E-Vehicle

Assignment -I

Madhura Kulkarni

Q.1st Explain the journey of Automative with the help of flow chart from the Beginning of 18th century to The 21st century & give brief description on the following milestones in the Automotive.

Journey :-

[~~1768~~] 1st Automobile [~~1768~~ 1768]
↓
1st IC engine vehicle [1806]
(by Isaac de Revaz
↓
Indigeneous Electric Vehicle (Toy car) [1826]
↓
① London Underground
② Electric ~~car~~ Tram Burmingum } [1865]
↓
Production of 1st IC engine Automobile [1884]
(Karl Benz)
↓
Golden Era of EV [1906 - 1910]
↓
Decline of EV [After 1910]
↓
New Era of EV [from 20th century]
↓
Low Emission Vehicle I [1993 - 2003]
↓
Low Emission Vehicle II [2003]
↓
Santa Monica Auto Expo by Tesla [2006]
↓
1st Affordable EV [2010] (Nisan leaf)

a) Inventor of Electric Motor

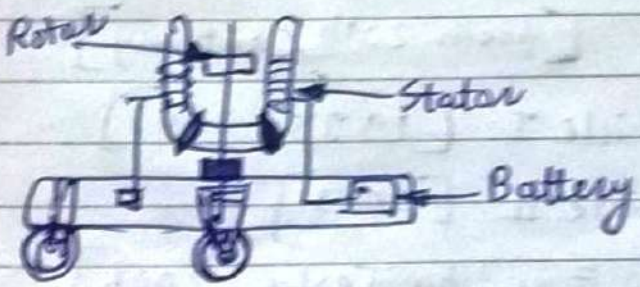
The 1st electric motors were simple electrostatic devices described in experiments by Scottish monk Andrew Gordon & American Experimenter Benjamin Franklin in 1740s

1834 - The first electric Motor is made.

History was made when Thomas Davenport of Vermont invented the 1st official battery powered electric motor in 1834

b) 1st Electric Motor [Patented]:

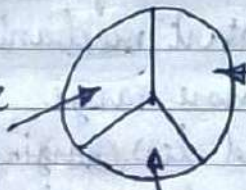
- Anyos Jedlik made a toy car which run on Electric motor.
- He was from Austria and made 1st Electric motor driven car in 1826.
- It was a simple model of Electric car having Stator and rotor and wire which was connected to the battery.



b) **Golden Era of EV**

- In 1865 The London underground and Electric Tram in ~~Bxxx~~ Burmingum was started.
- In 1886, The 1st Electric Vehicle ~~to xx~~ to undergo was made by Thomas Parker.
- ~~Xxx~~ In 1890 → Morrison Carriage was built by William Morrison in USA.
  It could carry 8 people including driver.
- From 1906 to 1910 there was The real Golden Era for EV ~~was started~~. That time was the time of EVs. EVs of that time was having.
  → Range = 100 miles in single charge
  (10 to 15 days no need of recharging)
  → Top Speed = 45 - 50 Km/hr

The range of 100 miles they could get by driving this car for 1800 miles across US in verious places and situations.



Electric Vehicle was very popular at that time because of the following reasons;

① No Emission
② More Efficient than other Vehicles
③ Lower cost
④ Easy to start as compared to steam engine and other vehicles.

* Steam Engine → 45 min to start
* Gasoline Engine → 15 min to start
* EV → Very quick start (within few seconds).

(c) Domination of Electric Vehicles by Gasoline Vehicles :-

Electric Vehicles started declining after 1910.
The reasons for decline of EVs after 1910 was as follows :-

1) Henry Ford started production of IC engine with Assembly line production.
2) Chevrolet launched Self start mechanism in 1912
3) World war → Needed more range
   → Needed less charging time } Reliability
4) Oil lobby → The great depression
   [Privatization in US.

They realised oil has better lobby and better future

d) **Coming of New Era in EV :-**

It began to start from the 20th century. Scientists and Economist found out that petrol and Diesel engine vehicles are harmful for the environment because of their emission of pollutants.

- **The Great Smog** → 5 Dec – 9 Dec 1950 (London – UK)

There was 12000 deaths happend in 4 days

After this incident Scientist and Environmentalists found out that the petrol and diesel engines are harmful to environment. They found the proof to rais their voice.

- **In califarnia (US) 1960s**

600 new cases per day found out of desease caused by the polution.

* 48% polution → because of automobile.

e) **Introduction to hybrid electrical vehicles**

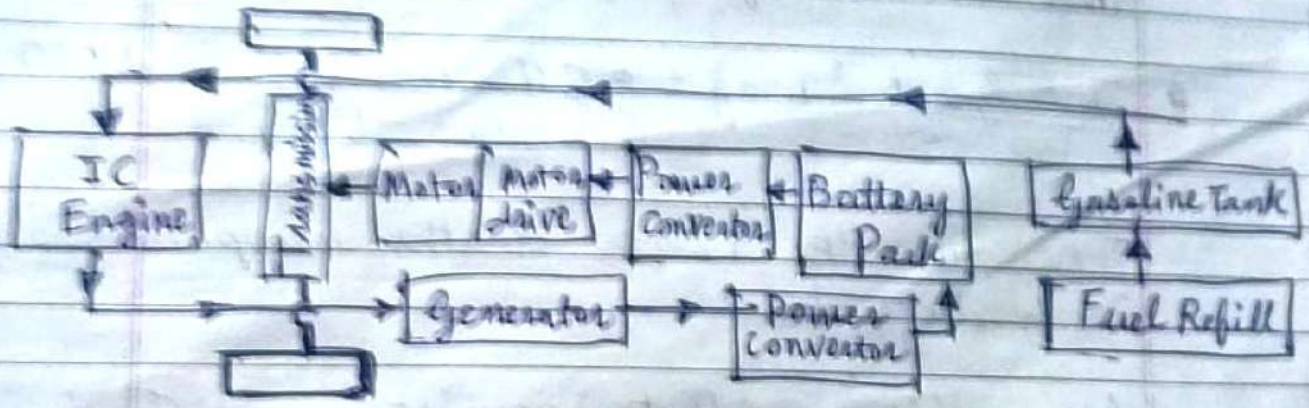
{Types of HEV}

1] On the basis of degree of Hybridization
(i) Micro
(ii) Mild
(iii) Full

2) Hybrid Architecture
(i) Series
(ii) Parallel
(iii) Series – Parallel.

Q.2nd Explain and Draw the layout of following Hybrid Electrical Vehicles with their Advantages, Disadvantages and Industrial application in Automotive Segment.

1) Series HEV:-



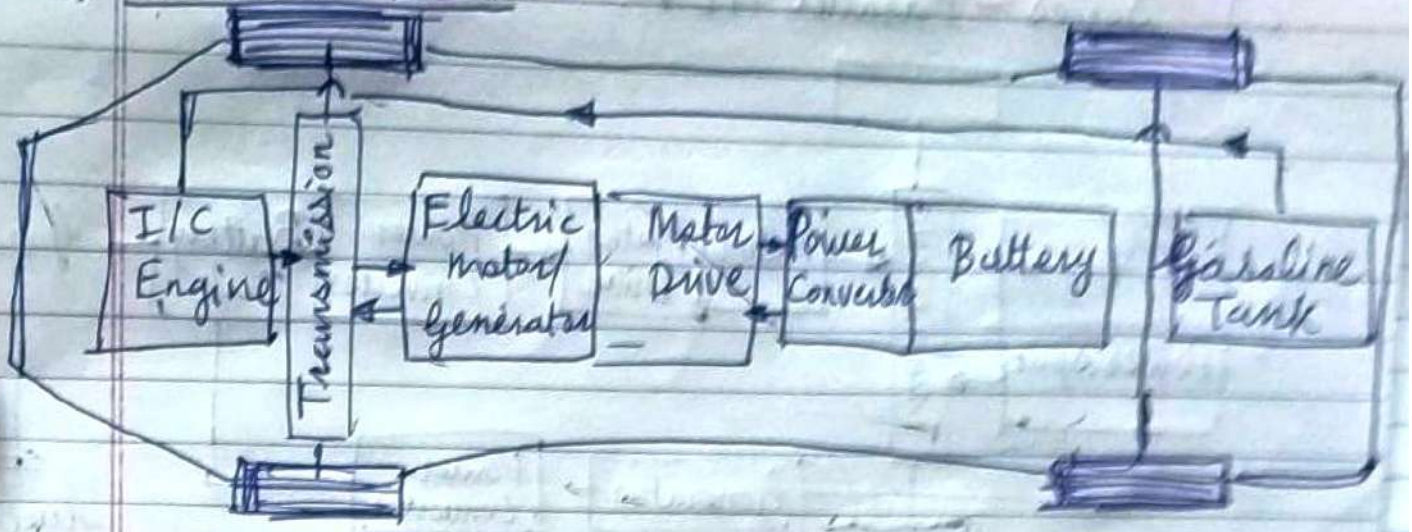
* Advantages of Series HEV:-

1) The engine operats at its max efficiency.
2) When fuel is empty, Battery can run the vehicle

* Disadvantages

1) Transmission efficiency is low.
2) Weight of this vehicle is very much.

b) Parallel HEV :-



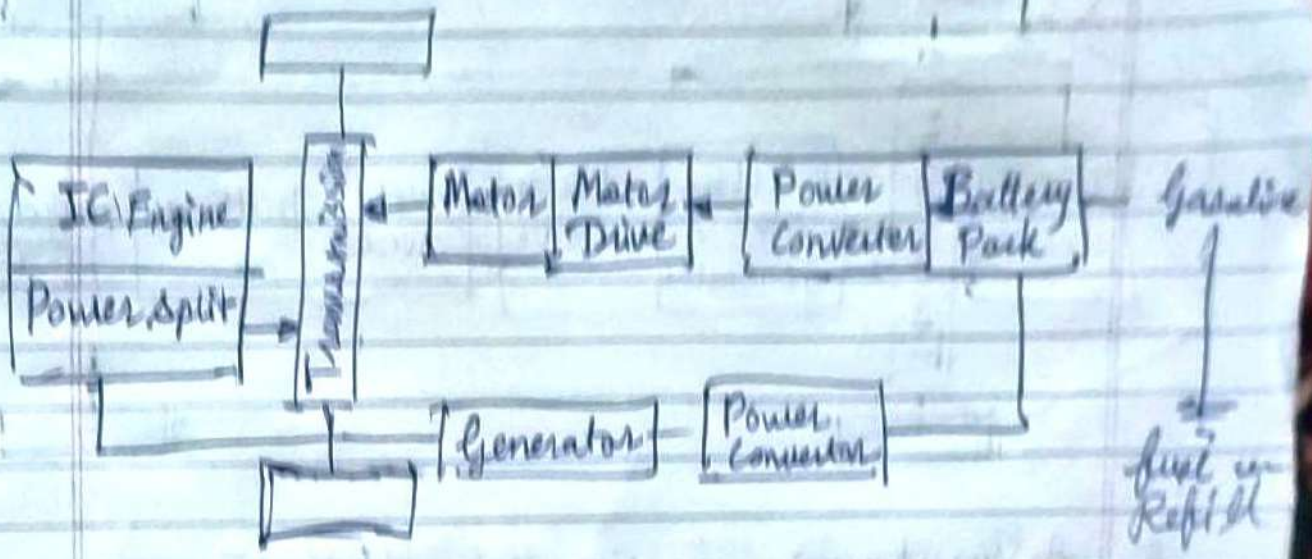
* Advantages of parallel HEV :-

1) Transmission efficiency is high as compared to the series HEV.
2) Vehicle transmission can change the battery.

* Disadvantages :-

1) High voltage system ~~is~~ having high maintainance cost
2) They ~~have~~ provides less power in switching battery mode

c) Series - Parallel HEV.



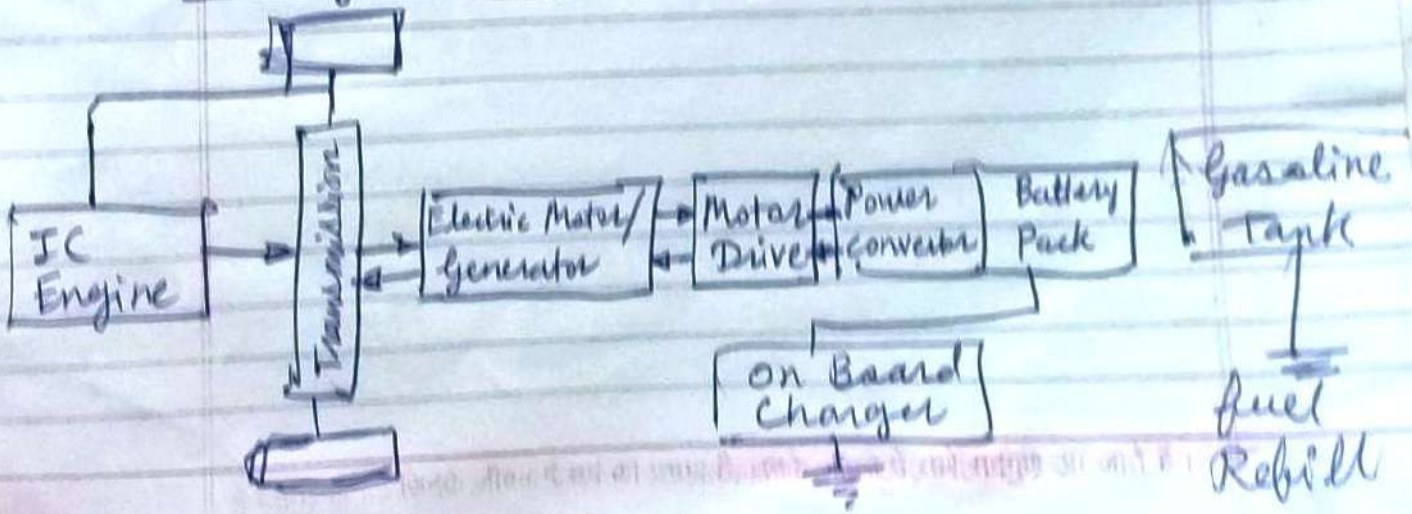
Advantages :-

1) It gives more range
2) We can drive without gasoline

Disadvanges :-

1) More weight.
2) Less efficiency as compared to IC Engine

d) Plug in Hybrid EV :-



* Advantages of plug in EV:-

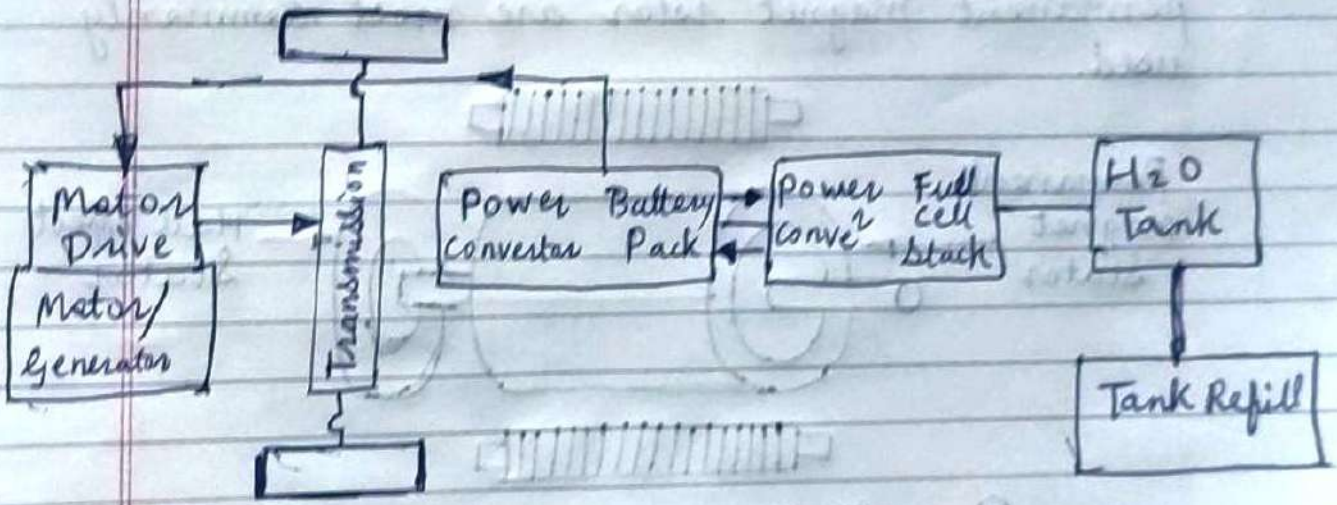
i) Then it gives seperate transmission power for IC engine and motor, Hence gives more range.

ii) Easy to drive.

* Disadvantages

1) Heavy Structure
2) More maintainance cost.
3) More Working cost

c) Fuel Cell EV:-



Advantages

1) High energy density, improves productivity
2) It's not harmful as compared to Li-Battery

Disadvantages

1) Hydrogen storage and transportation is difficult.
2) Fuel cell efficiency is less.

Q.3rd Explain with diagram Construction and working principle of Brushless motor BLDC

→

Construction :-

BLDC motor has many similarities to AC Induction motor and Brushed motors in terms of construction and working principle respectively BLDC motor also has Stator and rotor. Motor is constructed in different physical configuration, depending on the Stator windings.

These are configured as Single phase, two phase and three phase. However 3-ph BLDC with permanent magnet rotor are most commonly used.

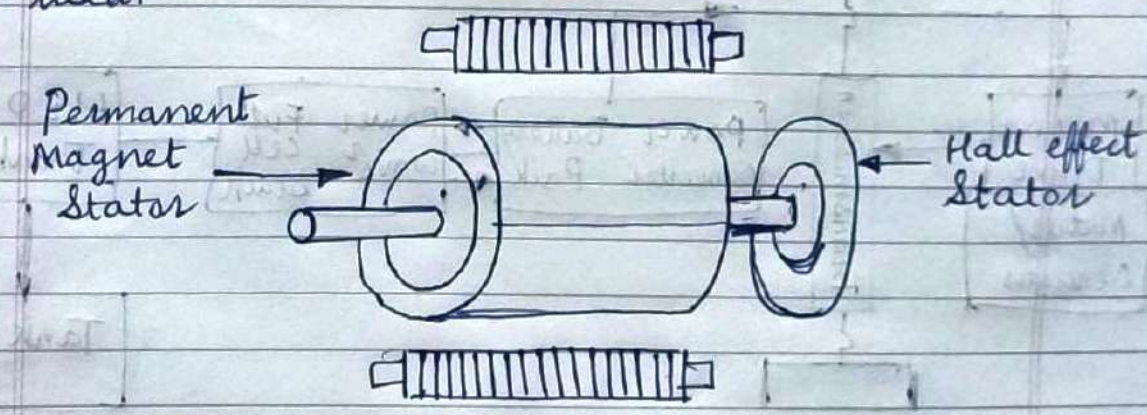
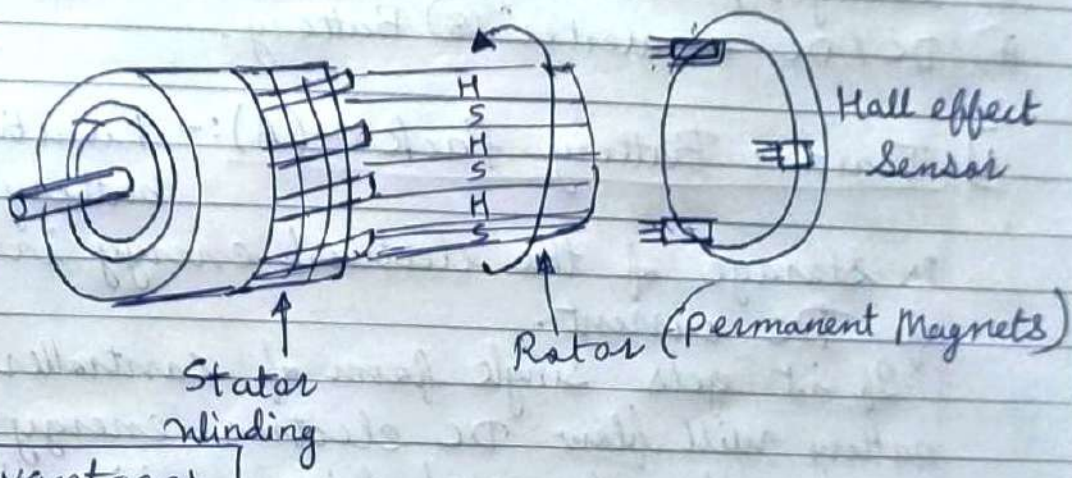


Fig :- BLDC Motor

Working Principle of BLDC motor :-

BLDC motor works on the principle Similar of that of a conventional DC motor i.e. the Lorentz Force Law which

States that whereever a current carrying conductor placed in mgn magnetic field consequence of a reaction force, As a consequence of a reaction force, the magnet will experience an equal and opposite force in case of BLDC motor, the current carrying conductor is Stationary while the permanent magnet motors.



Advantages

1) It has no mechanical problems
2) High efficiency due to use of permanent magnet rotors.
3) Less electromagnetic interference.

Disadvantages

1) These motors are costly.
2) ~~Need~~ It needs additional sensors.

Application

1) Pumps, blowers and fans
2) Electric vehicles
3) Computer hard drives

Q.4th Explain Battery pack composition with initial components discription as well as advantages and disadvantages of Battery Pack in EV installation

Ans:- EV components :-

1. Traction Battery Pack
2. Power inverter
3. Controller,
4. Electric Traction motor
5. Charger,
6. Transmission Unit
7. DC/DC converter
8. Battery.

1] Traction Battery Pack (A):- Function of a battery in EV is Storage of the electrical energy in the form of DC current.

If it gets single form of controller, the battery will flow DC electric energy to the inverter then ~~be~~ used ~~drive~~ to dive the motor. The battery is rechargeable which is arranged in such a way as to form is called a traction battery pack.

2] Power Inverter :- In inverter function its function is to change the DC current in the battery pack in to an AC current and then the AC current used by EV.

3] Controller :- The main function of the controller is to regulate the form of electric energy batteries & inverter that will be distributed to electric motors.

4] Transmission :-
The transmission transfers the mechanical power from the electric traction motor to drive the wheel.

5] DC/DC converter :-
This is ~~one of~~ one of the electric parts, that ~~is~~ converts higher voltage DC power from the traction battery pack to lower voltage DC power is devided to run the vehicle accessories & recharge the auxilliary battery.

6] Battery :- In an electrical drive vehicle, the auxilliary battery provides electricity to power vehicle accessories.

7] Thermal System :- This System maintains proper operation ~~temp~~ temperature range of engine, electric motor, power electronics and other components.

8) Charge Port :- The charging port allows the vehicles to supply an external power to the vehicle, inorder to change the traction battery pack

Advantages

1) Improves efficiency of battery.
2) Vehicles runs Smoothly.
3) Environmental Friendly.

Disadvantages

1) Cost of battery pack is very high.
2) Recharge time is high.
3) Heating problem in Electric Vehicles.