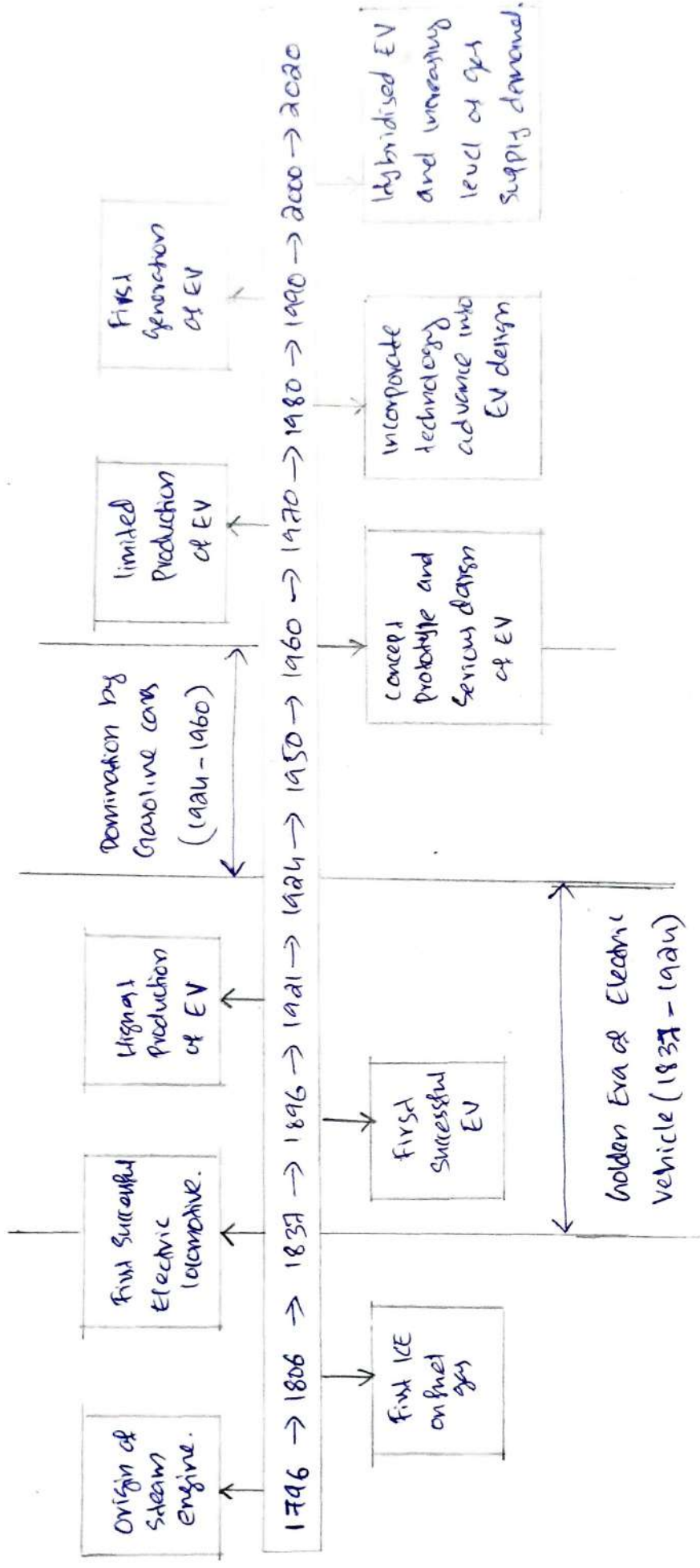


ELECTRIC VEHICLE ASSIGNMENT - 1

Krishnakumar AE

Answer:



a) Invention of Electric motor:

Hungarian Inventor Anyos Jedlik created the world's first electric motor in 1828. The first commutator DC electric motor capable of turning machinery was invented by British scientist William Sturgeon in 1832.

b) Golden era of EV:

Early 1900's was known as the golden era of EV's. During these days they made up more than $\frac{1}{3}$ rd of the car sales in United States.

c) Domination of EV by Gasoline cars:

Gasoline cars started dominating after the invention of Assembly line production by Henry Ford. In IC engines, which helps to decrease the price of engines in turn reduce in the overall price of the gasoline vehicle. And the self starting mechanism of IC Engine (1912) also boosted the production of gasoline vehicles.

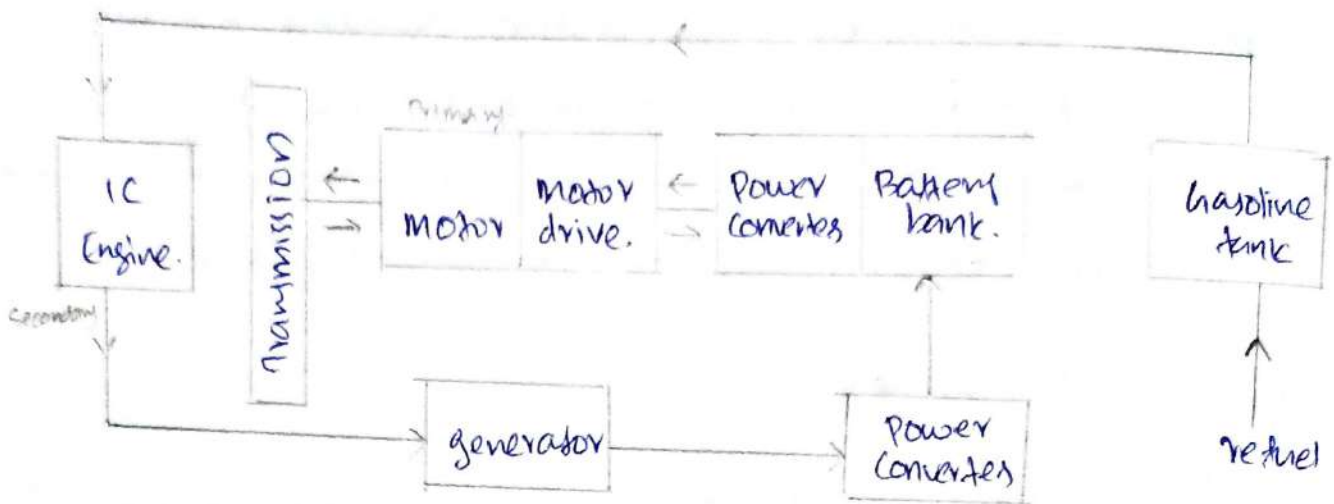
d) Coming of New Era in EV:

New era of EV is started with CARB. CARB adopted Level 1 and Level 2 programs which is related to the emission of gasoline vehicles. As a result of this the production of EV enhanced.

e) Introduction to Hybrid vehicles.

Introduction of hybrid vehicles started a new era in the vehicle market. These are more efficient than other vehicles. Hybrid vehicle comes with the combination of IC engine and electric motor.

a) Series Hybrid EV



Advantages:

- Reduces ~~emission~~ emission
- Smaller and efficient engine.

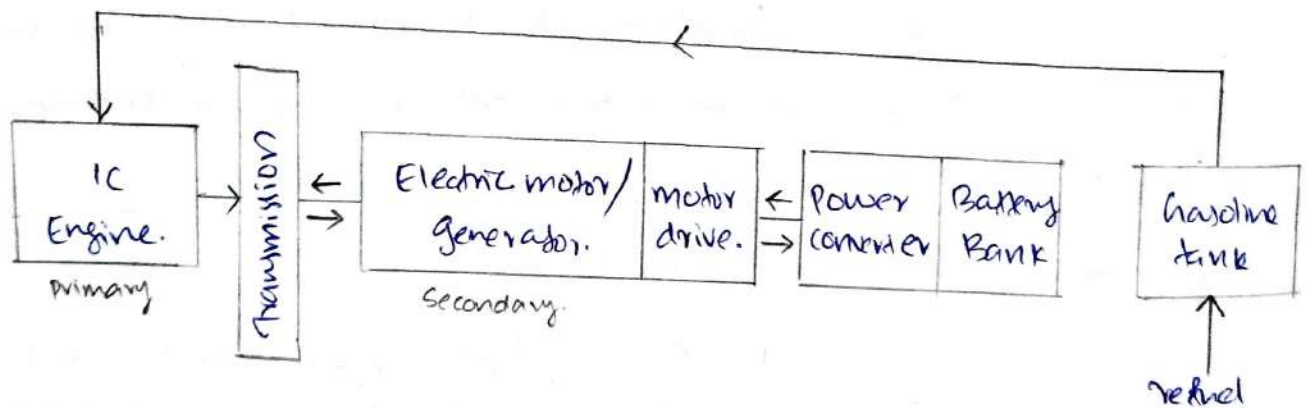
Industrial application:

- BMW i3

Disadvantages:

- No: of energy conversions result in losses.
- requires 3 machines with similar power ratings.

b) Parallel hybrid EV



Advantages:

- Smaller battery pack.
- Efficient
- Engine noise less
- Regenerative braking used.

Disadvantages

- High cost.
- High weight.

Industrial application

- BMW i8
- Honda Civic.

Have 5 cases:

Case 1:

IC - ON
M - OFF

Case 2:

IC - OFF
M - ON

Case 3:

IC - ON
M - ON

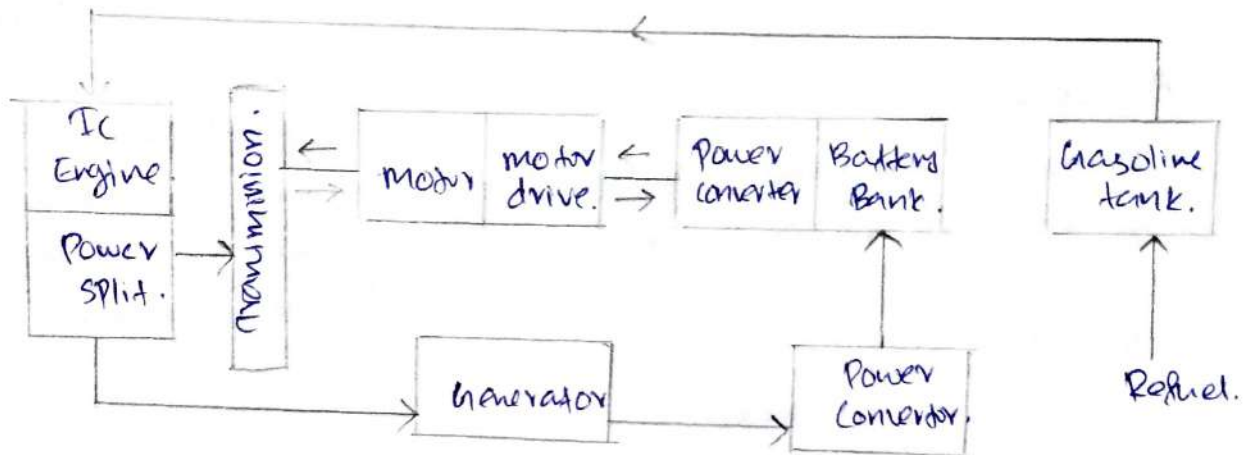
Case 4:

IC engine
charges
battery.

Case 5:

IC - OFF
M - charges battery by
regenerative braking.

c) Series - Parallel: EV



Advantages

- High efficiency.
- Power split

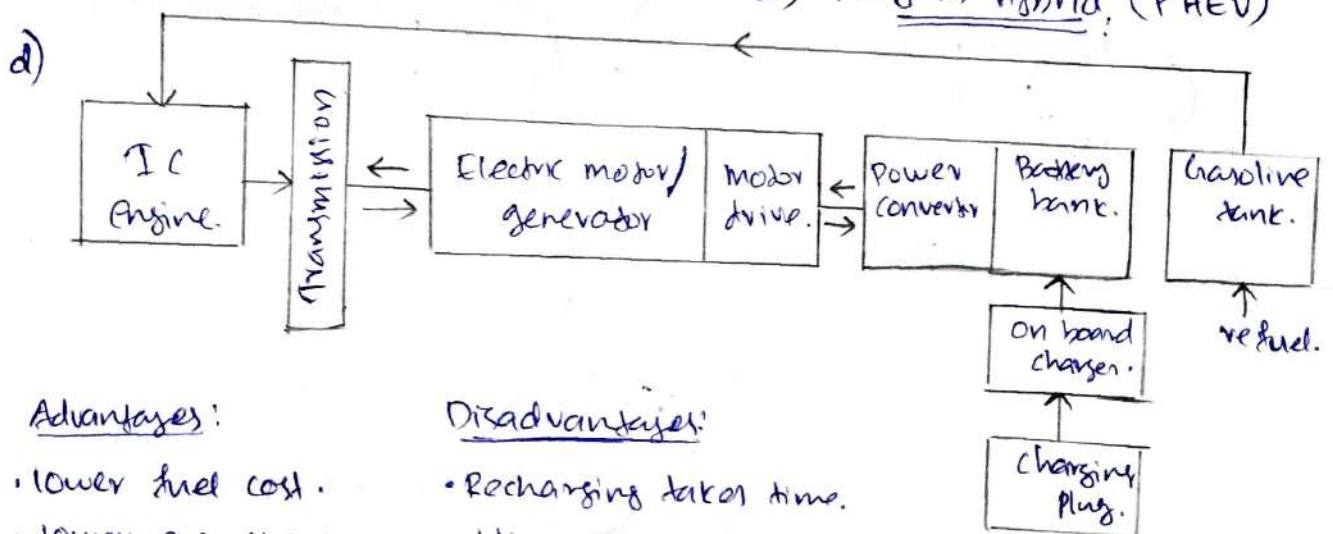
Disadvantages:

- High cost.
- Larger battery, motor and generator.
- Heavy setup

Industrial application:

- Toyota Prius (1995)

d) Plug in Hybrid (PHEV)



Advantages:

- Lower fuel cost.
- Lower emission

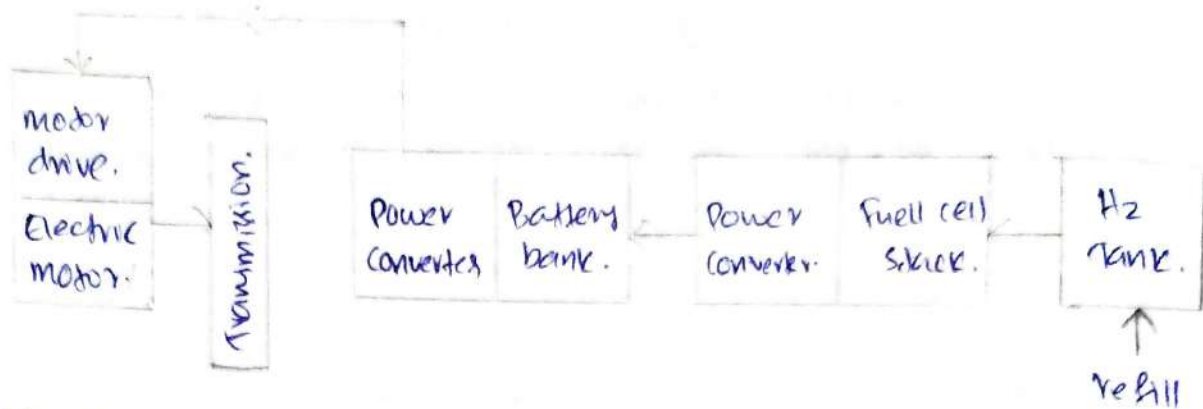
Disadvantages:

- Recharging takes time.
- High cost.

Industrial application

Tesla model 3

e) Fuel cell EV



Advantages:

- Renewable and Readily available fuel.
- No harmful tailpipe emission.

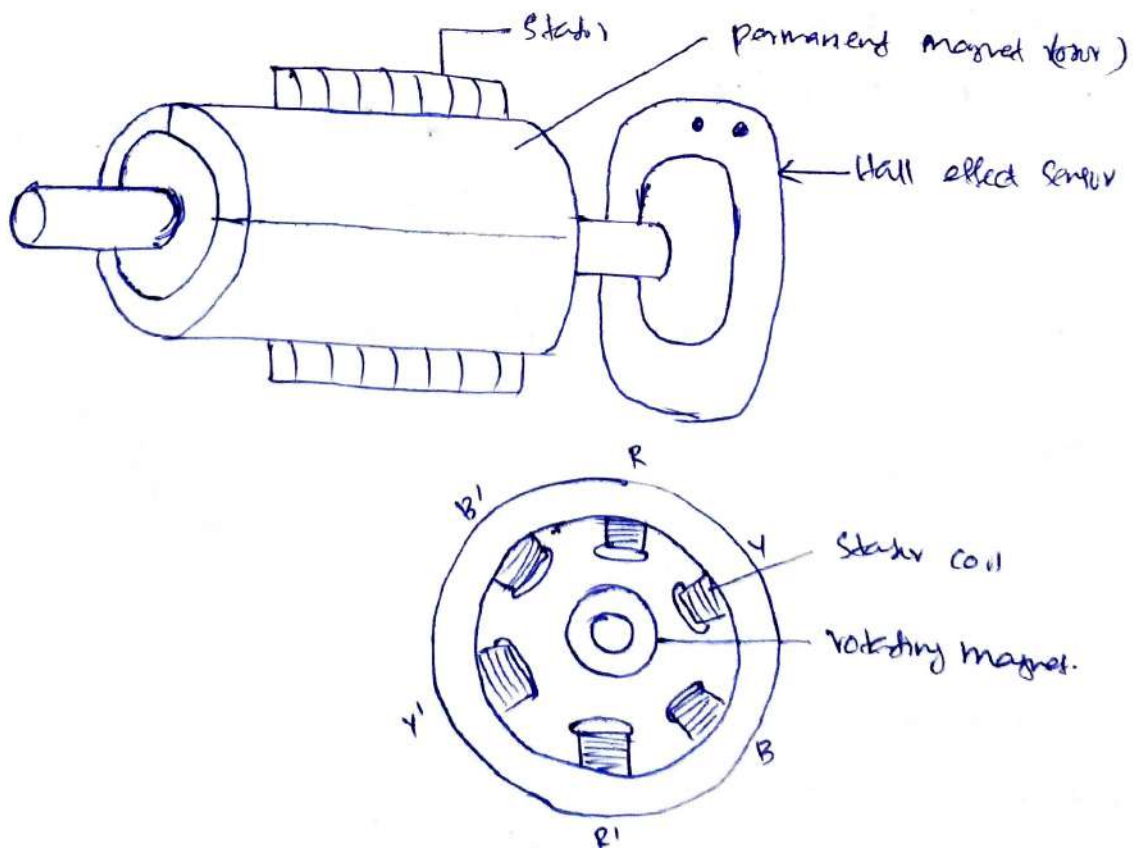
Disadvantages:

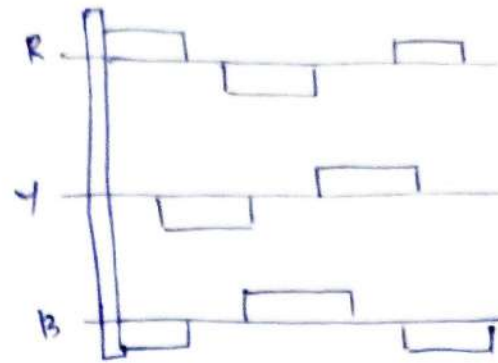
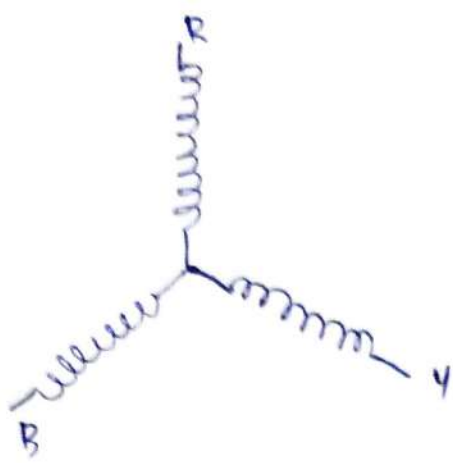
- Fuel cell efficiency.
- Storage and transportation of hydrogen.

Industrial application:

Hyundai Nexo

3) BLDC motor





Switching Sequence.

Construction and working Principle:

BLDC motor works on the principle similar to that of a Brushed DC motor. The Lorentz law, which states that when ever a current carrying conductor placed in a magnetic field experiences a force, As a consequence, of reaction force the magnet will experience an equal and opposite force. In BLDC, the current carrying conductor is stationary and permanent magnet act as a rotor.

When stator coil get supply from external source, it becomes electromagnet and starts producing the uniform field in the air gap. Though the source of supply is DC, switching makes to generate an AC voltage waveform with trapezoidal shape. Due to the force of interaction between electromagnet stator and permanent magnet rotor, rotor continues to rotate to form rotation motion.