

Assignment

Unit - 1

1A) Flow chart

Nicolas Cugnot

Vapour engine vehicle - 1768



Isaac de Rivaz

First IC engine - 1806



Anyos Zedlik

Patent for Electric motor - 1826



Thomas Parker

Electric Vehicle - 1886



Golden ERA of EV^{III} - 1910



mass production of IC engine

Henry Ford - IC components

Chevrolet - 1912 (Self start mechanism)



Health hazard due to increase in pollution



Formation of CARB - 1970

California Air Resources Board



Introduce Emission regulations

- 1991



Regulation LEV-I

- 1993 ~ 2003

low emission vehicle-I



Regulation LEV II

- 2003

low emission vehicle-II



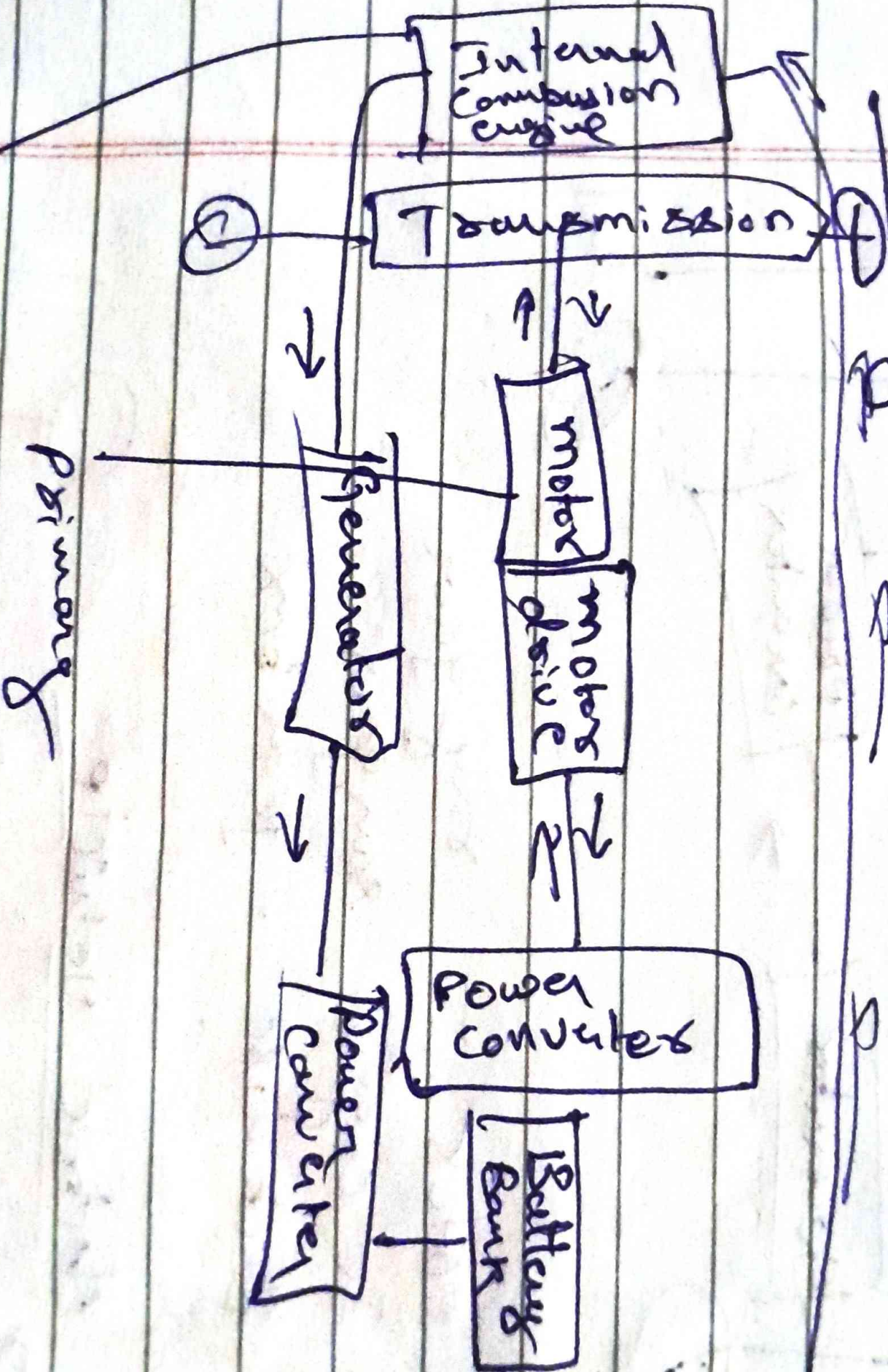
EV CARB - 2006

again boom markets

new
ERA of EV

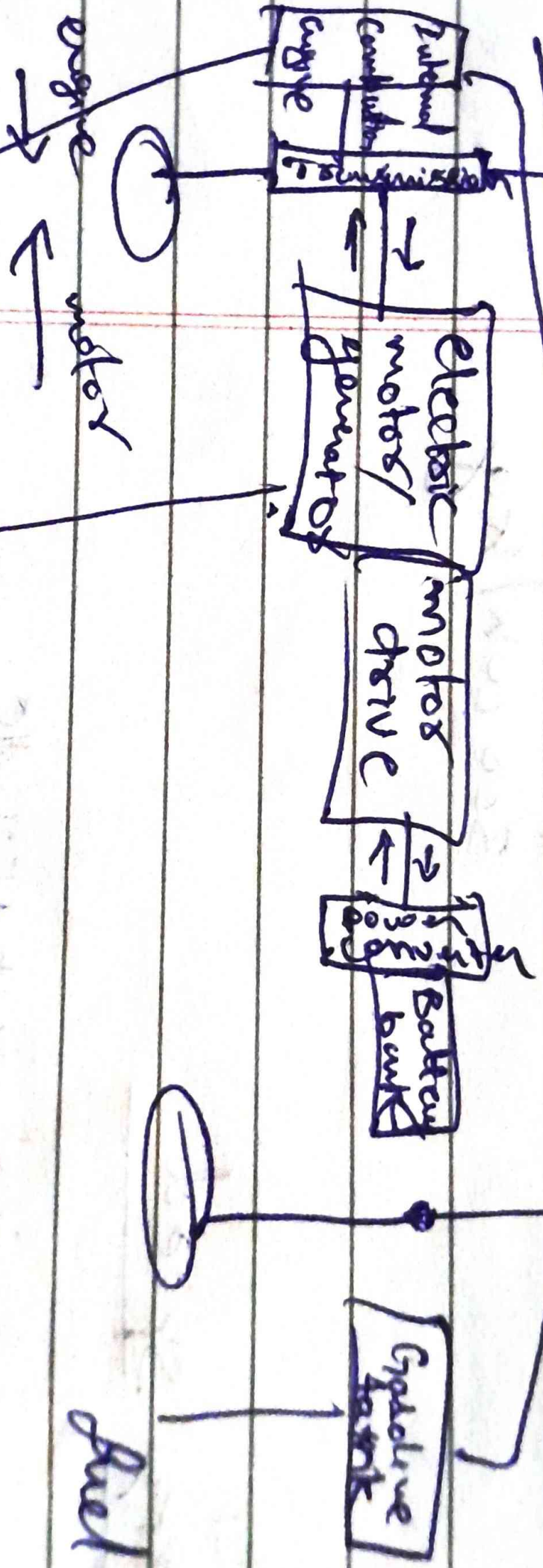
• Series hybrid

motor > engine



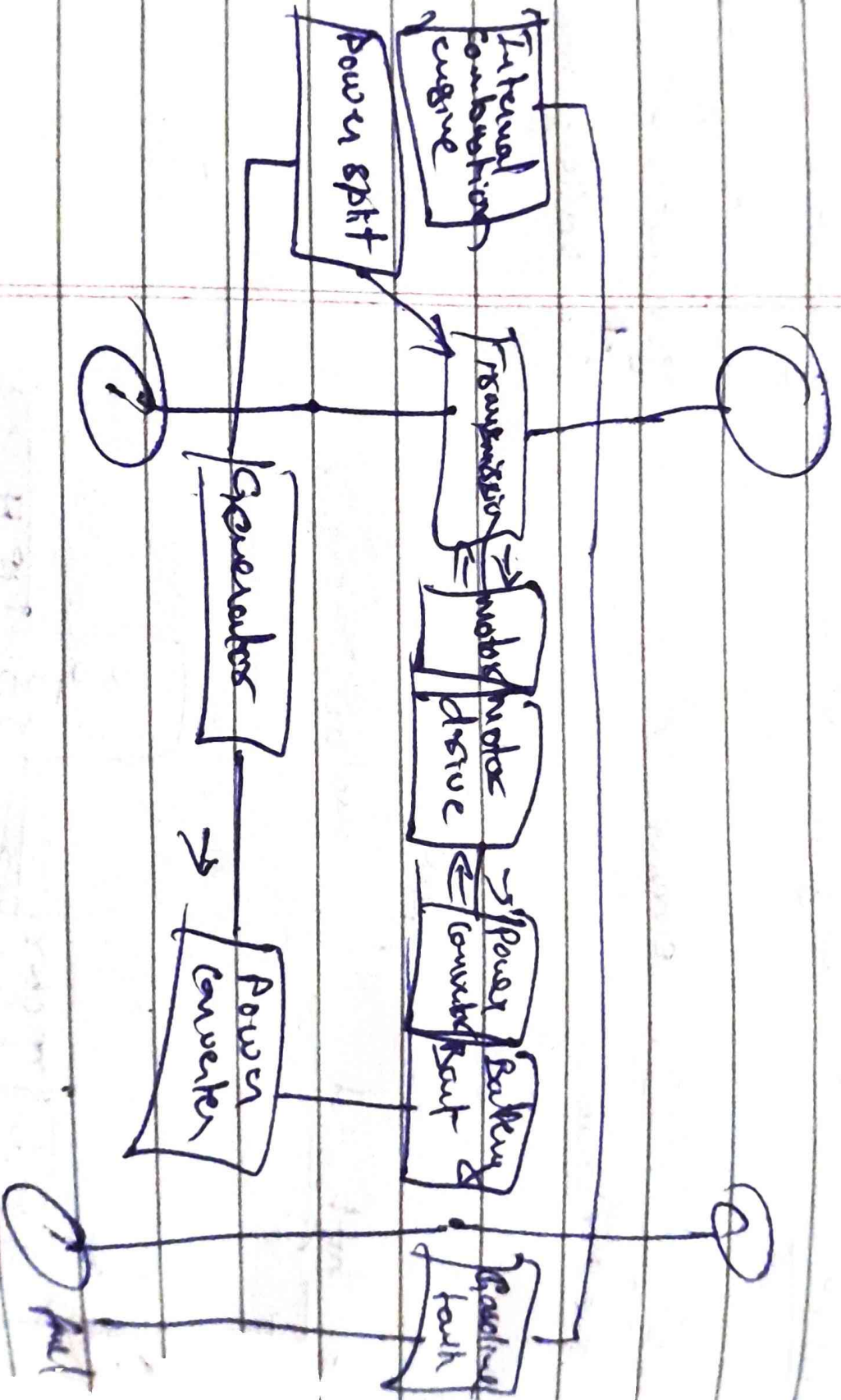
BMW i8

HEV - Parallel



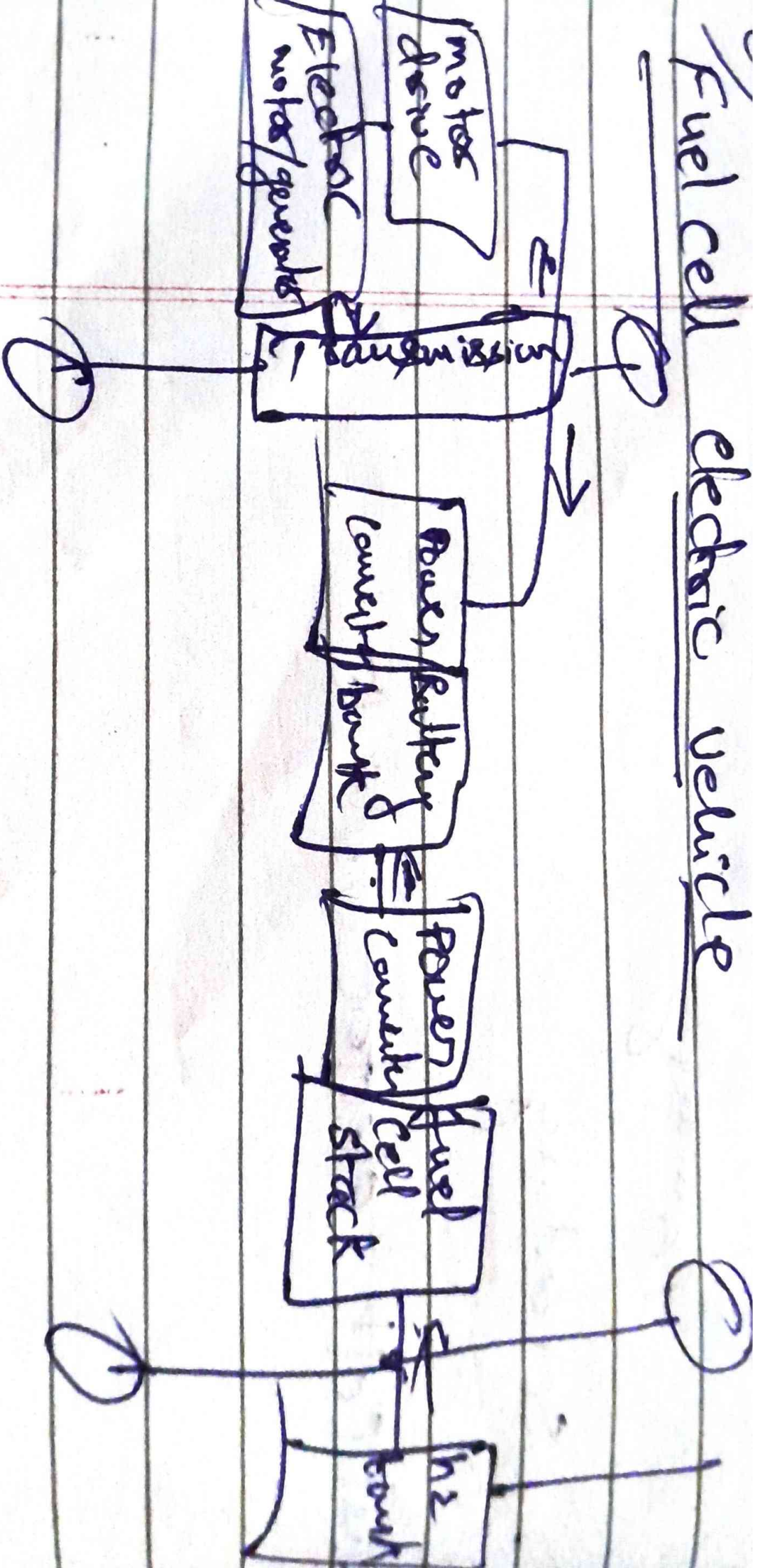
Internal combustion engine is
primary machine

Toyota



motor - ring gear
IC engine - sun gear
Rack and pinion gear box

Fuel cell electric vehicle



hyundai nex0

3A) Brushless DC motor working

- converts electrical energy to mechanical energy
- BLDC motor is also known as electronically commuted or DC synchronous motor
- There is no Brush and commutator present in BLDC motors

Types of BLDC motor

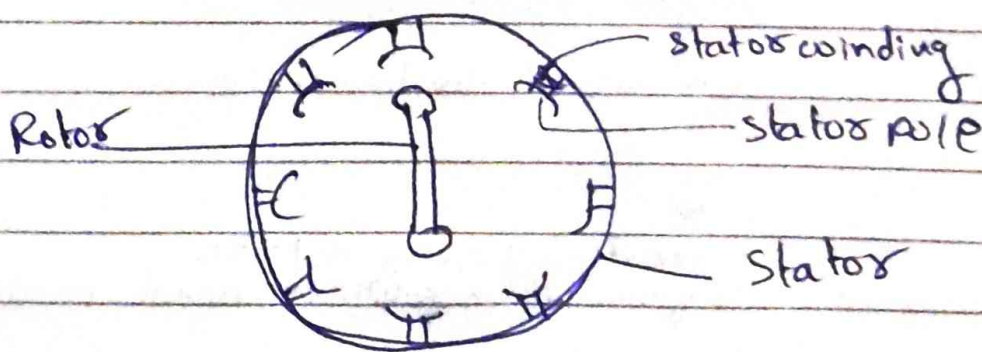
a) Inner rotor type BLDC motor

- Rotating Part is present in center
~~stator winding is present on rotor~~

b) outer rotor type BLDC motor

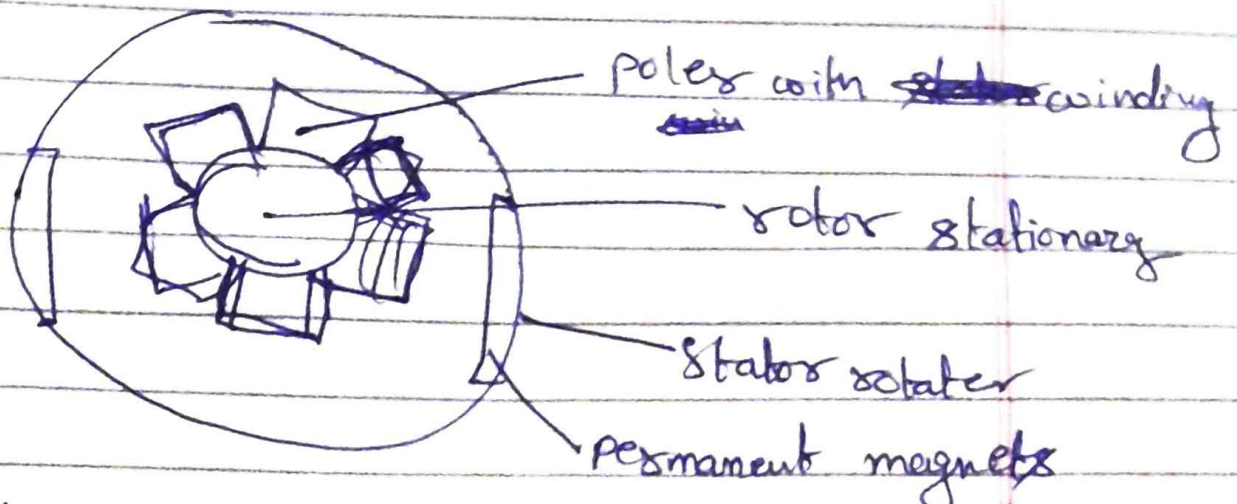
- Stationary Part is present in center
with help of magnets rotating Part is placed

Inner rotor type BLDC motor



Stator Pole winding supply controlled sequentially from N to S and S to N to make rotor rotate controlled electronically
Electronic Speed Controller

outer rotor type BLDC motor

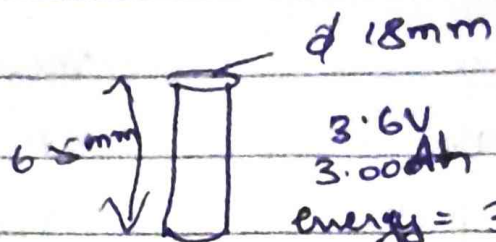


Similar to inner rotor type BLDC the electronic controller is used to energise coils in sequence to maintain rotation of motor.

4A)

Common battery used in industry

18650



hyundai kona

Car Price - 23.79 lac

Battery $\rightarrow$ 39.2 kWh

$$= \frac{39.2 \text{ kWh}}{10.8 \text{ Wh}} = \frac{39200}{10.8} = \underline{\underline{3630}}$$

$$3630 + 10\% \rightarrow 3960 \text{ cells}$$

no. of cells required for 39.2 kWh = 3960 cells

assume cost of each battery is 120 Rs/-

$$3960 \times 120 = 4,75,200 \text{ Rs}$$

$$+ \underline{1,50,000 \text{ Rs (others)}}$$

$$6,25,200 \text{ Rs/-}$$

30% of cost is of Battery pack

Energy Density

18650 - model (cunning)

$$10.8 \text{ Wh} / (\text{mass} \approx 49 \text{ g}) = 0.049 \text{ kg}$$

$$\frac{10.8}{0.049} \approx 220.40 \text{ Wh/kg}$$

• Petrol $\approx 1300 \text{ Wh/kg}$ • Hydrogen $\approx 3400 \text{ Wh/kg}$

L - lithium

C - cobalt

O - oxide

M - ~~magn~~ manganese

N - Nickel

A - Aluminium

• NMC (622) is latest
chemical composition of
batteries

• NMC (811) is new
coming to market

300 Wh/kg

220 Wh/kg

Charging speed

Level - 1 110 ~ 140 V AC

Level - 2 220 V AC (8h) Normal charging
(4h) Fast charging

Level - 3 DC fast chargers
20 min (80%)