Questionnaires

Q1. 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

Journey:-

1. Invention of Electric Motor

Anyos Jedlik from Austria invented World's First Electric Motor in 1828. He filed patent for the same and made different prototype and toy car to prove his invention

1. Golden Era of EV

In early 1900’s Ev was very popular, it had 32% of market share, Where ic engines had only 20% and Ic engines then were very hard to turn on, poor brakes, acceleration etc while ev was easy to start, efficient, low cost and easy start.

1. Domination of Electric Vehicle by Gasoline cars

Ev’s lost its demand after 1910’s due to following reasons

* Henry Ford founder of Ford motor company who were manufacturers of Ic engine vehicle were able to reduce the price of cars by assembly line production, which resulted in reduction their cars by 30%/year. They became huge competition.
* In 1912 Chevrolet acquired patent of self starting mechanism and implemented on their vehicle, which gave a popularity for Ic engine vehicles because earlier it was really hard and time consuming to ignite the vehicles.
* During World war Ic engines were preferred over Ev due to lesser range covered and charging time but in case of ic engines the troops could carry fuel which saved their time. Using these vehicles in hand made soldiers emotionally attached and they knew operating them easily.
* During great recession in US most of their federal organizations were privatized, which gave oil based companies to take over the economy to promote themselves and create a monopoly
1. Coming of New Era in EV

In 2006 Tesla introduced Tesla roadster at Santa Monica auto expo, which was revolutionary concept among Automobile industry and in later 2008 when the vehicle was on ground it proved comeback new Era of Ev with advancement and effective results. Later in 2010 Nissan introduced a car called Leaf with affordable price, since then companies are still working over for advancement of Evs.

1. Introduction to Hybrid Electric vehicles

Vehicles which are powered by IC engines and with combination of electric motors which are powered by batteries

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

1. Series Hybrid Electric vehicles
* In series HEV IC engines does not drives the vehicle, instead motor is attached to transmission to drive the vehicle
* Ic engines is connected to the generator which charges the battery pack through Power convertor
* Battery is also charged by Regenerative braking
* Battery pack size is huge

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| Advantages | Disadvantages |
| Since there is no direct connection between Engine and transmission, efficiency of engine output is high | Since there are two types of energy conversion taking place, overall efficiency decreases |
| No gearbox required as we using motor to drive the vehicle | Two electrical systems and traction motor is required since it is only torque source of the vehicle which increases overall weight, size and price of the vehicle. |

1. Parallel Hybrid Electric vehicles
* Both power generated from Ic engine and Electric motor is transferred to the transmission for the drive.
* In Parallel HEV Drive can be managed by Ic engine alone or only E motor and can be managed by both.
* Motor also acts as generator to charge the battery pack by regenerative braking.
* If Ic engines creates more power than to run transmission, that will be used to charge the battery

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| Advantages | Disadvantages |
| Since both Ic engine and Electric motor can supply power to transmission hence there is no energy conversion involved resulting in better efficiency | Can’t operate Ic engine in its narrow optimal range, which reduces efficiency |
| As there is no generator involved, whole system is compact and it results in reduction of size in traction motor | Complex drive train due to dual clutch system, which makes overall design complex |

1. Series Parallel Hybrid vehicle
* Series – Parallel HEV is combination of both parallel and series hybrid vehicle with an additional component called Powersplit.
* Powersplit is connected to Ic engine which drives the vehicles transmission and also connected to a generator which recharges the battery pack through power convertor.
* Battery pack through Power convertor is connected to a motor which also drives the vehicle.

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| Disadvantages |
| Powerspliter,Two electrical systems and traction motor is required since it is only torque source of the vehicle which increases overall weight, size and price of the vehicle. |

1. Plug in Hybrid electric vehicle
* Phev Vehicles runs in both Ic engines and Electric motor
* Battery pack can be charged by an onboard charger
* Motor also acts as generator to charge the battery pack by regenerative braking.
* If Ic engines creates more power than to run transmission, that will be used to charge the battery

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| Advantages | Disadvantages |
| Cost effective vehicle for short distance daily drives | Fuel economy won’t be great for long drives |

1. Fuel Cell Electric Vehicle
* Fuel cell electric vehicles are similar to Hybrid electric vehicles, Instead of I.C engines Hydrogen is used to to recharge the battery pack through fuel cell stack and power convertor
* Motor also acts as generator to charge the battery pack by regenerative braking.
* If Ic engines creates more power than to run transmission, that will be used to charge the battery

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| Advantages | Disadvantages |
| Fuel cell electric vehicles can be an alternative when EV comes in full fledge in coming years.i.e, load on electricity will be high at that time | Difficulty to handle hydrogen and really space consuming for storage |
|  | Cost of fuel is high |

Q3. Explain with Diagram the Construction & Working principle of Brushless Motor BLDC?

* Bldc are brushless motors, it works in DC power source
* Stator and rotor are two main components of motor. Rotor consists of permanent magnet and stator consist of windings around them.
* Rotor rotates around the stator when Dc power is applied to the coil, the coil energize and becomes an electromagnet.
* Bldc motors are based on simple force interaction between the permanent and electro magnet, when coil is energized opposite pole of rotor and stator attracts to each other and starts rotating over next coil due to magnetic attraction.

