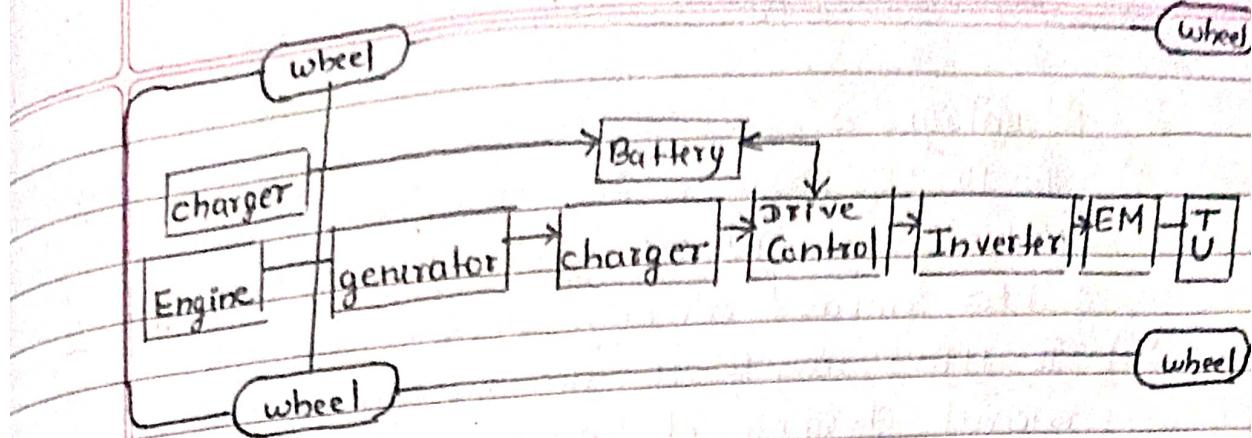
#### i) Series Hybrid Electric Vehicles →

In Series hybrid vchls ; EM is the only means of providing the power to the wheels through transmission unit.

The EM receives electric power from either

- i) rechargeable battery OR
- ii) generator run by IC engine.

### • Layout →



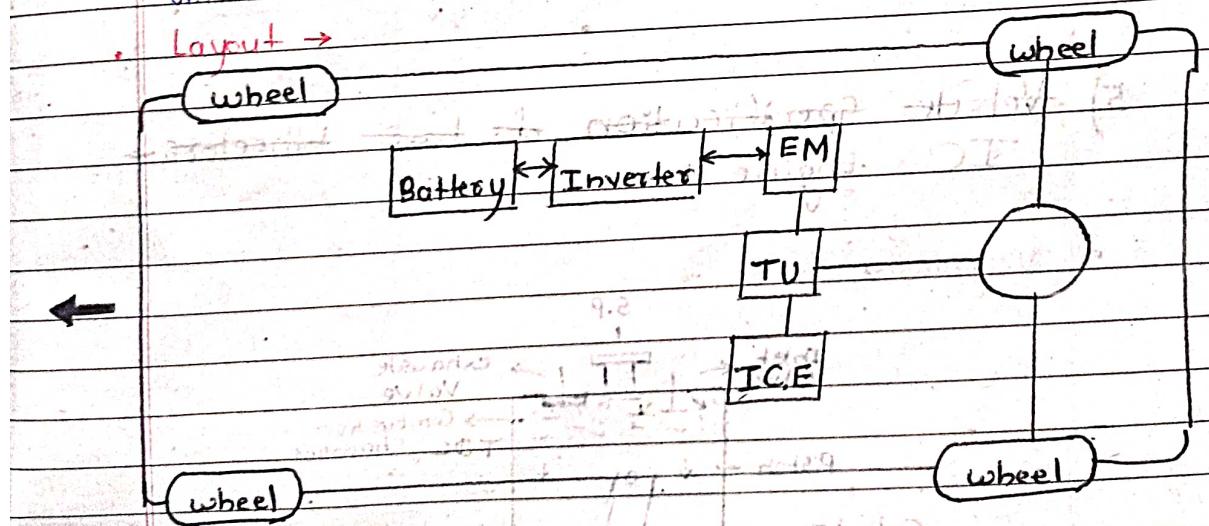
**Components →**

- 1) Battery with charger
- 2) Drive control unit
- 3) Inverter
- 4) EM
- 5) T.C. E
- 6) Generator
- 7) Transmission Unit (Gear box)

**(ii) Parallel HEV →**

In Parallel HV, the T.C.E as well as EM drives the wheels through the transmission unit.

**Layout →**



**Components →**

- i) T.C. E
- ii) Battery
- iii) Inverter
- iv) EM
- v) Drive control unit
- vi) Transmission Unit (Gear box)

• Advantages →

- The HEV's has a power and speed of conventional vehicle with reduced fuel cost and emission level so it has combined advantage of CV and EV.
- The HEV's can travel any distance without external charging of battery.
- In HEV's the energy produced during braking is used to charge the battery. This reduces the fuel consumption of vehicle.

• Limitations →

- The initial cost of electric vehicles is high because of large capacity of battery.
- The life of HEV's is less than EV's. They need frequent battery replacement. This increases the running cost of EV.

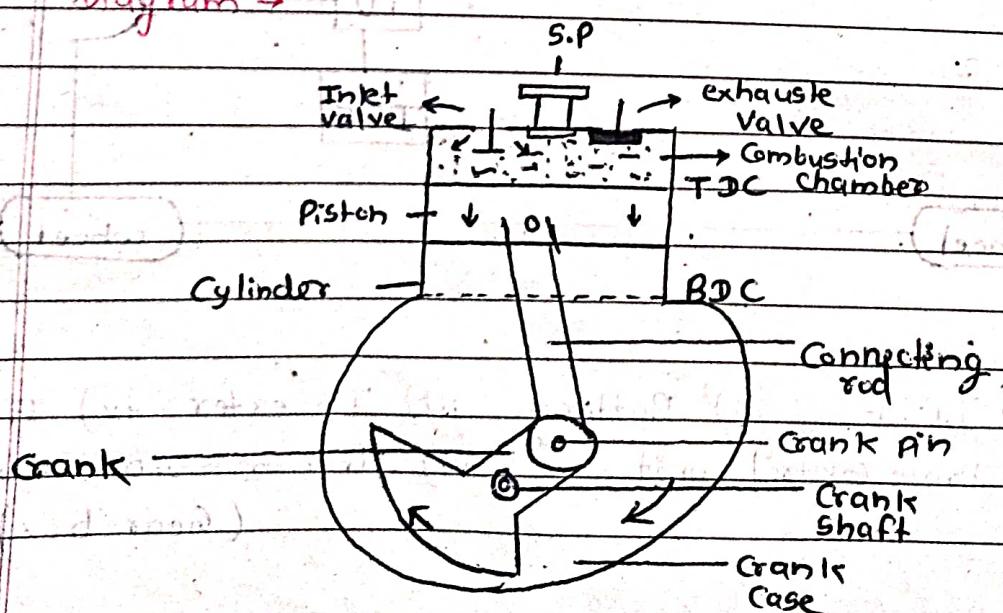
• Eg → Toyota Camry Hybrid, Ford escape Hybrid, Honda insight

5) Vehicle specification of two wheelers →

IC

Engine →

• Diagram →



• Components →

1) **Cylinder** → It is main part of body of IC engine in which piston reciprocates to develop power. It has to withstand very high pressure upto 7.0 bar and temp upto  $2500^{\circ}\text{C}$ , bcz the combustion takes place in cylinder. It is made up of cast iron, aluminium alloys.

2) **Piston** →

Used to compress charge (air-fuel) mixture during compression stroke.

3) **Spark plug** →

Used to initiate sparks for the combustion of air-fuel mixture in petrol engines.

4) **Connecting rod** →

(Small) One end of is connected to piston and other (big) end is connected to crank.

5) **Crank pin** → Used to connect big end of connecting rod to the crank.

6) **Inlet and exhaust Valve** →

Inlet valve controls admission of charge in cylinder and exhaust valve controls discharge of exhaust gas from cylinder.

7) **Crank** → Crank is the integral part of crankshaft. Crankshaft is supported in main bearings.

8) **Cylinder head** →

Used to closing the one end of cylinder.