

Assignment - 1.

Invention of Electric Motor.

In 1828, Ansgar Jedlik invented World's First Electric Motor.

b) The Golden Era of EV

- First Successful Electric Vehicle was built in 1896, by William Morrison.

- In ~~1906~~ At beginning of the 20th century, EV gained popularity.

- EV gained popularity because.

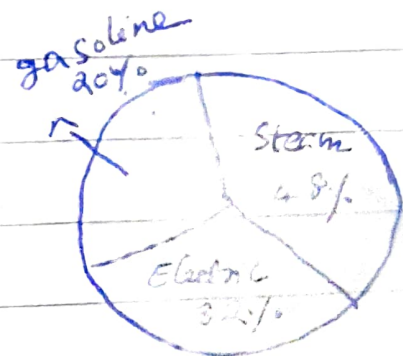
- No emission; ~~etc~~

- Efficient.

- Low cost

- Easy start.

→ Upto 1910, EV were popular.



(c) Domination of EV by Gasoline car

(c) After 1910, EV declined

Reasons :- Henry Ford → Assembly line production
Price of IC Engine were brought down drastically.
EV's were unable to ~~complete~~ compete because of that

→ EV was dominated by gasoline cars (1924-1966)

→ Cherevok - In 1912 Invented self start mechanism for IC Engine vehicles

→ World war → 2 factors → Range & charging time

(d) Coming of new era in EV

CARB → 1970s implemented emission regulations, → They made changes to the regulations periodically

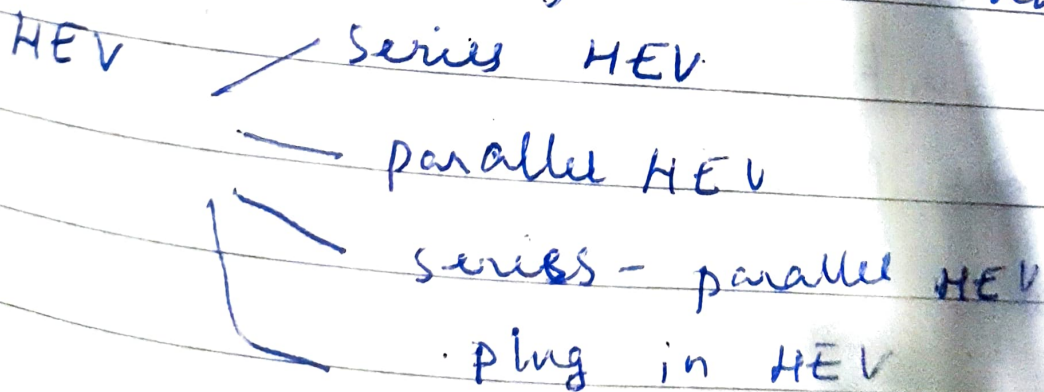
In 2003 CARB brought LEV II for Automobile manufacturers → ~~LEV~~ They categorized vehicles by LEV (low emission vehicle), ULEV and PZEV (0% emission)

→ In 2004, Tesla Roadster model was introduced.
→ Tesla was also the first to introduce lithium ion batteries in its car production.

→ In 2022, many MNC had taken initiative for green mobility and EV vehicles such as TATA Motors, Mahindra electric.

→ In 2010 → Nissan Leaf (First affordable EV was introduced).

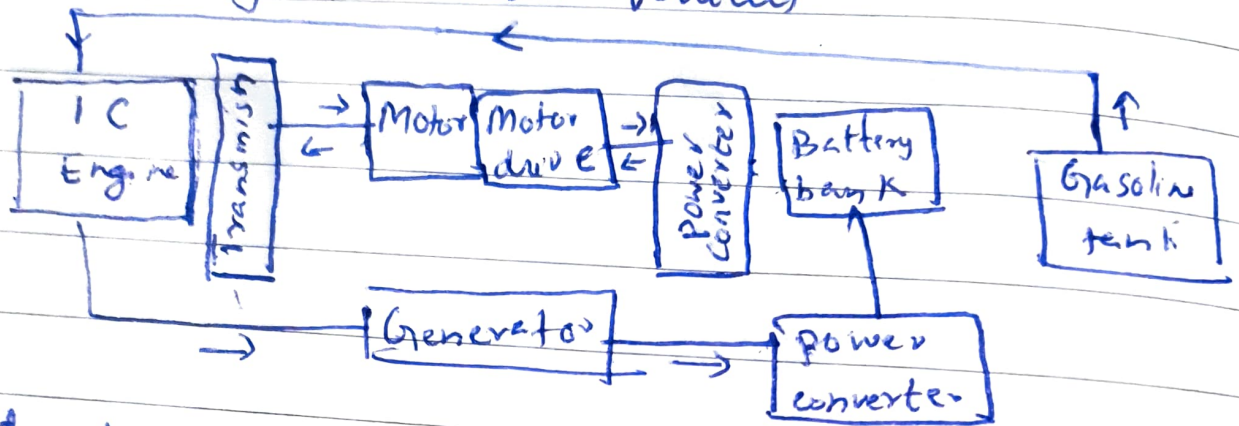
e) Introduction to hybrid electric vehicle.



Q2.

(a)

Series Hybrid Electric Vehicles



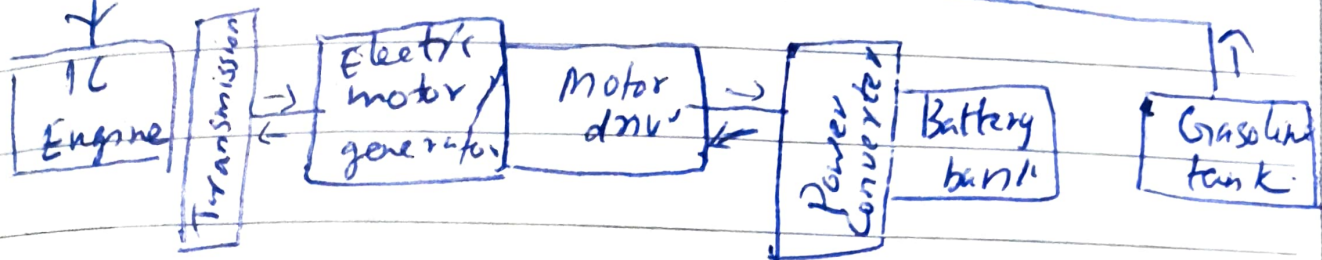
Advantages

- Mechanical decoupling between the ICE & driven wheels allows the IC Engine operating at its very narrow optimal region
- Nearly ideal torque-speed characteristics of electric motor make Multi gear transmission unnecessary

Disadvantages

- The energy is converted twice and this reduces the overall efficiency
- Two Electric machines are needed and a big traction motor is required because it is the only torque source of the driven wheels

Parallel Hybrid EV's



Case 1 : IC Engine

- Motor - charging
- IC Engine - Performing Drive

Case 2 : Electric Drive

- Motor - Performing Drive
- IC Engine - Rest Condition

Case 3 : Hybrid mode

- Engine
- IC Engine

Case 4 : Low Battery

Engine - Charging & drive mode

Case 5 : Regenerative Braking -

motor - Generator, Power stored

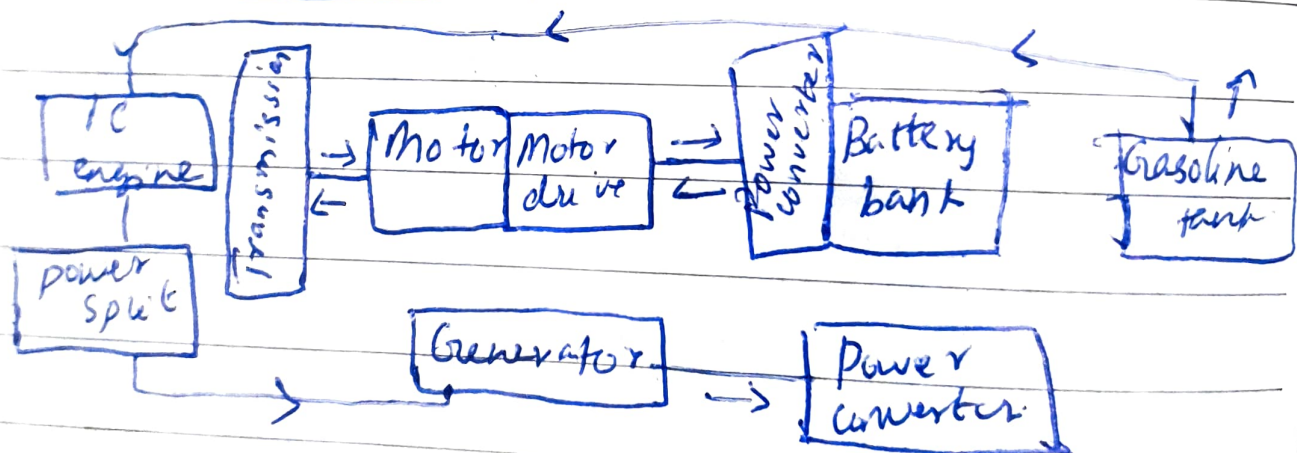
Advantages :

- Both engine and electric motor directly supply torques to the driven wheel and no energy form conversion occurs, hence energy loss is
- Compactness due to no need of the generator and smaller traction motor.

Disadvantages

- Mechanical coupling b/w the engines and the driven wheels, thus the engine operating points cannot be fixed in a narrow speed region.
- The mechanical configuration & the control strategy are common to series hybrid drivetrain.

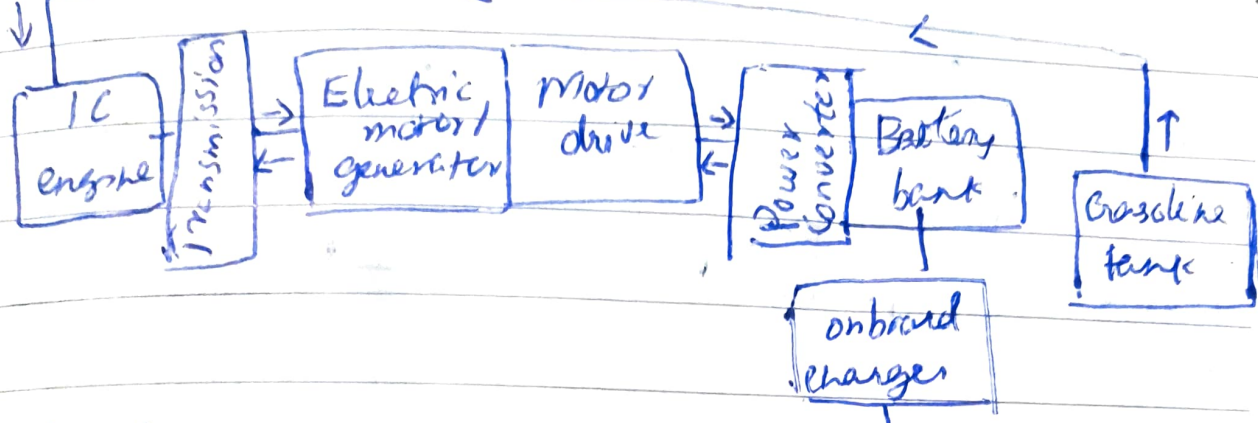
(C) Series-Parallel Hybrid vehicle



→ Have feature of both series and parallel hybrid

→ many different modes of driving are possible under more ICE dominant hybrid vehicle and under Motor dominant drive mode.

(d) Plug in EV's



Advantages

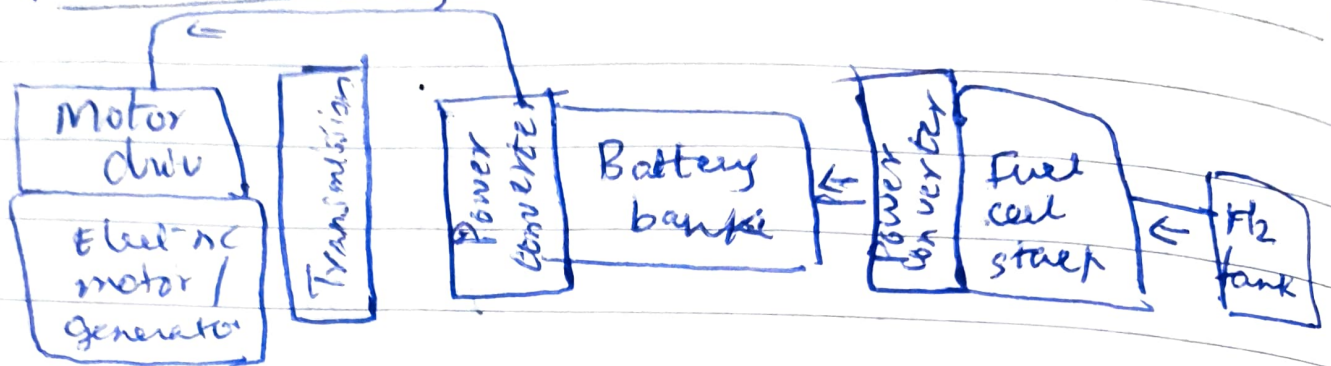
- zero emission when on batteries
- fuel efficient in traffic
- easy to drive
- cheap to run if doing regular 10/15 mile commutes

charging plug

Disadvantage

- relative expensive & complex to maintain
- fuel economy not very good on motorway journeys
- battery life concerns

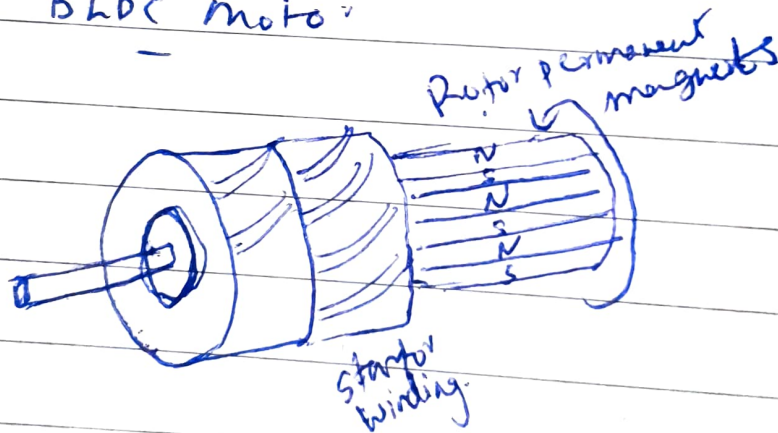
Fuel cell EV



- Uses fuel cell that generate electricity
- have to be refilled at hydrogen charging station

Q3)

BLDC motor



Working principle : Whenever a current carrying conductor placed in a magnetic field it experiences a force. As a consequence the magnet will experience an equal

and opposite force:

→ In case of BLDC motor, the current carrying conductor is stationary while the permanent magnet moves.