Assignment 1 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 milestones in the automotive

Ans The journey of automotive industry starts in the 18th century with the invention of world first motor by anyos jedlik, which is then used for his first small model cars. As a continuation of this invention Automotive industry got developed and took further steps ahead. Invention of crude electric carriage, small scale electric car powered by non-rechargeable primary cells and building of first known electric locomotive were the major inventions in eighteen.

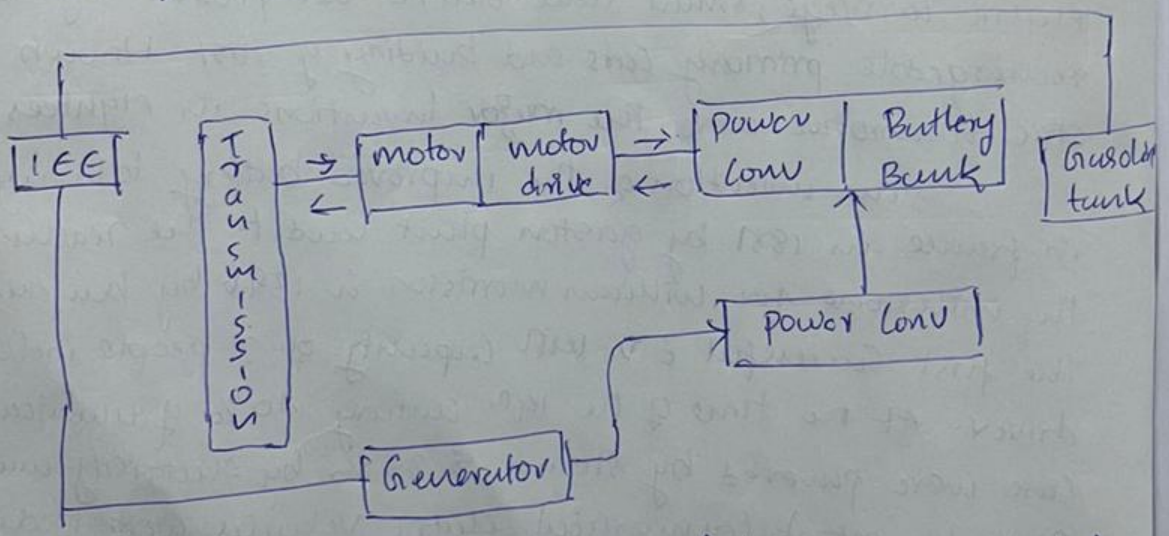
The invention of the improved battery technology in france in 1881 by gaston plant lead to the reaching the milestone for william morrison in 1890 by building the first successful E V with capacity of 3 people including driver. At the time of the 19th century 40% of american cars were powered by steam, & 38% by electricity and 22% by petrol. Commercial electric vehicles were produced primarily in Europe.

Electric cars began to lose their position in the cars makes as america in 1920 because of the invention of electric starter for petrol powered cars and E.V was dominated by gasoline cars by 1954-1960. The energy crisis in 81 century led to the new era of E.V, lot of small companies started to design and advertize electric cars to the republic.

Then in the year of 22nd november 2002 toyota offered its RAV4-E.VS and in 2004 tesla motors started the development of tesla roadster model which is then delivered in 2008. in 2002 many MNC company had taken initiative for green mobility and EV vehicles such as TATA motors, Kinetic green, mahindra e electric are such of them.

(2) Explain and draw the layout of the following hybrid ev with their two advantages, disadvantages & industrial application in customer segment?

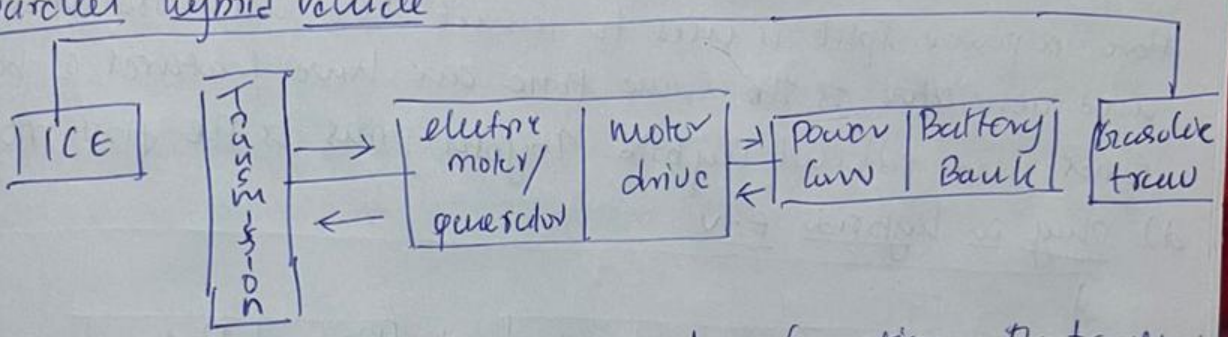
Ans Series hybrid E.V




Series hybrid electric vehicle is an electric vehicle which is assisted by an ICE the transmission system doesn't have direct connection which the IEC. when the EV needed extra power the generator connected to the EV ICE starts producing electricity which is then used for charging battery with the help of a power converter. which is then converted and controlled by motor drive. It has 4 case according to the driving condition normal driving, light road, during braking,

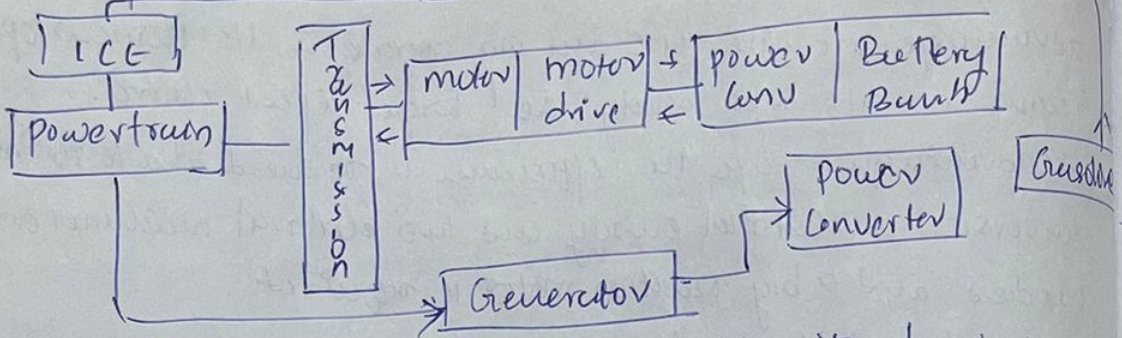
and vehicle at stop.
advantage are the ICE has no operate in its narrow optimal region and it has nearly ideal torque - speed curve.
disadvantage - are the efficiency is reduced due to the multiple conversion of electrical energy. and two electrical machines are needed and a big traction motor is required.

b) parallel hybrid vehicle



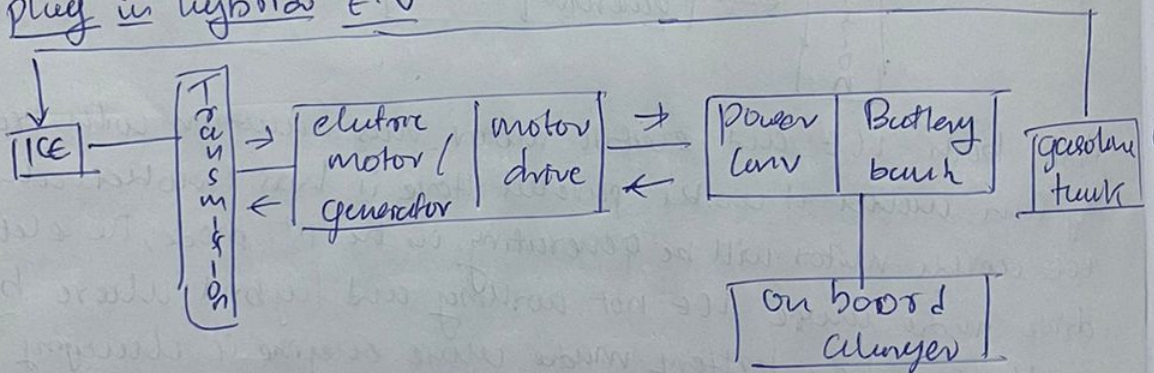

Here both ICE and electric motor has connection with transmission system unlike it works parallel. Here it has 3 modes. when ICE works motor will be generating in the 1st mode, the electric drive mode where ICE not working and hybrid where both works and low battery mode where engine is charging drive mode. and Regenerative braking where motor generates electricity and stores in battery while breaking the adv are low energy loss from conversion and ~~stores in battery~~ while braking the adv complexness and disadv are the engine operating points cannot be fixed in a narrow speed region, the mechanical coupling and the control strategy are complex compared to series hybrid powertrain

c) Series parallel H.V



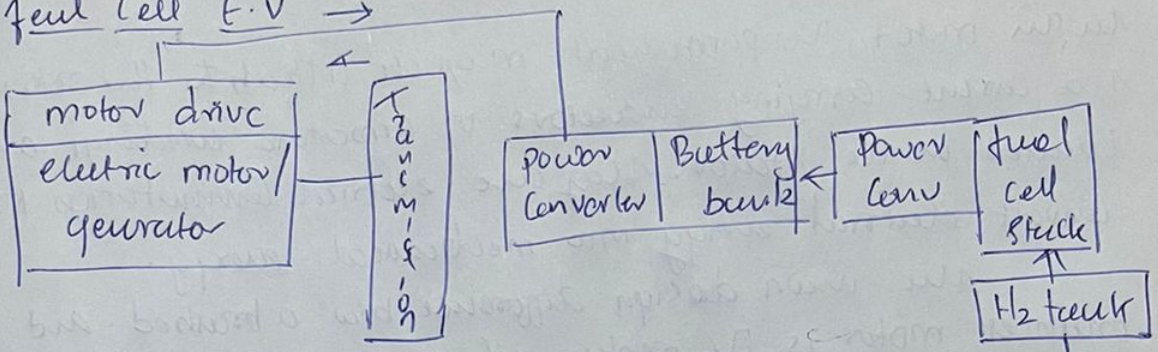

Here a power split is used to connect ICE with transmission and generator at the same time and have features of both series and parallel hybrid Toyota prius is the first model.

d) Plug in hybrid E.V




In this type of HEV there is no direct or indirect connection of ICE which motor like ICE cannot be used be used as a generator to charge battery. but there is an on board charger to charge the battery bank. The main adv of PHEV are Zero emission on battery driving, fuel efficiency in traffic, easy to drive. and ~~adv~~ disadv are its relatively expensive & complex to maintain and battery life concerns.

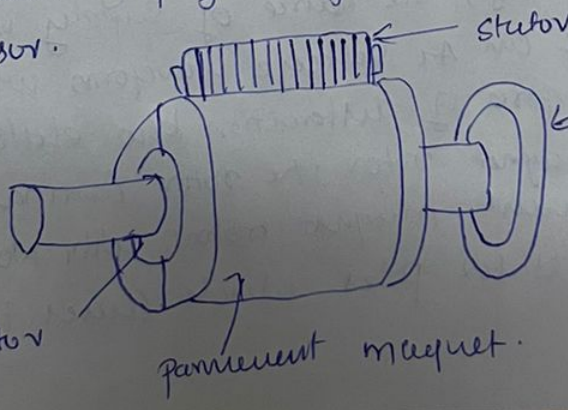
e) Fuel Cell E.V →




In FCEV $H_2$ gas is used as a fuel in fuel cell Stack to produce electricity charge battery for running motor. Here motor is only connected to transmission and act as a motor & generator.

③ Explain with diagram the construction & working principle of BLDC motor.

Ans Brushless DC electric motors also known as electronically commutated motors (ECM, EC motors). primary efficiency is most important feature for BLDC motors. Because the rotor is the sole bearer of the magnets and it doesn't require any power. ie, no connection, no, commutator and no brushes. In place of these, the motor employs control circuitry. BLDC motor employ along with controller, rotary encoder or Hall sensor.



Construction

In this motor, the permanent magnets attach to the rotor. The current-carrying conductors or armature windings are located on the stator. They use electrical commutation to convert electrical energy into mechanical energy.

The main design difference b/w a brushed and brushless motor is the replacement of mechanical commutator with electronic switch circuit. A BLDC motor is a type of syn motor in the sense that the magnetic field generated by the magnetic field generated by the stator and the rotor revolve at the same freq.

Working principle

BLDC motor works on the principle similar to that of a Brushed DC motor. 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 the BLDC motor, the current carrying conductor is stationary and the permanent magnet is moving.

When the stator coil get a supply from source, it become 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.

The permanent magnet rotor with North and South poles align with stator poles which cause the motor to rotate.