QUESTIONS :-

1) Explain the journey of automotive with the help of flow chart from the beginning of 18th Century to the 21st Century & give brief description on the following milestone in the automotive

2) JOURNEY :-

a) Invention of Electric Motor
b) Golden Era of EV
c) Domination of electric vehicle by Gasoline cars
d) Coming of new Era in EV
e) Introduction of Hybrid Electric Vehicle

1806 - Francois Isaac de Rivaz invented a hydrogen powered IC engine

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1884 - Carl - benz production of IC engine vehicle

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1886 - electricle vehicle to under production

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1906 - electric vehicle very advanced

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1910 - Henry ford, assembly line production

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1912 - Chevrolet Self start Mechanism

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1991 - low emmission vehicle I introduced

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2003 - low emission vehicle II introduced
→ low emission vehicle
→ ultra low emission vehicle
→ pure zero emission vehicle

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2006 - Santa Monic auto expo telsa introduced Roadster electric car

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2010 - nissan introduced first-affordable 5 door hatchback EV

INVENTION OF ELECTRIC MOTOR

Early incarnations of the electric motor first appeared in the 1740's through the work of scottish, Benedictine Monk Scientist, Andrew Gordon. other Scientists Such as michael faraday and joseph henry Continued to dumlope early motors, experimenting with electromagnetic fields and discovering how to Convert electrical energy in to Mechanical energy

History was Made when Thomas Davenport of vermont invented the first affiuial battery powered electric motor in 1834. This was the first electric Motor that had enough power to perform a task and its invention was used to power a small - scale printing press

GOLDEN ERA OF EV

Golden age of electric Vehicle Marked from 1890 to 1924 with peak production of electric vehicle in 1912. however the runge was limited by energy storage in the battery.

DOMINATION OF ELECTRIC VEHICLE BYE GASOLINE CARS

gas Cars domeriate the industry and have done for decades with little Competetion - that is until, Recently, with EVs being the next big thing.

Gasoline Cars Could generally drive further and faster and even do it over rough terrain. EVs while, Quiet, clean and user friendly, where limited in range, struggled to drive up hills and Suffered the lack of charging infrastructure.

Date: / /

The discovery of oil in Texas further excacerbated situation. with a plentfull supply of oil on its door step, gasoline - powered Motoring Suddenly got a lot cheaper in america. it was cheaper than electricity at the time and Made the choice between Ev or gasoline Much simpler.

At this point, as Evs began to feel the effects of the Scandel, buyers began to realize the gas cars were, from a practical and financial point of view at-least, a Superior form of transport.

e) INDRODUCTION OF HYBRID ELECTRIC VEHICLES

* hybrid electric vehicle (HEV) is a type of hybrid vehicle that combines a conventional internal combustion engine (ICE) system with an electric propulsion system (hybrid vehicle drivetrain). The presence of the electric powertrain is intended to achieve either better fuel economy than a conventional vehicle or better performance. There is a variety of HEV types and the degree to which each function as an electric vehicle (EV) also varies. The most common form of HEV is the hybrid electric car, although hybrid electric trucks (pickups & tractors) buses, boats, and aircraft also exist.

Q2. Explain and Draw the Layout of following Hybrid Electric vehicles with their two Advantages, Disadvantages & Industrial application in automotive segment?

a) Series Hybrid Electric vehicles

b) Parallel Hybrid Electric vehicles

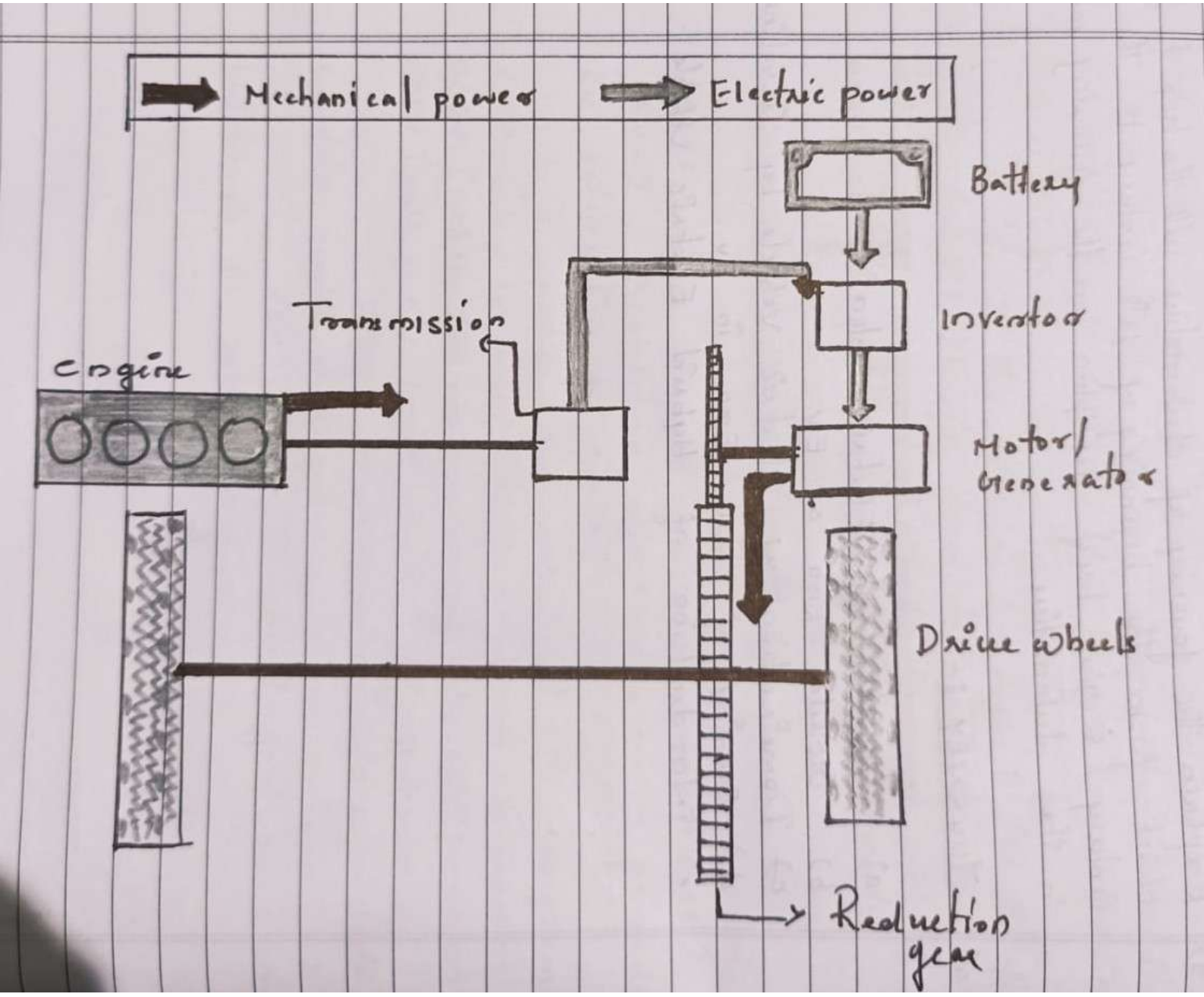
c) Series Parallel Hybrid vehicle

d) Plug in Hybrid electric vehicle

e) Fuel Cell Electric Vehicle

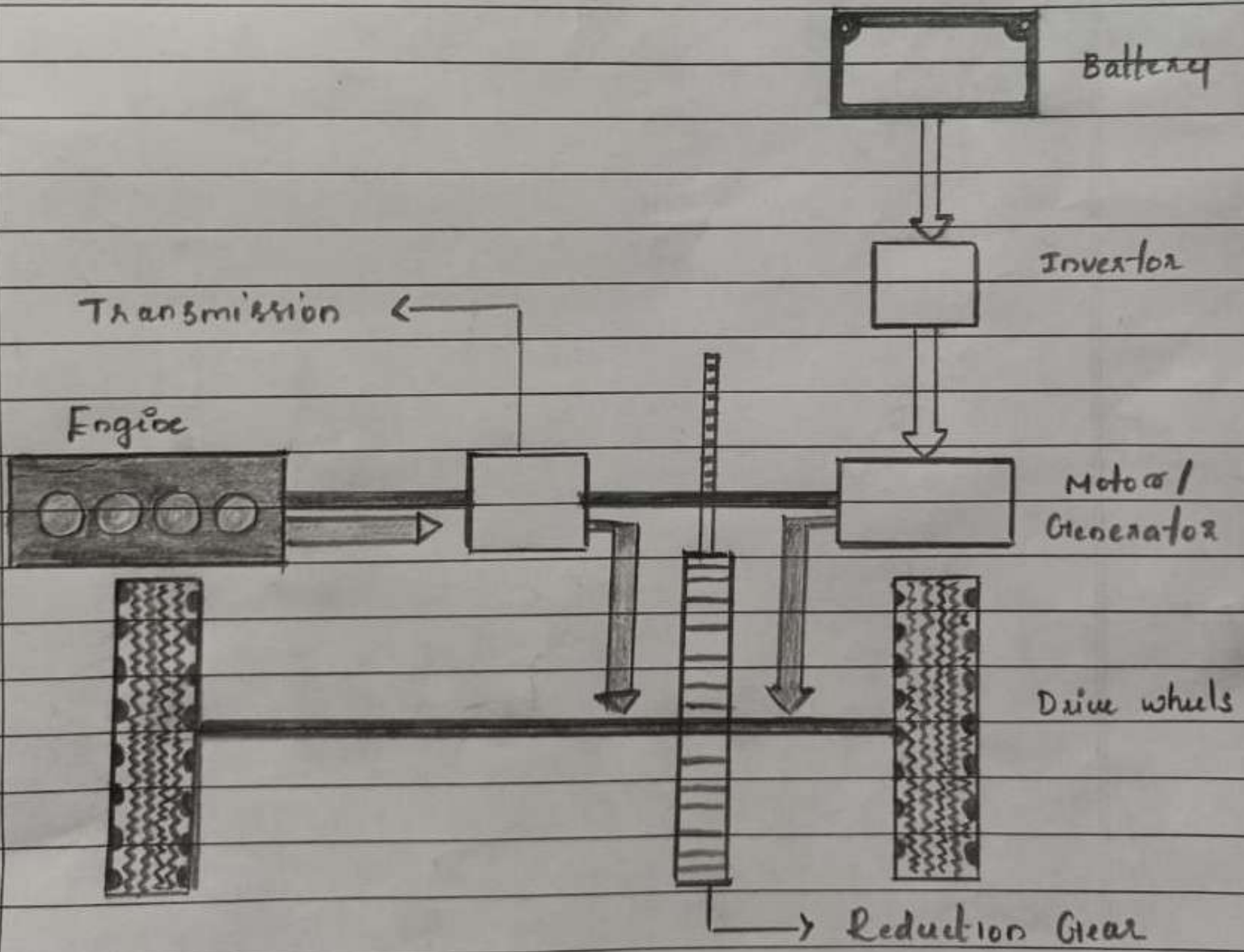
SERIES HYBRID

A Series hybrid is like a battery electric vehicle (BEV) in design. Here the combustion engine drives an electric generator instead of directly and driving the wheels. The generator both charges a battery and powers an electric motor that moves the vehicle. when large amounts of power are required, the motor draws electricity from both the battery and the generator. Series hybrids may also be reffered to as extended range electric vehicles. (EREVS) or range extended electric vehicles (REEVS) since the gas engine only generates electricity to be used by the electric motor and never directly drives the wheels. Modern examples include the Cadillac ELR chevrolet volt and fisker karma


Mechanical power
Electric power
Battery
Inverter
Transmission
Engine
Motor/
Generator
Drive wheels
Reduction
gear

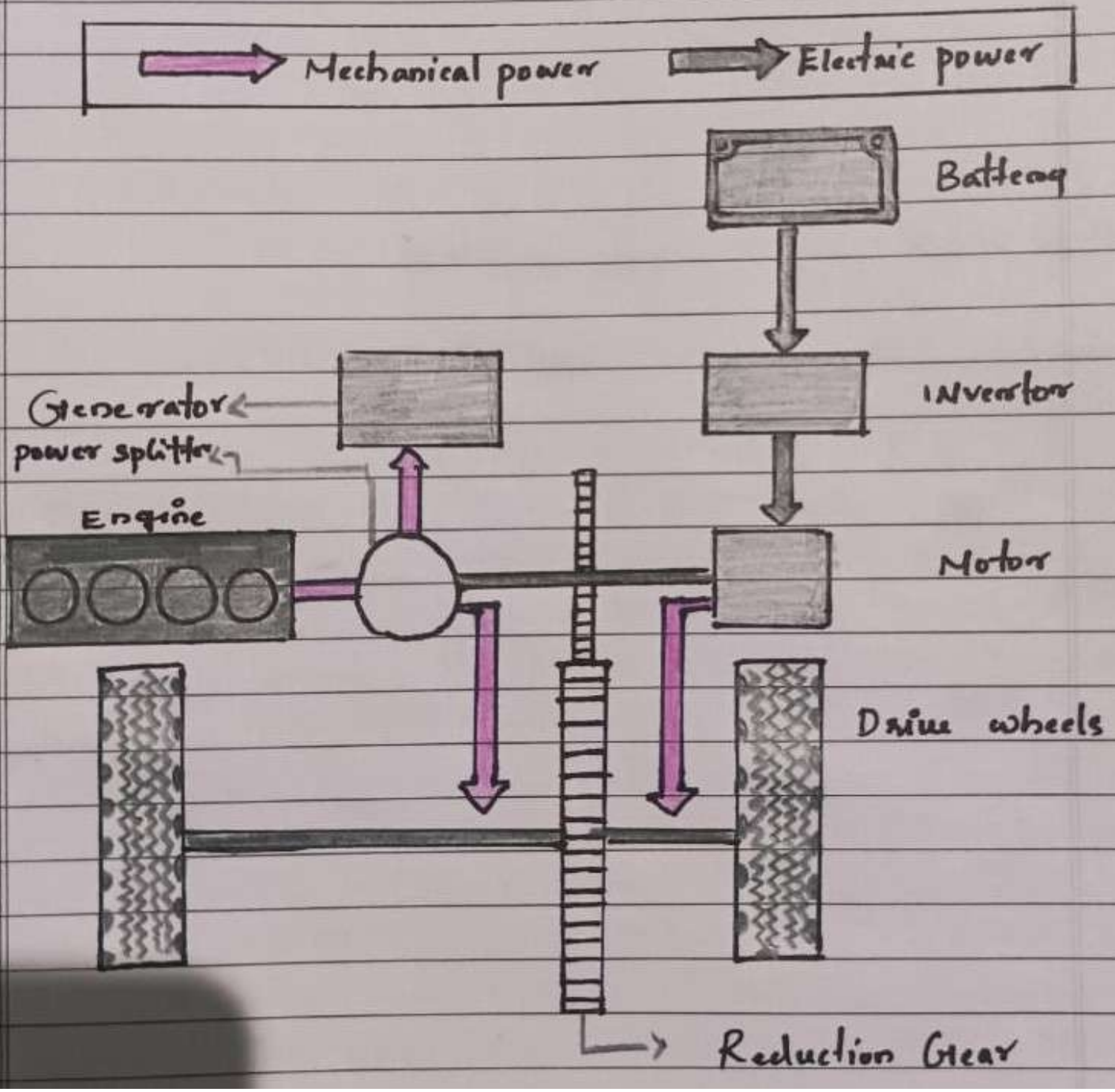
PARALLEL HYBRID

A parallel hybrid is propelled by both an internal combustion engine (ICE) and an electric Motor Connected to a Machanical transmission. power distribution between the engine and the Motor is varied so both run in their optimum operating region as much as possible. There is no Seperate generator in parallel hybrid. whenever the generators operation is needed, the Motor functions as generator. in a parallel mild hybrid, the vehicle can never drive in pure electric mode. The electric Motor turns on only when a boost is needed.



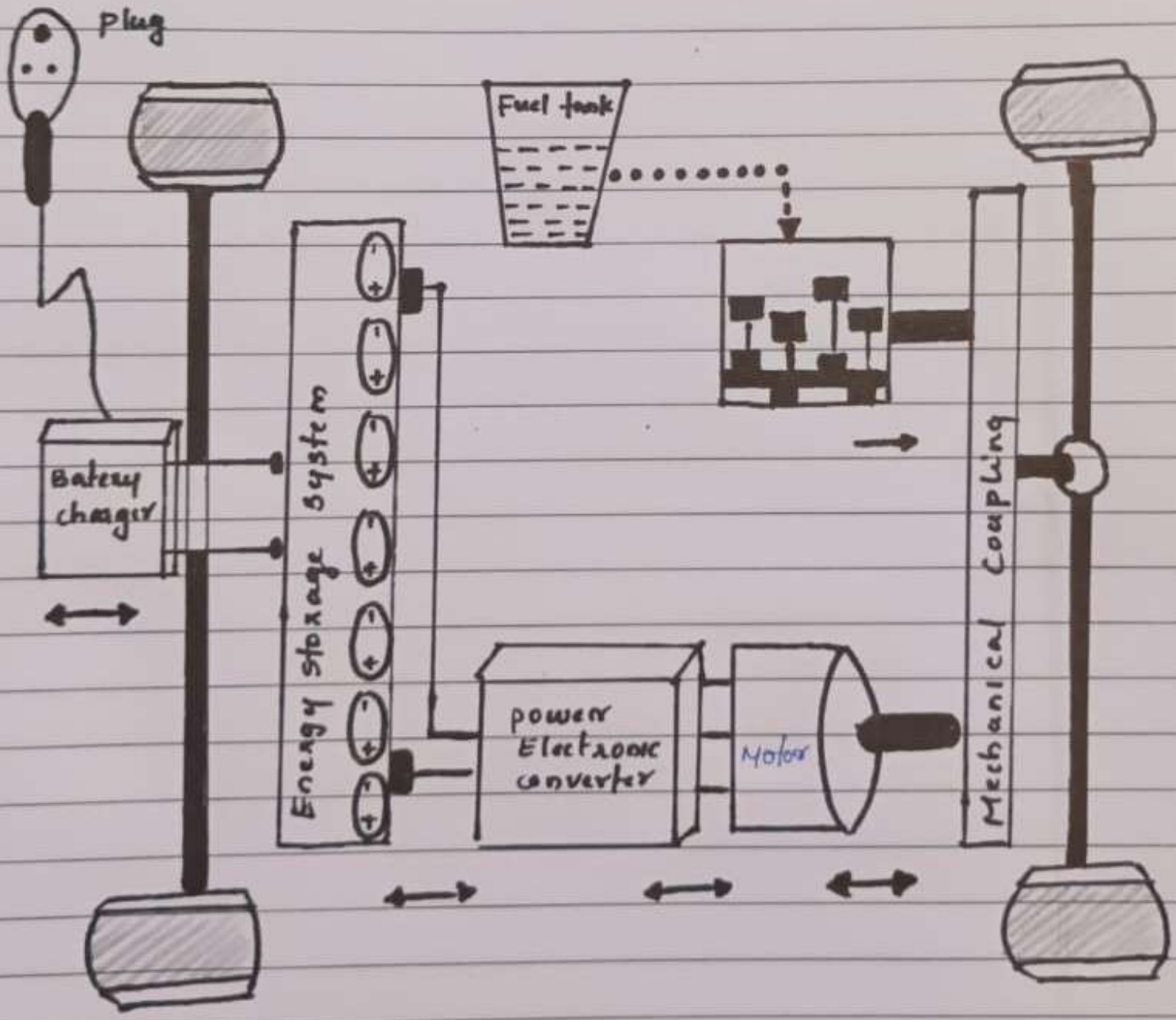
SERIES PARALLEL

The vehicle can be powered by the gasoline engine working alone, the electric Motor by itself, or by both energy Converters working together. power distribution between the engine and Motor is designed so that the engine can run in its optimum operating range as much as possible



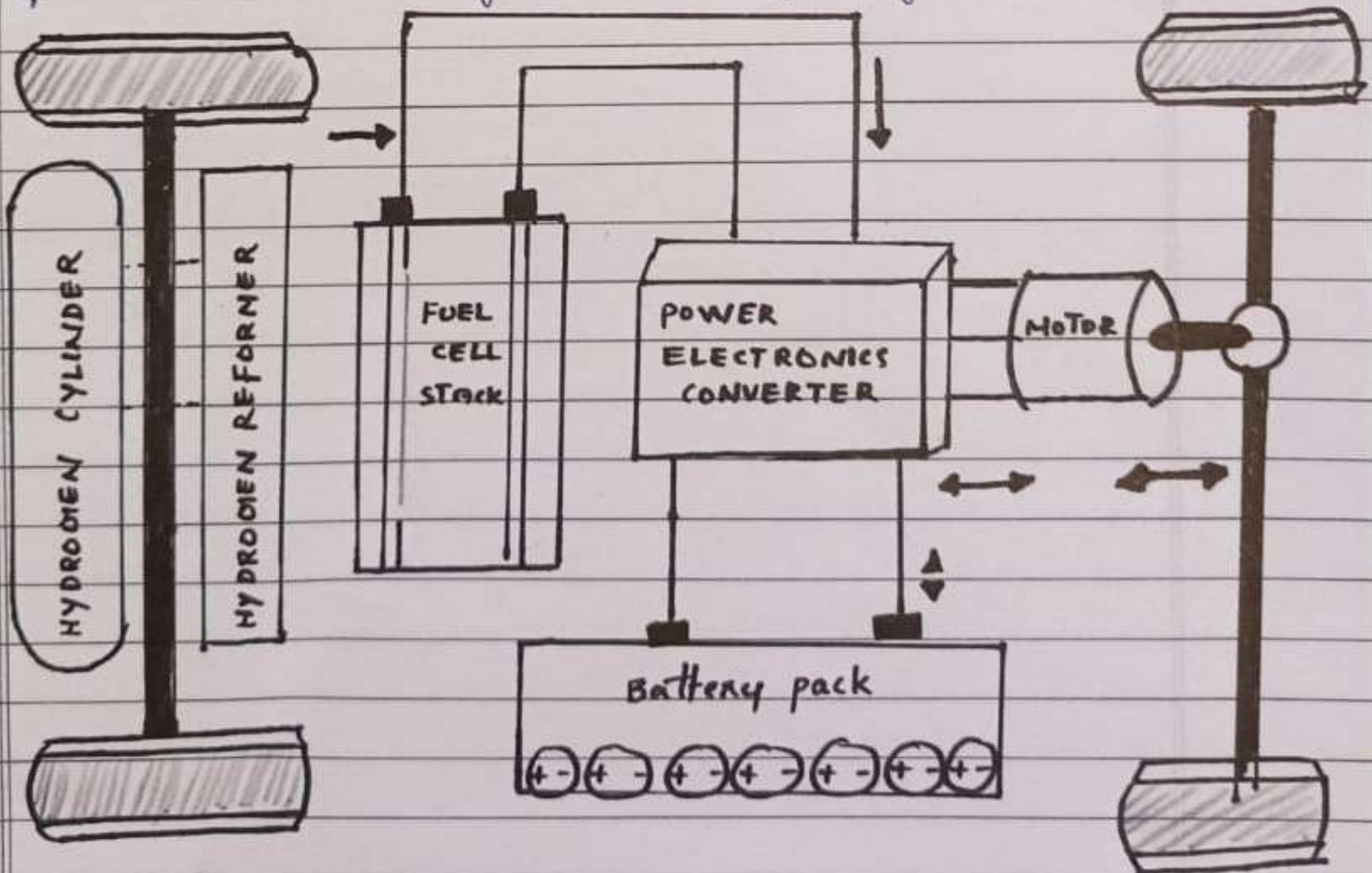
PLUG IN HYBRID VEHICLE

A plug in hybrid electric vehicle (PHEV) is a hybrid electric vehicle whose battery pack can be recharged by plugging a charging cable into an external electric power source, in addition to internally by its on-board internal combustion engine-powered generator. Most PHEVs versions of commercial are passengers cars, but there are also PHE version of commercial vehicles and vans, utility trucks, buses, trains, Motorcycles, Mopeds and even Military vehicles



FUEL CELL ELECTRIC VEHICLE :

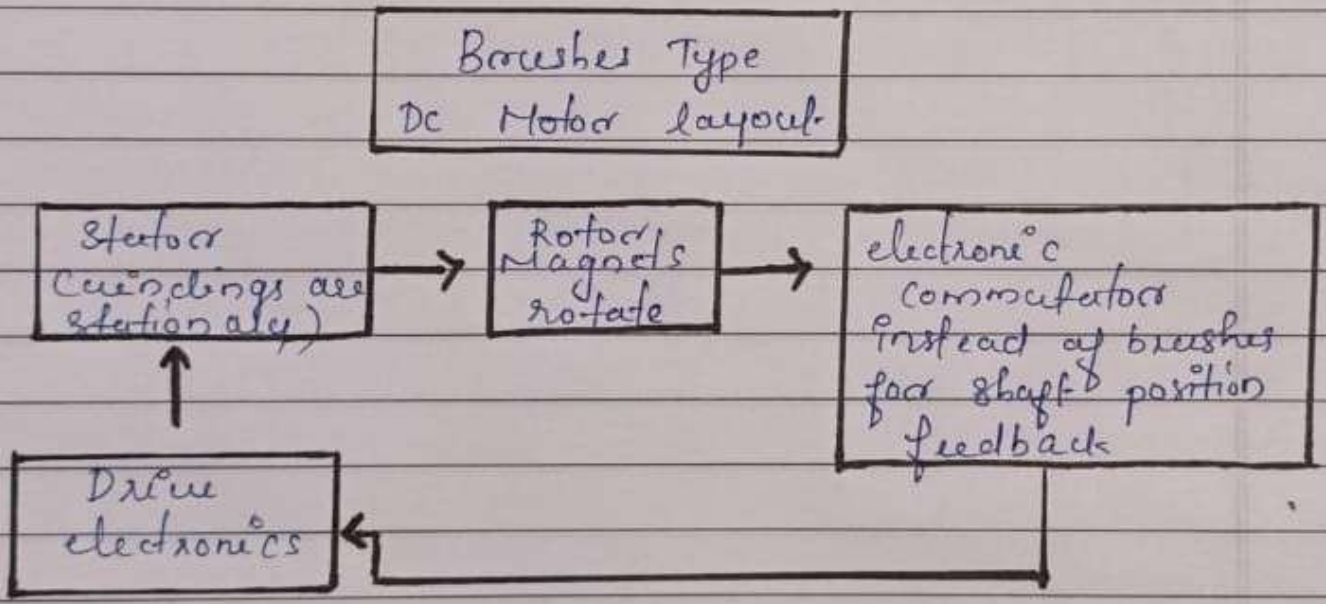
FCEVS share many of the same components as BEVS such as electric motors and power controllers or inverters :- however the major difference is the main energy source : while BEVS use energy stored in the battery. FCEVS use fuel cells as they are superior to batteries in many ways . The major advantages are that fuel cells are lighter and smaller and can produce electricity has long as the fuel is supplied . due to the clear similarities b/w batteries and fuel cells, both these technologies will coexist in the future, while the BEV is suitable for short range and small vehicles, the FCEV is suitable for medium . large and long range vehicles



Q3. Explain with diagram the Construction & working principle of Brushless Motor BLDC ?.

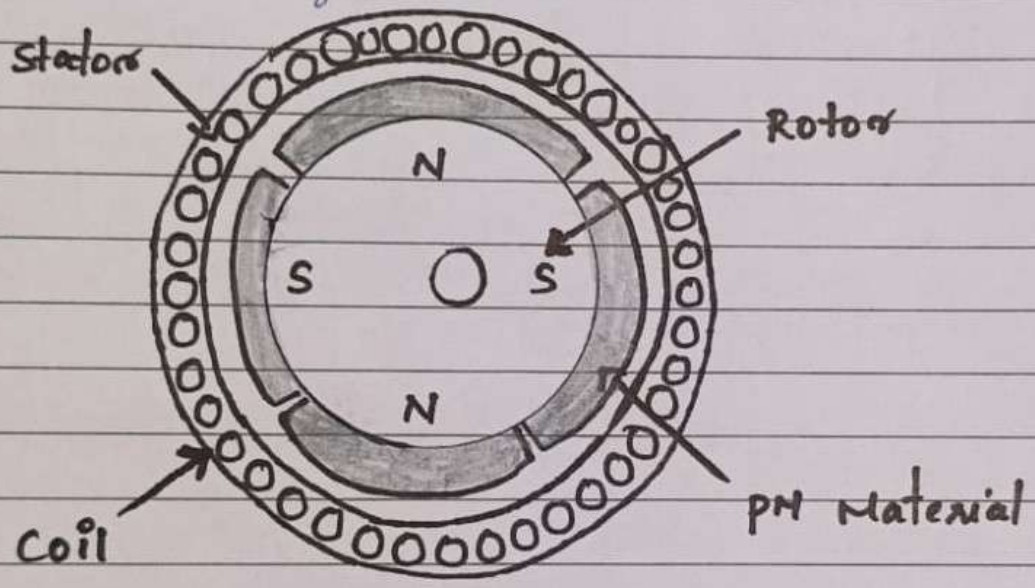
A Brushless DC Motor is similar to a Brushed DC Motor but as the name suggests, a BLDC doesn't use brushes for Commutation but rather they are electronically Commutated. in Conventional Brushed DC Motors, the brushes are used to transmit the power to the rotor as they turn in a fixed Magnetic field.

As Mentioned earlier, a BLDC Motor used electronic Commutation and thus eliminates the Mechanically worn brushes



CONSTRUCTION OF BLDC MOTOR

The Main design difference between a brushed and brushless Motors is the replacement of Mechanical Commutations with an electric Switch circuit. Keeping that in mind, a BLDC Motor is a type of Synchronous motor in the Sense that the Magnetic field generated by the Stator and the rotor Revolve at the Same frequency



STATOR

The structure of the Stator of a BLDC Motor is similar to that of an Induction Motor. it is Made up of stacked steel laminations with axially cut slots for winding. The winding in BLDC are slightly different than that of the traditional Induction Motor.

ROTOR

The rotor part of the BLDC Motor is made up of permanent Magnets (usually rare, earth alloy Magnets like Neodymium (Nd) Samarium Cobalt (SmCo) and alloy of Neodymium, ferrite and Boron (NdFeB).

POSITION SENSORS

A position sensor, which is usually a Hall sensor (that works on the principle of hall effect) is generally used to detect the posit of the ~~door~~ rotor and transforms it into an electrical signal. Most BLDC Motors used three hall sensors that are embeded into the stator to sense the rotor's position.

The output of the hall sensor will be either HIGH or LOW depending on whether the North or South pole of the rotor passes near it. By combining the results from the three sensors. the exact sequence of energizing that can be determined.

WORKING PRINCIPLE AND OPERATION OF BLDC ?.

BLDC Motor works on the principle similar to that of a Conventional Dc Motor ie; the lorentz force law which states that whenever a Current Carrying Conductor placed in a Magnetic field it experiences a force. As a Consequence of reaction force, the Magnet will experience an equal and opposite force. in case BLDC Motor the current Carrying Conductor is Stationary while the permanent Magnet Moves

when the stator coil are electrically Switched by Supply 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 b/w electromagnet stator and permanent Magnet rotor, the rotor Continues to rotate.