Assignment.1

Q1. Flowchart

In 1828, the Hungarian inventor Anyos Jedlik invented World's First Electric Motor, and created a First small model car powered by his Electric Motor

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Golden age of Electrical vehicle marked from 1890 to 1924 with peak production of electric vehicles in 1912.
The first Successful Electric Vehicle was built in 1896, in US by William Morrison.
In Beginning of 1900 Electric cars were even labelled as "Women's cars". At the turn of the century, 40 % of American cars were powered by steam, 38 % by electricity and 22 % by petrol. Commercial electric vehicles were produced primarily in Europe.

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In 1912, petrol-powered cars became easier to drive due to the invention of Charles Kettering and his electric "starter", Electric cars began to lose their position in the car market at America in 1920. EV was Dominated by Gasoline cars (1924-1960).

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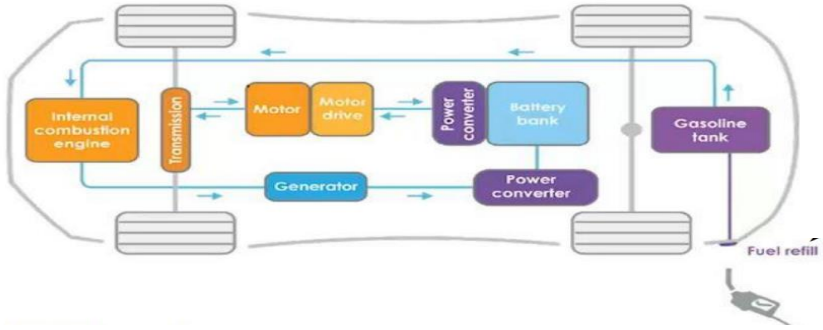
The energy crises in 21 centuries led to renewed interest in electric cars. A lot of small companies started to design and advertise electric cars to the public. Toyota offered its RAV4-EVS in Year 22nd November ,2002.
Californian manufacturer of electric cars, Tesla Motors, in 2004 started the development of the Tesla Roadster model, which was first delivered to customers in 2008. Tesla was also the first to introduce lithium-ion batteries in its car production.

Q2.

a) <u>Series Hybrid Electric vehicles(SHEV)</u>

Explanation: Series hybrid vehicles consist of IC engine, electric motor, battery pack, generator and fuel tank. the electric motor is the only means of providing power to the wheels. The motor receives electric power from either the battery pack or from a generator run by IC engine.



Advantages:

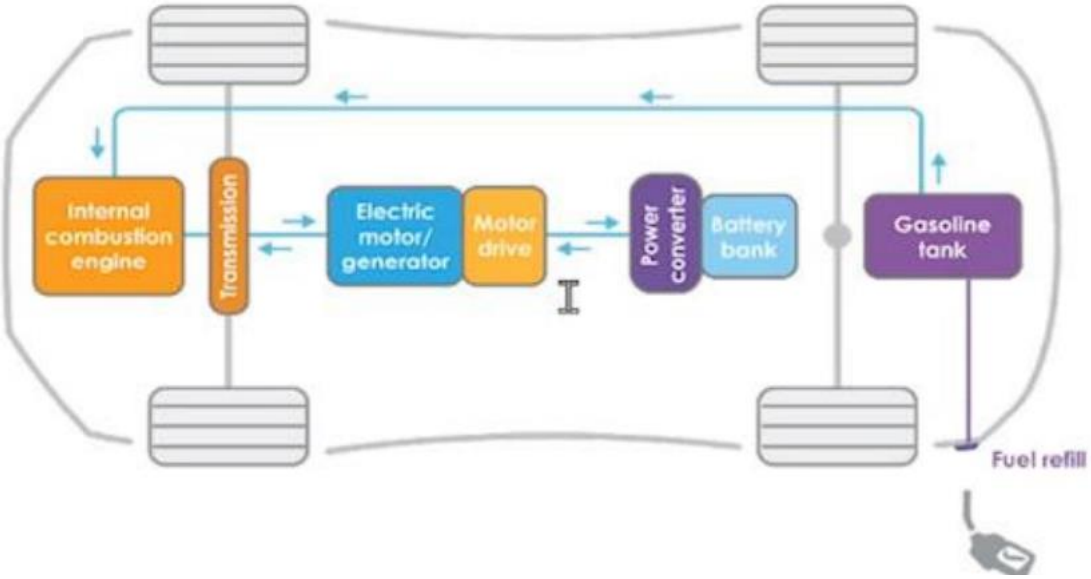
1. Mechanical decoupling between the ICE and driven wheels allows the IC engine operating at its very narrow optimal region.
2. Nearly ideal torque-speed characteristics of electric motor makes Multi-gear transmission unnecessary.

Disadvantages

1. Reduced efficiency
2. More difficult to maintain

b) Parallel Hybrid Electric vehicles

Explanation: Parallel Series hybrid vehicles consist of IC engine, electric motor, battery pack, generator and fuel tank. the engine and electric motor work in tandem to generate the power that drives the wheels.



Advantages:

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

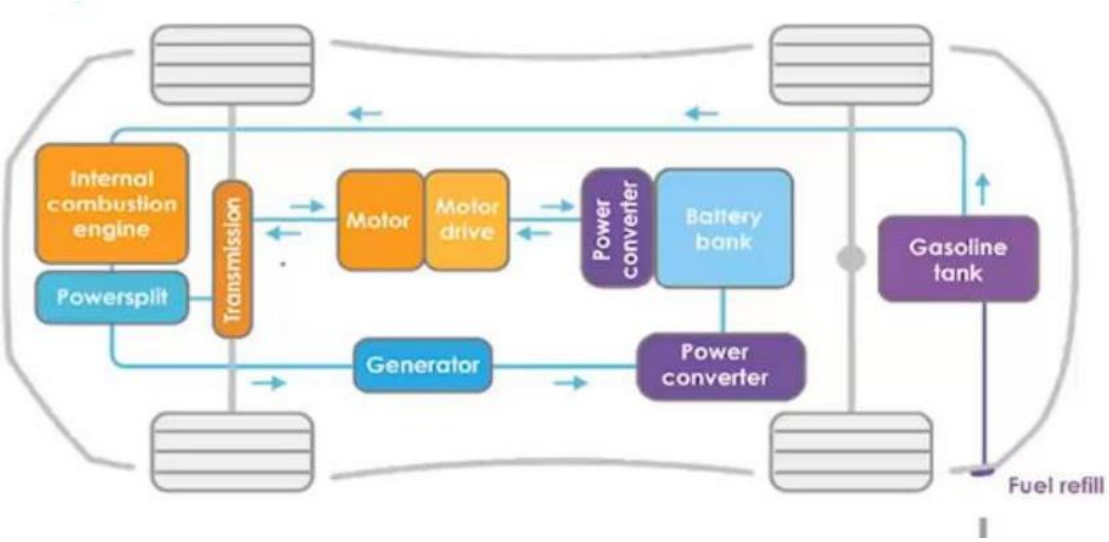
Disadvantages:

1. Mechanical coupling between the engines and the driven wheels, thus the engine operating points cannot be fixed in a narrow speed region.
2. The mechanical configuration and the control strategy are complex compared to series hybrid drivetrain.

C) Series Parallel Hybrid vehicle

Explanation: Series/parallel drivetrains merge the advantages and complications of the parallel and series drivetrains. By combining the two designs, the engine can both drive the

wheels directly (as in the parallel drivetrain), and be effectively disconnected, with only the electric motor providing power (as in the series drivetrain).



Advantages:

1. Enable the engine and electric motor to provide power independently or in conjunction with one another.

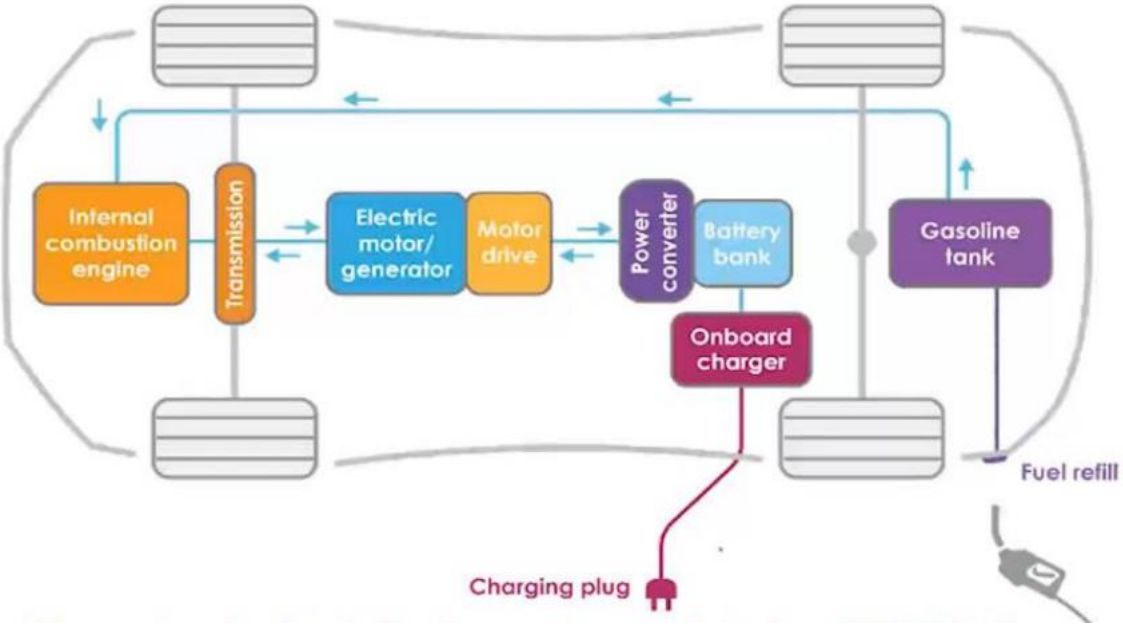
Disadvantages:

1. More complicated battery and motor

D) <u>Plug in Hybrid electric vehicle(PHEV)</u>

Explanation:

Plug-in hybrid electric vehicles (PHEVs) use batteries to power an electric motor and another fuel, such as gasoline, to power an internal combustion engine (ICE). PHEV batteries can be charged using a wall outlet or charging equipment.



Advantages:

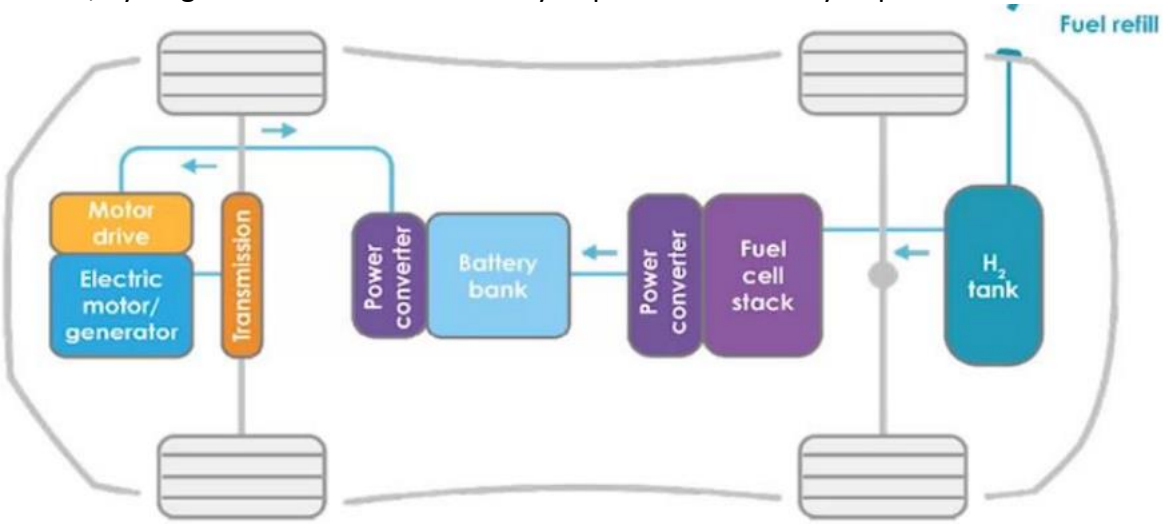
1. Zero emission when driving on batteries
2. Fuel efficient in traffic

Disadvantages:

1. Relatively expensive & complex to maintain
2. Fuel economy not very good on motorway journeys

E) Fuel Cell Electric Vehicle

Explanation: Fuel Cell Electric Vehicle use a propulsion system similar to that of electric vehicles, where energy stored as hydrogen is converted to electricity by the fuel cell. In a fuel cell, hydrogen reacts electrochemically to produce electricity to power the car.



Advantages:

1. No harmful tailpipe emissions
2. Higher efficiencies than combustion engines

Disadvantages:

1. Hydrogen handling issues
2. Safety concerns

Q3) BLDC Motors

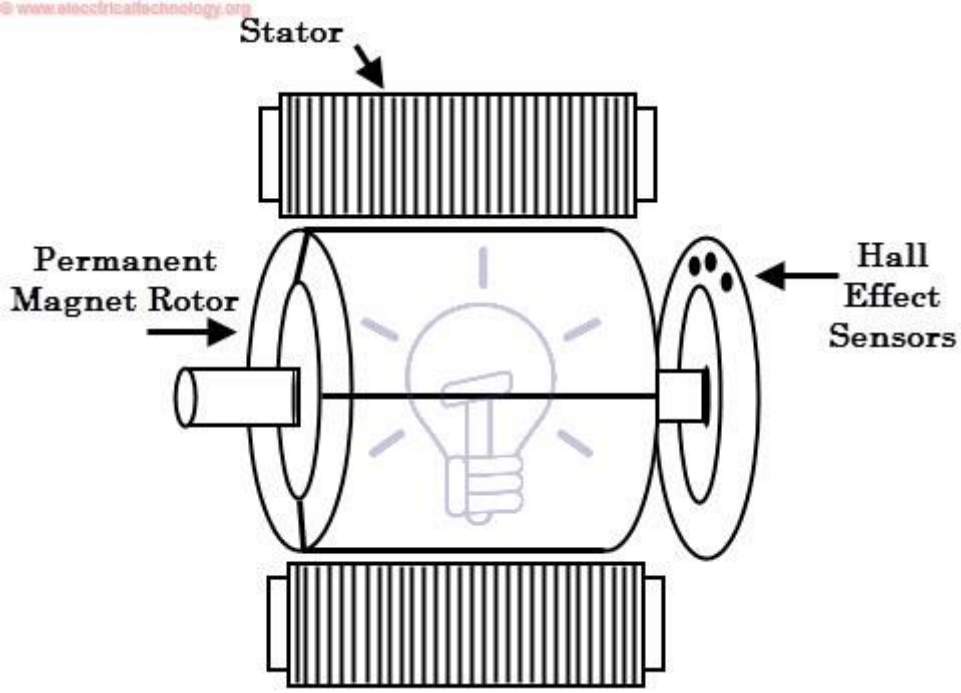
A brushless DC motor (known as BLDC) is a permanent magnet synchronous electric motor which is driven by direct current (DC) electricity and it accomplishes electronically controlled commutation system (commutation is the process of producing rotational torque in the motor by changing phase currents through it at appropriate times).

Construction:

- The construction of this motor has many similarities of three phase induction motor as well as conventional DC motor. This motor has stator and rotor parts as like all other motors.
- a BLDC motor also consists of two main parts a stator and a rotor. Permanent magnets are mounted on the rotor of a BLDC motor, and the stator is wound for a specific

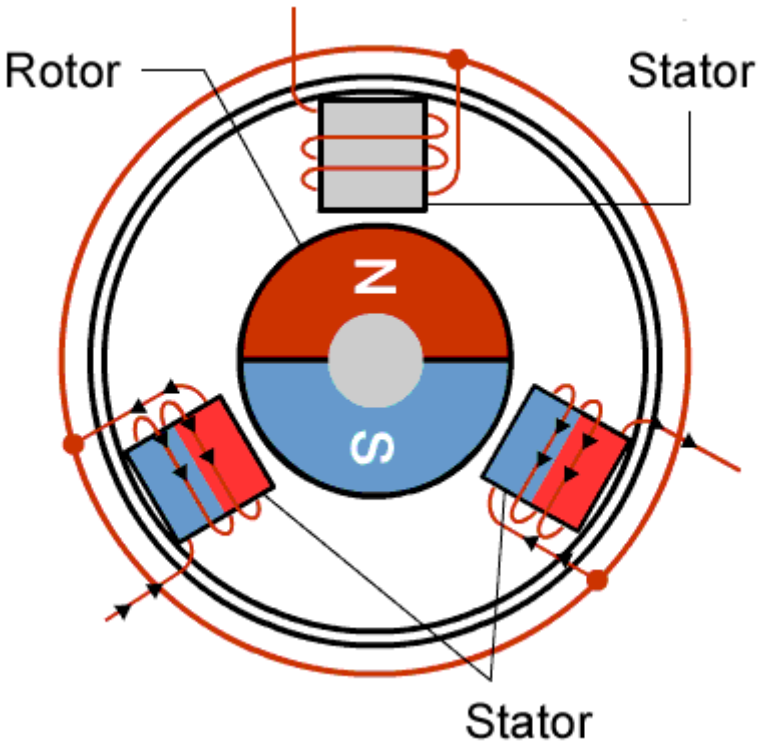
number of poles. Also, a control circuit is connected to the stator winding. Most of the times, the inverter/control circuit or controller is integrated into the stator assembly. This is the basic constructional difference between a brushless motor and a typical dc motor.

- A typical controller provides a three-phase frequency-controlled supply to the stator winding. The supply is controlled by logical control circuits and energizes specific stator poles at a specific point of time.



Working Principle:

- 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 coils get a supply from 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, the rotor continues to rotate.



Submitted by

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