Assignment -1

Q1 :-

Ans :-

- 1768
  - First car was invented
  - Inventor Name → "Nicholas -Joseph Cugnot"
  - It was powered by steam engine.
  - He also had first car accident.
- 1806
  - First I.C Engine car invented
  - Isaac de Rivaz is inventor
  - Hydrogen gas is used as a fuel.
- 1827/28
  - Electric Motor patent.
  - By "Anyos Jedlik" sztvan
  - Toy car made with electric motor
  - "Austria" to the black.
- 1834
  - Battery electric car invented
  - Thomas Davenport
  - the Batteries were not rechargeable.

1886

- Electric vehicle to undergo Production.
- By Thomas Parker
- England is the Place.
- Battery was rechargeable.

1885 - 1903

- Production of I.C Engine Car started in 1885 By "Karl Benz"
- In 1903, "Henry Ford" introduced "Assembly line Production".
- "Model-T" was Built By Henry Ford.

Early 1900's

In 1900, a third US vehicle is electric, "Henry Ford wanted to built cheap electric Vehicle which can run for 100 miles, but later abandoned the idea as gas fuled vehicle began to take over.

1906 - 1912

In 1906, EV becomes advance with range of 100 miles and Speed upto 50 Kmph.

→ Market share of E.V b/w this timeline is around 32%.

→ Market share of Steam and I.C Engine vehicles are 48% and 20% respectively.

→ In 1912 Peak of Electric Car Sales in USA.

1930's → By the 30's the rise in demand for mass-produced, gas fuelled "Ford Model T" meant that few battery powered vehicles were left on the roads. Cars become readily available in USA.

1950's - 1980's →

→ In 1950, "The Great Smog" causes 12000 deaths

→ In 1960, "600 new pollution related disease cases. in which 48% caused by gas automatic

→ In 1970, California Air Resource Board "CARB" is formed. which brings emission regulation by which they are able to reduce 80% ~~population~~ pollution.

→ Gas price soared creating interest in electric vehicles again.

1990's

→ Government tightened emission requirements for vehicles, forcing car companies to look at alternative fuel. The first mass-produced hybrids to go on sale were "Toyota Prius" 1995 and "Honda Insight". They were produced by Lithium-ion batteries which was later used in smart phones and Tesla cars.

2000-2006

→ In 2006, At Santa Monica Auto Expo Tesla Roadster was introduced.

→ In 2008, Tesla Started it production and breaks all the traditional thinking.

→ In 2010 Nissan Leaf "First Affordable 5 door Hatchback E.V launched which was world's best selling E.V car.

Present Day

→ There are many options like Hybrids, plug-in Hybrids and all electric vehicle model.

→ More many is invested in charging infrastructure to promote EV and Also "Subsidy" is being introduced.

(i) Invention of Electric Motor :-

→ • The first rotating device was built by Englishman Peter Barlow (1822) which was driven by electromagnetism.

• In 1827/28, Sotoan (Anyo) Jedlik invento first rotary machine with electromagents and a commutator.

• In 1835, the two Dutchmen Sibrandus Stratingh and Christopher Becker built an electric motor which produced actual mechanical output which powered small model car.

(ii) Golden Era of EV.

→ • From 1906 - 1912, EV becomes advance with range of 100 miles and speed upto 50 Kmph was achieved

• Market share of EV between 1906 - 1912 becomes 32% of the total automobile ove.

• In 1912, USA has Peak of Electric Vehicle Sales.

(iii) Domination of Electric Vehicle by Gasoline Cars:-

→ • The vehicles dominated because of following reasons :-

(a) No emission of any type.

(b) The EV are efficient.

(c) Low cost to manufacture compared to IC engine.

(d) Easy Start was available as IC engine take 20 min to start.

(iv) Coming of a New Era in EV.

→ • In 1950, "the Great Smog causes 12000 deaths

• In 1980, "600 new pollution related disease registered in which 48% caused by gas automobiles.

• In 1970, "CARB" was formed which brings emission regulation.

• Gas Prices raised creating interest in electric vehicles.

• In 1990's Government tightened emission requirements, brings hybrid EV's

(v) Introduction to Hybrid Electric vehicles :-

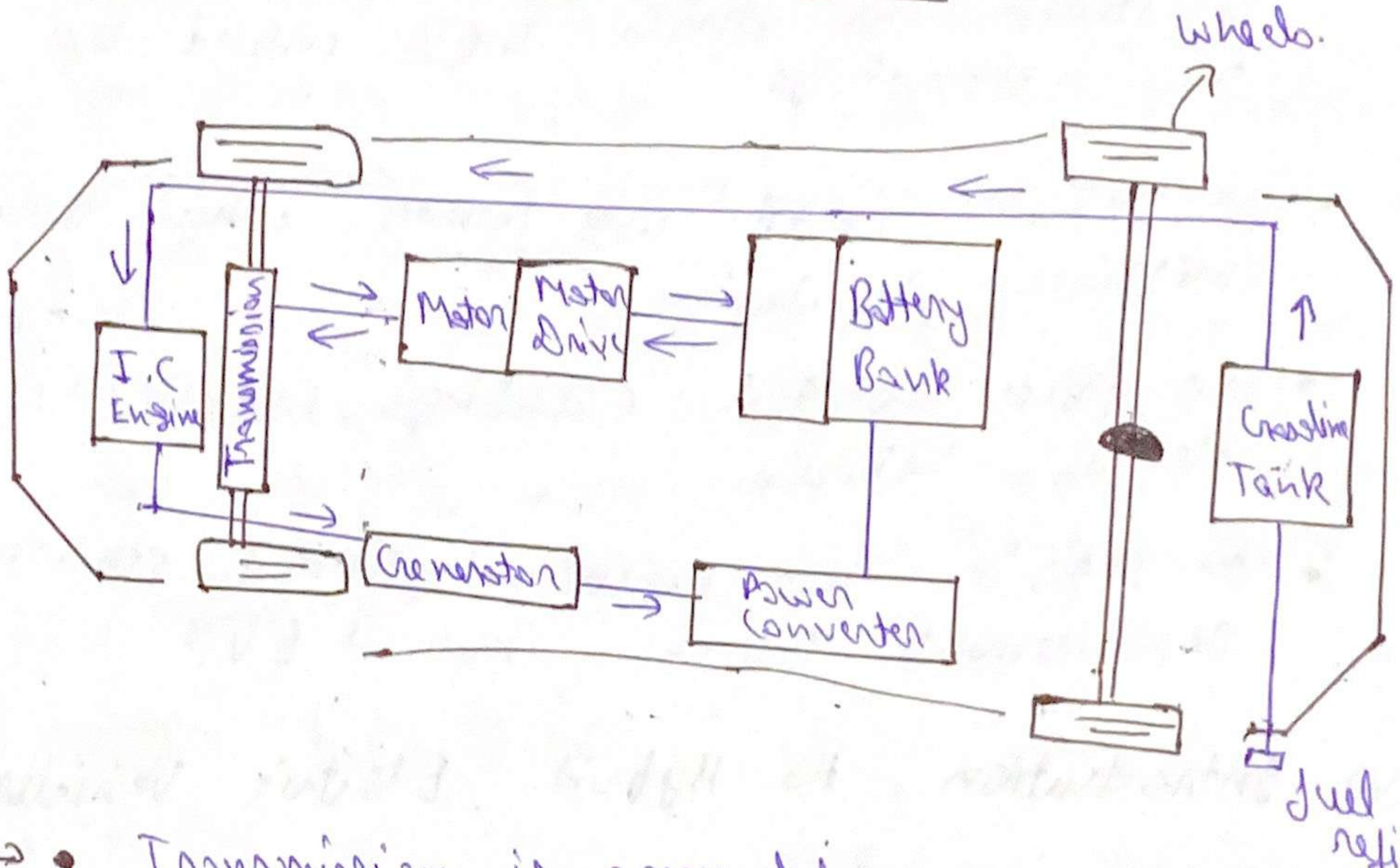
→ Hybrid electric vehicles (HEV) are powered by an internal combustion engine in combination with one or more electric motors that use energy stored in batteries. HEV's combine the benefits of high fuel economy and low tailpipe emissions with the power range of conventional vehicles.

X X

Q2:-

Ans:-

(a) Series Hybrid Electric Vehicle :-



→ • Transmission is connected only from Motor, No connection is their from I.C Engine.

- I.C Engine Present is only to recharge the battery on battery is low.
- Motor is more powerful than I.C Engine.
- Small I.C engine is used.
- Battery Pack is longer in size.
- Cost of vehicle is high and hence polarity is low.
- Primary is Motor and Secondary is Engine.

* Advantages:-

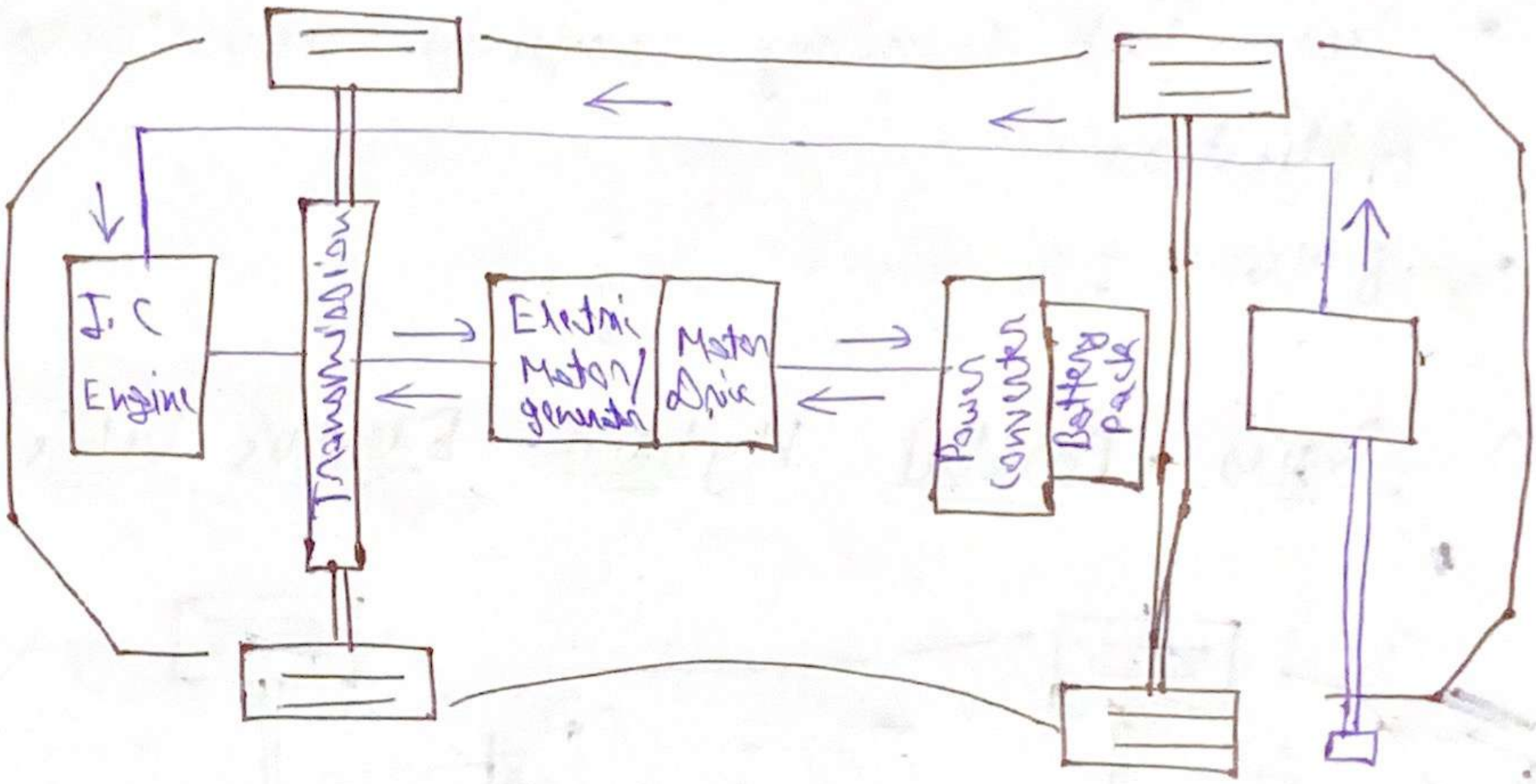
- Pollution is low due to less emission.
- Eco-friendly and more practical to adopt.
- Fuel Efficiency is more.

Disadvantages :-

- Cost is very high due to large battery Pack and powerful Motor.
- Cost become more by adding range extender to it.

Abbplication → BMW I3.

(b) Parallel Hybrid Electric Vehicle.



→ • Both Engine and Electric Motor is connected with the transmission.

- Two power source are present., I.C Engine is Primary machine and Motor is secondary.
- I.C Engine is more powerful hence motor support the engine.
- Battery Pack is small.
- Both can work alone or simultaneously together.
- Range depends upon I.C Engine more.

Advantages :-

- Connected with two power source as, when in Hybrid Mode generates more power.
- Cheaper in comparision with Series Hybrid E.V.

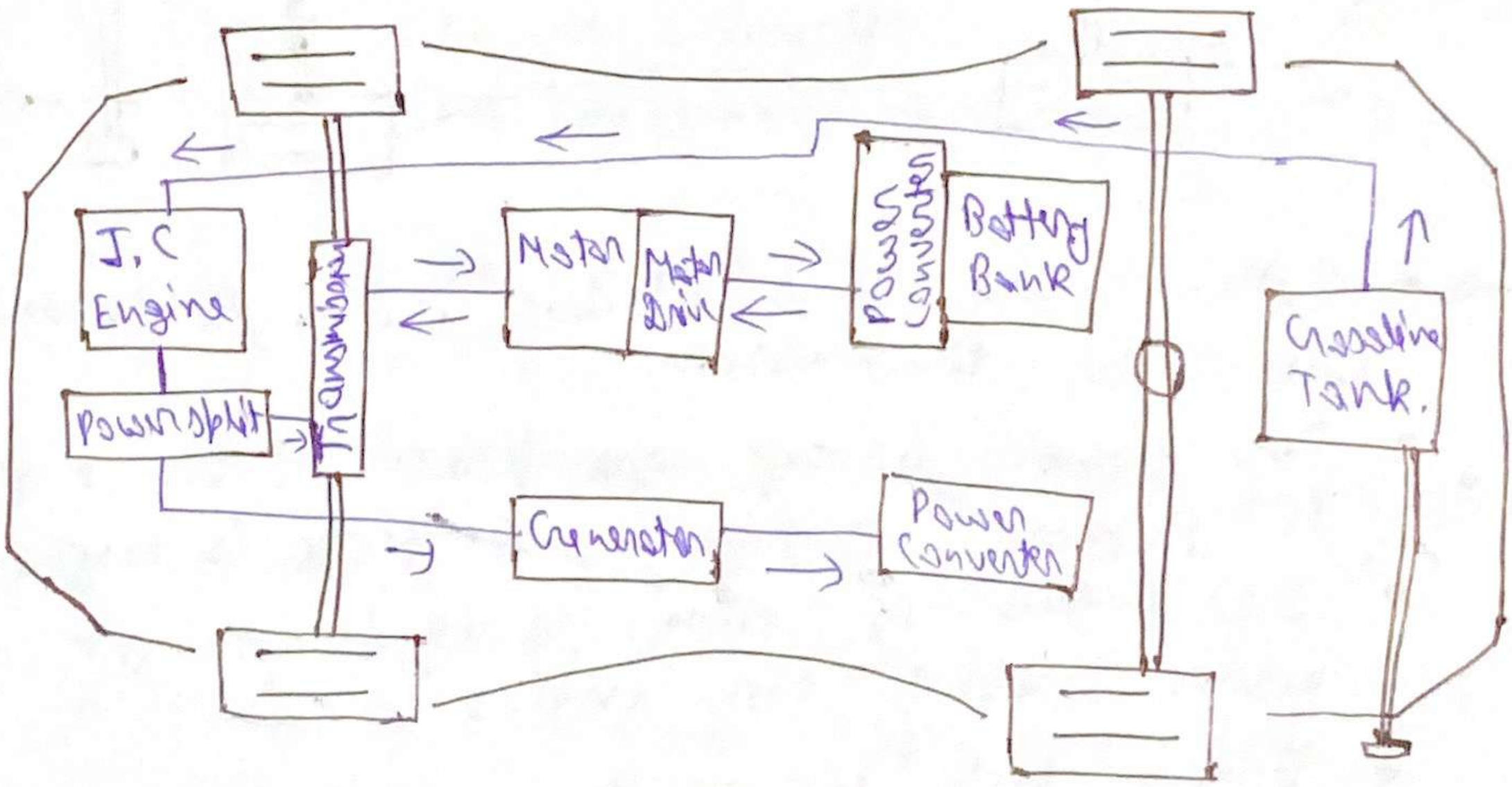
Disadvantages :-

- Less ecofriendly than Series Hybrid E.V vehicles hence more polluting.
- Less fuel economy compared with Series HEV.

Application :-

- BMW I8.

(C) Series - Parallel Hybrid Electric Vehicle :-



→ • I.C Engine is connected with power split which divide the power between transmission and Generator simultaneously.

- When battery is low it split the power to generator to charge the battery.

- It can work as both Series Hybrid and parallel - Hybrid or as both.

Advantages :-

- Power when required is available from both Motor and I.C engine.
- Can achieve greater range and also have greater range of power.

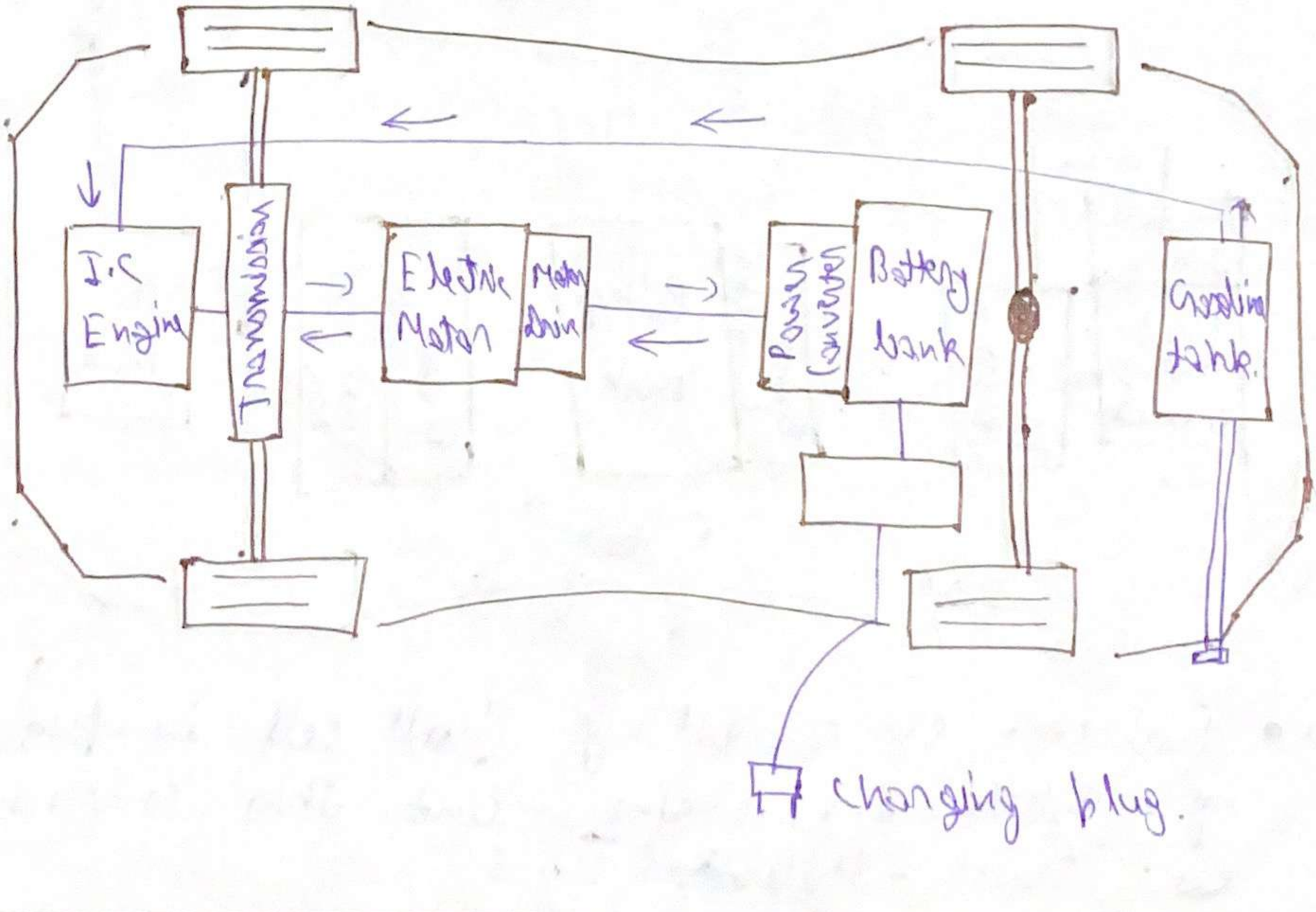
Disadvantages :-

- Very complex design.
- Battery is not big enough so less eco-friendly.

Application :-

- Toyota Prius.

(d) Plug - In Hybrid Electric Vehicle :-



→ • This is parallel - Hybrid Electric vehicle which has onboard charging facility and fuel refill facility as well.

Advantages :-

- Can have better range with charging hence, economical.
- Low emission as dependancy for fuel will decrease to charge the battery

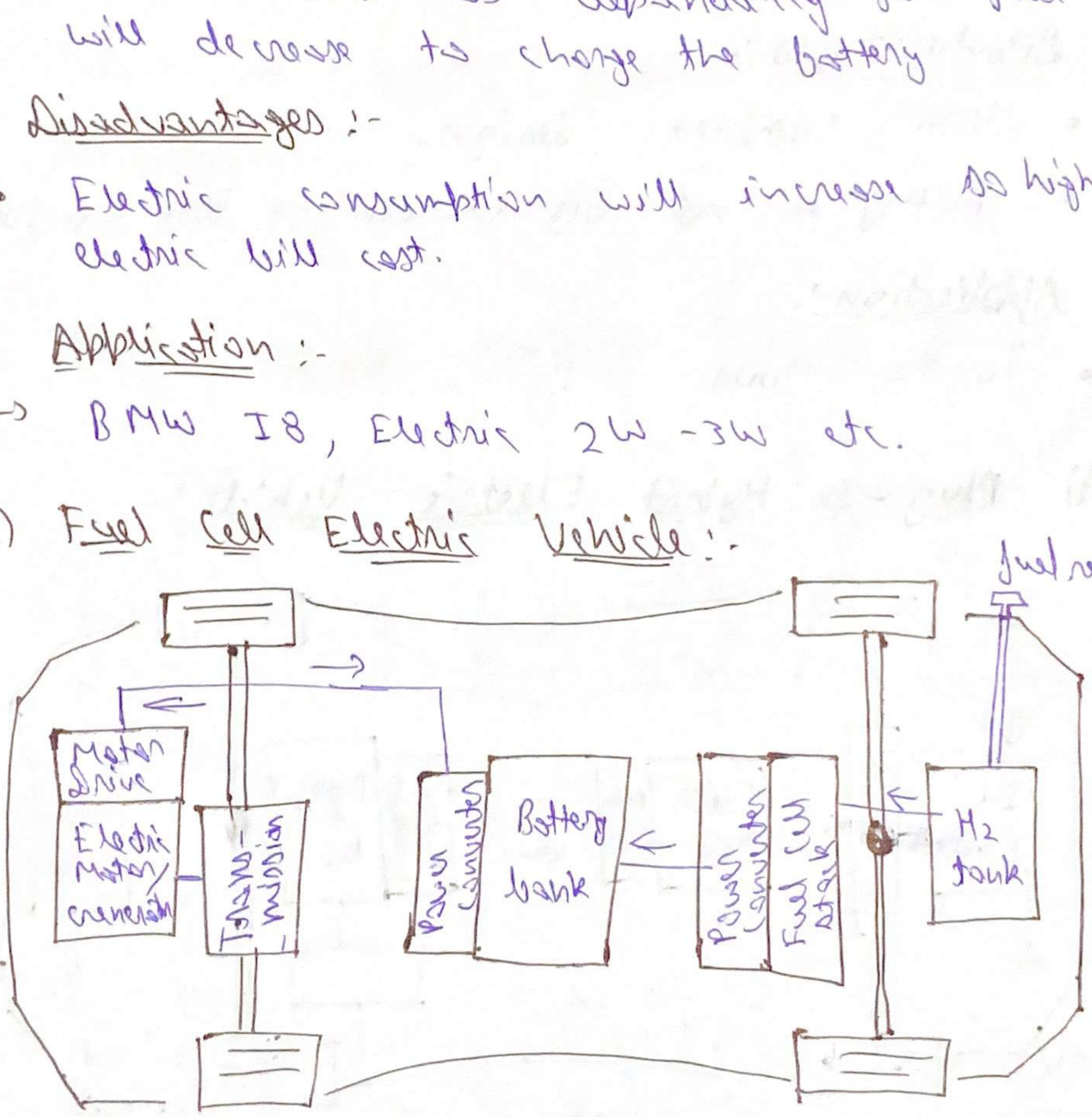
Disadvantages :-

- Electric consumption will increase so higher electric bill cost.

Application :-

→ BMW I8, Electric 2W - 3W etc.

(c) Fuel Cell Electric Vehicle :-



→ • Fuel cell EV consist of fuell cell in-place of ~~Hybrid~~ I.C Engine and this is same as Series - Hybrid.

Application

→ Hyundai Nexo.

Advantages :-

- Eco-friendly than all the other segment.
- Can have greater range.

Disadvantages :-

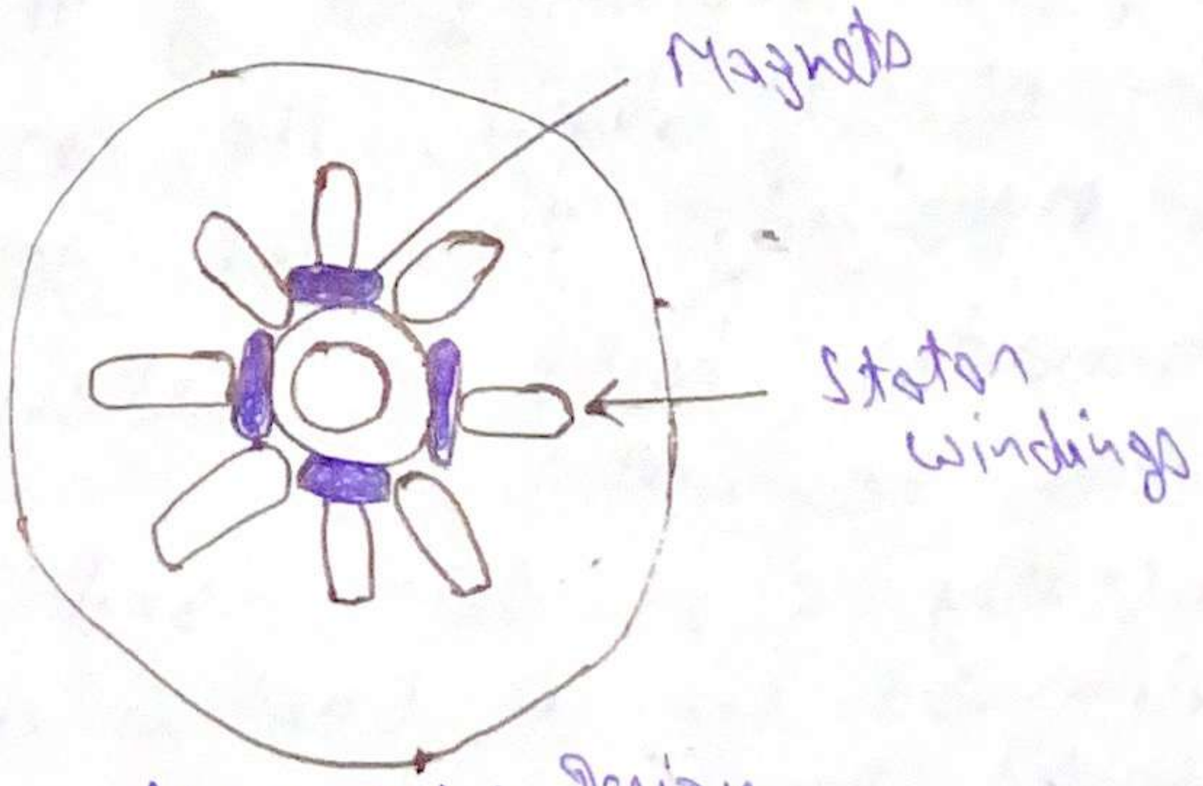
- Production of Hydrogen is costly.
- Transporting and storing Hydrogen is difficult to manage because of high inflammable property of Hydrogen.

Q3 :-

Ans :- There are two types of BLDC motor on the basis of construction :-

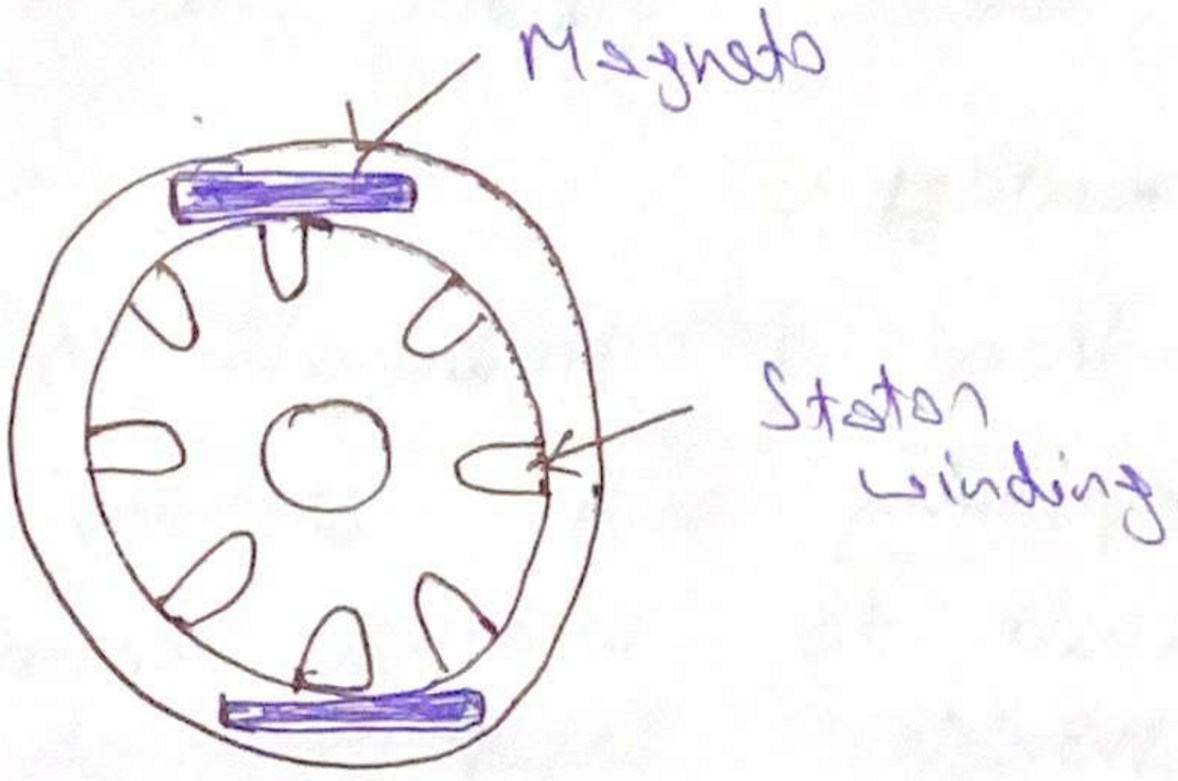
(i) BLDC Inner Rotor Design :-

→ This is a conventional design, where the the rotor is located at the core (center) and stator winding surrounds it.



2. BLDC Outer Rotor Design :-

→ In this design, the rotor is external. i.e, stator windings are located at the core while the rotor, carrying permanent magnets surrounds the stator.



Outer rotor design.

- Working Principle of A BLDC Motor :-

→ • Stator windings of a BLDC motor are connected to a control circuit (an integrated circuit). The control circuit energizes proper winding at proper time, in a pattern which rotates around the stator.

- The rotor magnet tries to align with the energized electromagnet of the stator, and as soon as it aligns, the next electromagnet is energized. Thus the rotor keeps running.
- Commutator helps in achieving unidirectional torque dc motor.
- Obviously, commutator and brush arrangement is eliminated in a brushless dc motor. And an integrated inverter / switch circuit is used to

achive unidirectional torque.

- these motors are also called 'electronically commutated motors'.
- Benefits of BLDC over brushed motors:-
  - Increased efficiency.
  - Reliability.
  - longer lifetime.
  - No sparking and less noise.
  - More torque per weight.

Q4:-

Ans:-

→ The Battery Pack is the final shape of the battery system, which is going to be installed in the electric vehicle. It composed of following:-

(i) Battery Module:- A battery cells assembly which consist of different number of cells, put into a frame to protect them both from external shocks such as heat or vibration, is called Battery module. the cells are basic unit of a lithium ion battery.

(ii) Battery Cell → This is the basic unit of lithium ion battery that exerts electric energy ~~and~~ by charging and

discharging. Made by inserting cathode, anode, seperator and electrolyte into a rectangular aluminium case.

(iii) Battery Management System :-

→ A BMS monitors the temperature across the Battery Pack, and open and closes various valves to maintain the temperature of the overall battery within a narrow temperature range to ensure optimal battery performance.

(iv) Battery Cooling System :-

→ The battery pack consist of a cooling system, ~~channels~~ the battery pack is located on the cold plate which consist of cooling channels through which liquid flows. ~~And~~ the heat absorbed by the cooling liquid is transported to the heating - cooling unit.

- Advantages :-

→ • An Advantage of a battery pack is the easy with which it can be swaped in or out of a battery.
  • Flexibility of design.

- Disadvantages :-

→ • Battery pack poses danger as potential chemical, electrical and fire risks.