2201 E-VEHICLE TECHNOLOGY AND POLICY

PART-A

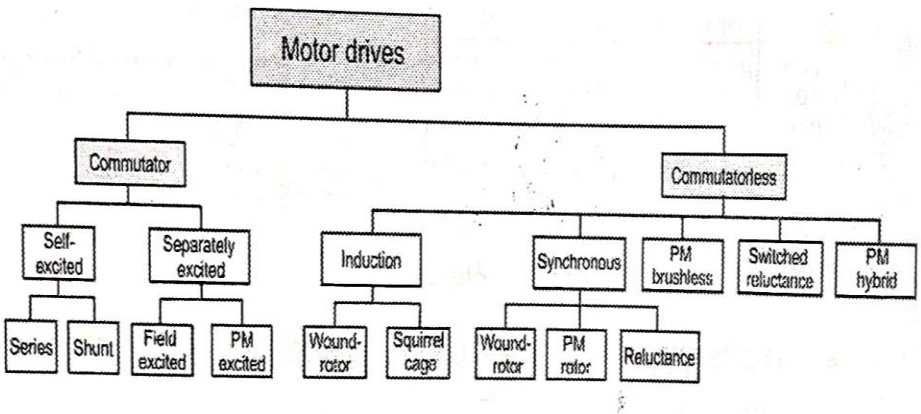
1.What are the effects of unburnt hydrocarbon to the atmosphere? (3 Marks)

Due to incomplete combustion, The Unburnt hydrocarbons of exhaust gases are considered as pollutants which leads to air pollution. Unburnt Hydro carbons affects the eyes and cause lung cancer.

2. Differentiate Battery Electric Vehicle (BEV) and Conventional Vehicle. (3 Marks)

S.No	Parameter	BEV	Conventional vehicle
1	Energy force	Battery	Gasoline etc.,
2	Propulsion mechanism	Motors	Engine, ICE
3	Co2 Emission	More	Less
4	Fuel facility locations	Only Charging stations (rarely available)	Fuel stations (available in plenty)
5	Tax liability	Low	High
6	Cruising distance	Short	Long

3.List the types of EV motors. (3 Marks)



4.What is hub motor drive system ? (3 Marks)

The wheel hub motor (also called wheel motor, wheel hub drive, hub motor or in-wheel motor) is an electric motor that is incorporated into the hub of a wheel and drives it directly. The hub motor is connected to the central, normally rotating axle to the static frame of a bicycle or the chassis of a car. When power is switched on, the outer part of the motor rotates, becoming a wheel that powers the vehicle forward.

5.Write down the advantages of Lithium based batteries. Any 3 (3 Marks)

1. High charge density,
2. Long life,
3. Smaller in size,
4. Portable.
5. Available in many sizes and shapes.

6.Mention any three effects of EV. Any 3 (3 Marks)

The various effects of EV are,
1. Least partially powered by electricity.
2. Saving the climate.
3. Saving the lives.
4.Has only smaller carbon footprint.
5. Better for the climate.
6.Can be charged anywhere.
7. Truly clean vehicle.
8.Zero-emission vehicle.
9. Less environmental pollution

7.Write about the ARAI standards for EV. (3 Marks)

ARAI (Automobile Research Association of India) comprehensive certification and homologation services for an entire range of automotive vehicles, systems, and components. ARAI also assists the vehicle manufacturers for export homologation activities.

ARAI is recognized by the international certification authorities of Singapore, Netherlands, and Australia for carrying out tests as per their standards and regulations. ARAI is also establishing a comprehensive infrastructure and facilities for testing, certification, and development of the electric and hybrid vehicles ARAI assists the Government of India in the formulation of automotive industry standards and harmonization of regulations. ARAI is also assisting Government of India in establishing vehicle Inspection and Certification centres all across the country.

8.Write about the need of EV policy. Any 3 (3 Marks)

- To improve air quality
- To reduce greenhouse gas (GHG) emissions
- For low cost
- To reduce overall negative environmental impact
- To enhance energy security
- To reduce air pollution
- To improve driving experience, etc.,

9.What are the objectives of Tamil Nadu E-Vehicle Policy 2019?Any 3 **(3 Marks)**

1.To create robust infrastructure.
2.To promote innovation.
3. To create a pool of skilled workforce.
4. To make Tamilnadu the preferred destination for EV's.
5. To create conductive environment for industry and research institutions to focus on EV technologies and reap the benefit from the outcome.
6. To recycle and reuse used batteries.
7. To dispose the rejected batteries in environmental friendly manner without pollution.

10. What is recycling eco system ? **(3 Marks)**

Re-cycling Eco system (Batteries and EV's): The Government will encourage the re-use of EV batteries that have reached the end of life and is setting up recycling business in collaboration with battery and EV manufactures that focus on "Urban Mining" of rare materials within the battery for re-use by battery manufactures. Charging Station Operators will be encouraged to operates end-of life battery recycling agencies. Electrical Vehicle owners can deposit their vehicle batteries that have reached their end of life.

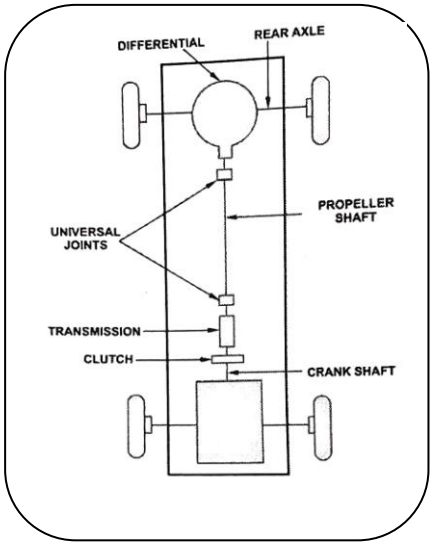
The Government of Tamil Nadu will invite battery recycling business to establish their presence in Tamil Nadu. Appropriate protocols and investment subsides for setting up such a business shall be notified by the Government of Tamil Nadu after consultation with stakeholders. OMES should take responsibility of recycling of old batteries and its components.

PART-B

11. (a) Explain about the conventional drive train system.

Diagram 7 Marks , Explanation 7 Marks

- The mechanism which transmits power developed by the engine to turn the driving wheels is called the transmission system.
- It is composed of clutch, gear box, propeller shaft, universal joints, rear axle, wheel and tyres.
- The power produced by the engine is transmitted to the rear wheels through a system of transmission.
- The rotary motion of the crankshaft is transmitted to the gear box through the clutch.
- This motion is transmitted to the propeller shaft through the universal joint.
- Finally, the power is transmitted to the rear wheels through rear axles.
- The differential provides a relative motion to the rear wheels while the vehicle is taking a turn.



The purpose of transmission system are:

1. To connect or disconnect the engine from wheels when required without shock.
2. To reduce the engine speed
3. To enable the leverage between the engine and the driving wheel.
4. To turn the drive through a right angle.
5. To enable the rear wheels to run at different speed while taking a turn.
6. To withstand the effect of torque reaction, driving thrust and braking effort effectively.

11.(b) Explain about Plug-in Hybrid Electric Vehicle (PHEV) with block diagram.

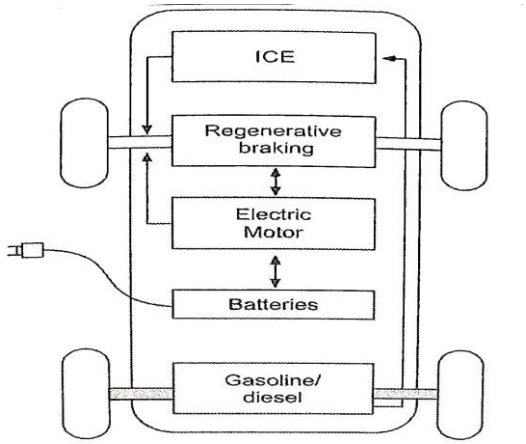
Diagram 7 Marks , Explanation 7 Marks

- The Plug-in Hybrid Electric Vehicle (PHEV's) use batteries to power an electric motor and another fuel, such as gasoline, to power ICE.
- It is a hybrid EV whose battery can be recharged by plugging a charging cable into an external electric charging station.
- The vehicle typically runs on electric power until the battery is nearly depleted and then automatically switches over to use of ICE.

Working of PHEV:

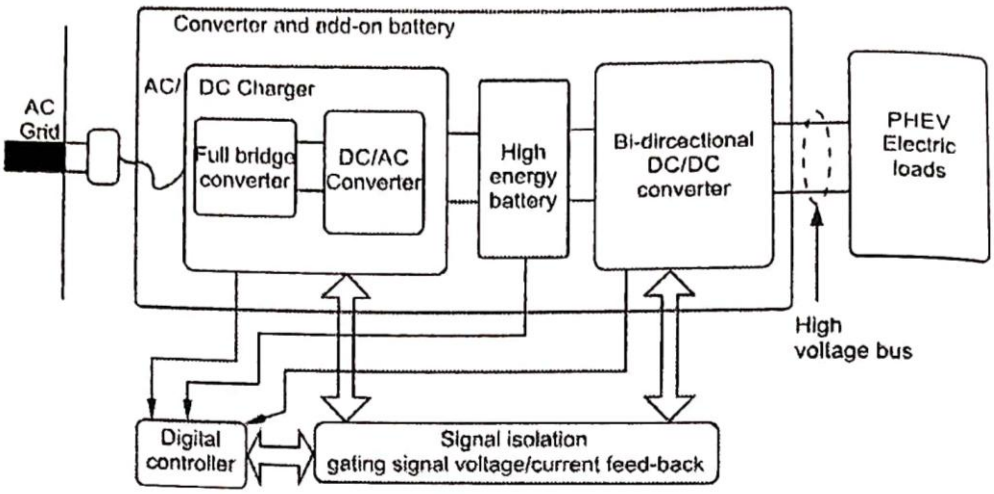
The PHEV works in various modes, they are,

1. Charge depleting mode
2. Charge sustaining mode
3. Mixed mode (or) blended mode



In charge depleting mode, it allows a fully charged to operate exclusively (or depending on the vehicle, almost exclusively, except during hard acceleration) on electric power until its battery start of charge is depleted to a predetermined level, at that time the vehicles ICE will be engaged.

In mixed mode, it describes a trip using a combination of multiple modes. In beginning of a trip in low speed charge depleting mode, and then enter into freeway and operate in blended mode.



Advantages of PHEV:

1. Battery fuel economy
2. Ability to cover larger distances
3. Regenerative braking system
4. Lower emissions
5. Less cost

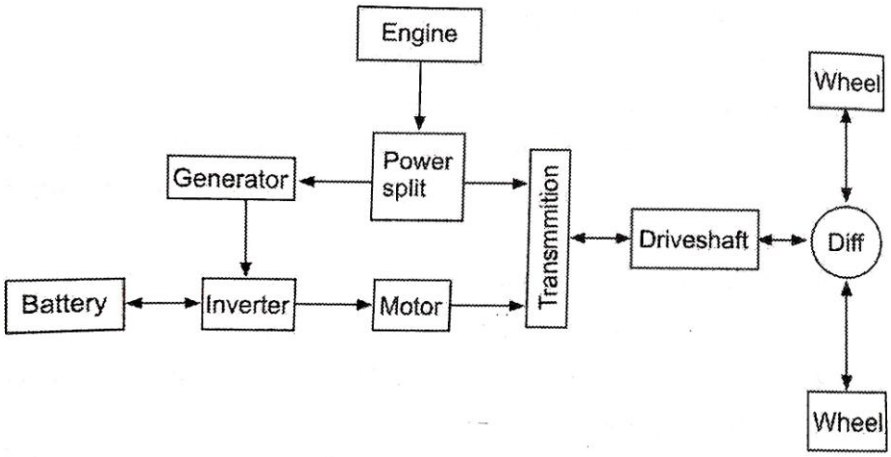
Disadvantages of PHEV:

1. Costlier when used with lithium ion batteries
2. Safety concern
3. Needs frequent checkups, oil changes
4. More weight

12. (a) Explain about the series and parallel architecture of hybrid electric drive trains with block diagram.

Diagram 7 Marks , Explanation 7 Marks

The series-parallel HEV incorporates the features of both series and parallel HEVS.



In comparison to a series HEV, the series-parallel HEV adds a mechanical link between engine and the final drive, so the engine I can drive the wheels directly. Therefore, it can be operated as a Electric vehicles and electric propulsion system series or parallel HEV.

The power split device splits the output from the engine into mechanical and electrical transmission paths.

The series and parallel hybrid electric drive train uses a planetary gear unit to connect the

1. Engine.

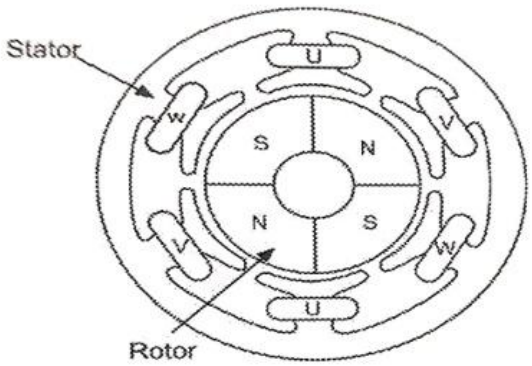
2. Motor and

3. Transmission.

12 . (b) Explain the construction and working of Brush Less DC (BLDC) motor drive with a neat sketch.

Diagram 7 Marks , Explanation 7 Marks

Permanent magnet, brush less DC (BLDC) motor, is designed with,

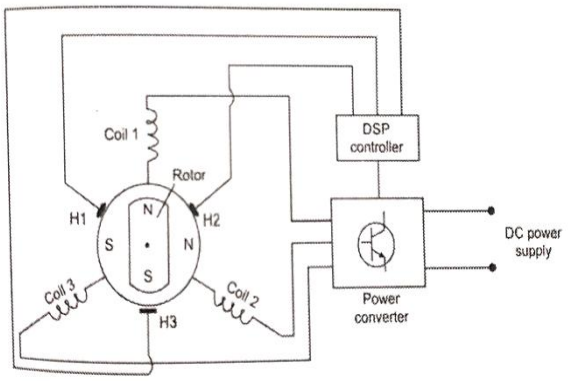


U: Phase-U winding
V: Phase- V winding
W: Phase- W winding
Rotor: Magnet

1. High power density
2. High speed
3. High operation efficiency
4. Attractive for EV and HEV.

In this PM (permanent magnet), Brush Less DC motors, high energy permanents magnets are used as field excitation mechanism.

Principle of BLDC motor drive:

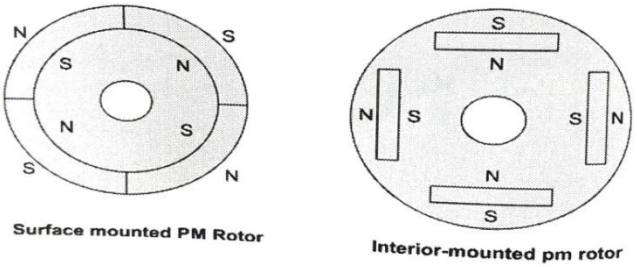


A BLDC motor drive consists mainly of brush-less DC machine. It has DSP based controller and power electronics based power convertor.

The position sensors, senses the position of the machine rotor. The rotor position information is fed to the DSP based controller, which in turn, supplies gating signals to the power converter by turning on and off the proper starter pole windings of the machine.

Construction of PM BLDC motor:

It has two main parts stator and rotor.



Rotor has no windings. It has permanent magnets. The rotor shaft carries a three rotor position sensors.

The BLDC motor is classified into two types, categorized by the position of rotor permanent magnet.

1. Surface mounted and

2. Interior mounted

Working:

The poles on the stator are alternating, in such a way that the rotor is turning clockwise. The pole on the stator pulls the pole on the rotor clockwise and when the poles are in line with each other, the current is switched off. Momentum then carries the rotor further and current is reversed, changing the magnetic field and the poles in the stator. The position of the rotor are determined by hall effect sensors.

Advantages of PM BLDC motor:

1. High efficiency
2. Compactness 3. Ease of control
4. Ease of cooling
5. Low maintenance
6. Great longevity
7. Reliability
8. Low noise emissions, etc.,

Disadvantages of PM BLDC motor:

1. Expensive
2. Limited constant power range
3. Dangerous
4. Magnet demagnetization
5. Can't reach high speed
6. Limited mechanical strength
7. Short circuit failure in inverter, etc.

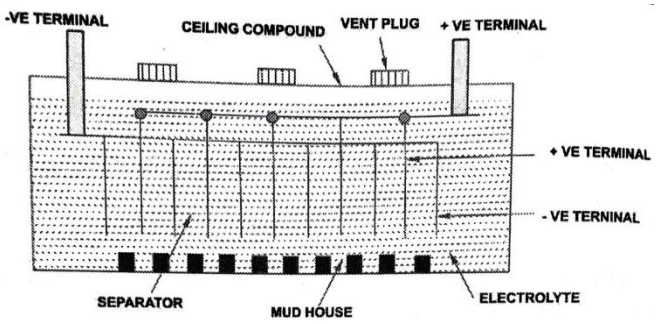
13. (a) Explain the construction and working of lead acid battery with a neat sketch.

Diagram 7 Marks, Explanation 7 Marks

Construction:

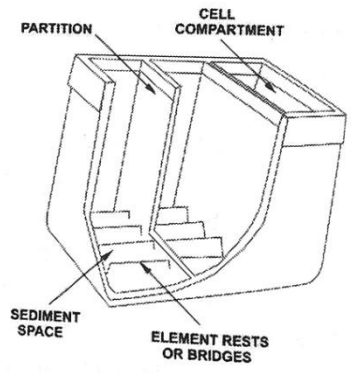
A lead acid battery consists of the following components.

1. Container
2. Plates
3. Separators
4. Cell covers
5. Electrolyte



Container:

The battery container is the single piece moulded type case. This is made up of hard rubber or plastic or bituminous composition (or) polypropylene.



This is divided into compartments over different cells by providing partitions. At the bottom there is bridge for placing the battery plates. The space provided between the bridge ribs is to collect the sediments and also minimize the short circuiting of plates.

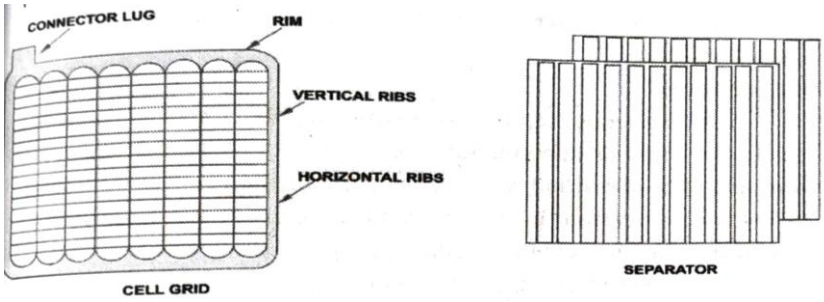
Plates:

There are two types of plates, the positive and negative plate in each cell. For each plate there is a supporting frame work or grid made of an alloy of lead and antimony.

The plates consist of perforated grids into which lead peroxide has been pressed. The plates formed as a group are connected to the positive terminal of the cell consisting of grids filled with a paste of lead peroxide. The plate group connected to the negative terminal on the cell consists of grids filled with metallic lead.

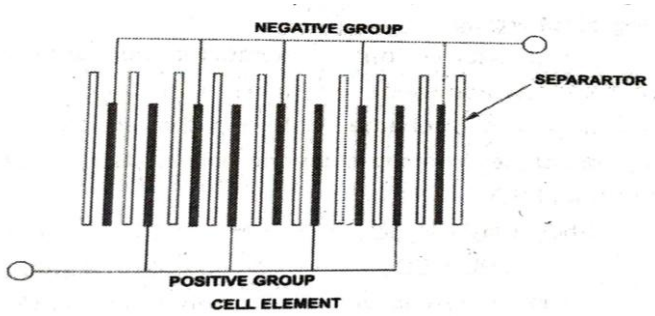
Separator:

The separators are placed between the positive and negative plates so as to separate each other avoiding short circuit of plates. Separators are usually made up of specially treated wood, hard rubber, resin impregnated fibre.



Cell element:

All the positive plates of the cell are welded to a post strap as shown in figure, thereby forming a positive group. Similarly the negative plates are welded to another post strap, forming a negative group.



One positive and one negative group of plates are made to shown in figure. This assembly is called as 'element' which is inserted into battery compartment to form a cell.

Cell cover

It is provided on top of the battery container. Each cell cover has an opening through which liquid can be added. A filler cap is screwed on this opening. The filler cap has an air vent, for the escape of gases.

Electrolyte

An aqueous solution of dilute sulphuric acid is used as electrolyte. This diluted sulphuric acid consists of 40% of sulphuric acid and 60% of distilled water. The sulphuric acid is also the carrier of the electric current inside the battery between the positive and negative plates through the separators.

The electrolyte has the specific gravity of 1.230 at 27° C. The level of the electrolyte is about 10 mm above the top of the plate.

CHEMICAL REACTIONS

The battery cell will convert chemical energy into electrical energy during discharge and vice versa during charging. During discharging

When external load is connected between the terminals, current will flow from positive terminal to negative terminal and the battery begins to discharge. Referring the equation of discharge, during this process diluted sulphuric acid (H_2SO_4) is broken up into parts, H_2 and SO_4.

$PbO_2 + H_2^+ + H_2SO_4 \longrightarrow PbSO_4 + 2H_2O$ (Anode)

$Pb + SO_4^- \longrightarrow PbSO_4$ (Cathode)

There H_2 reacts with PbO_2 and forms PbO which further reacts with a part of H_2SO_4 and forms $PbSO_4$ and H_2O. In this way during this process $PbSO_4$ and $-H_2O$ are formed continuously and the H_2SO_4 available in the battery is diluted. After certain time limit a stage comes when battery stops to discharge, then it needs recharging.

During charging

The discharged battery is recharged by passing current through it in opposite direction by means of an external source. Under this process chemical reaction takes place in the battery. It is just reverse of that the process during discharging.

$PbSO_4 + H_2^+ \longrightarrow Pb + H_2SO_4$ (Cathode)

$PbSO_4 + SO_4^- + 2H_2O \longrightarrow PbO_2 + 2H_2SO_4$ (Anode)

The $PbSO_4$ deposited on the positive plate is converted back into PbO_2 and that $PbSO_4$ of negative plate is converted into Pb. The remaining SO_4 reacts with H_2O and forms H_2SO_4, thereby increasing the strength and specific gravity of $H2SO_4$. As a result, H_2SO_4 gains desired specific gravity.

Thus the battery is fully charged.

Advantages of lead acid battery

- It is less dangerous than other types because the chemical reaction of it occurs in the room temperature.
- It has high reliability and low cost respectively.

Disadvantages of lead acid battery

- The energy density is about 40 Wh/kgf, lower than others. It has shorter lifetime and longer charging time than others.

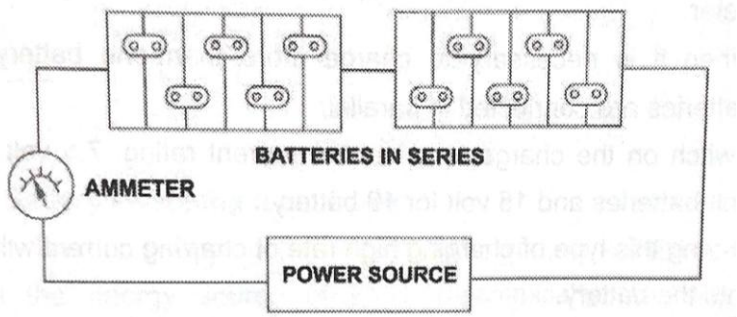
13. (b) Explain any three battery charging techniques with neat sketches. (Any 3)

Diagram 7 Marks , Explanation 7 Marks

1.Constant current (CC) battery charging technique:

Constant current (CC) battery charging technique, is a simple form of charging batteries, with the current level set at approximately 10% of the maximum battery rating.

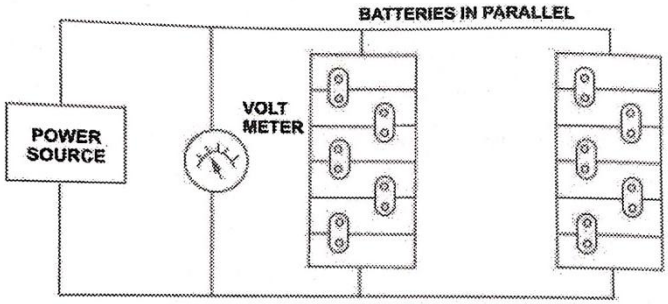
- First check the electrolyte level, if necessary top up with distilled water.
- They are connected in series connection.
- Set the charging rate as per the manufacturers instructions. This is charged at 5 amps rating.
- Check the temperature and specific charge for every hour. If the electrolyte temperature increases above 45°, stop the charging and allow it to cool and then charge again.
- Charging is continued till gassing occurs.



It is widely used for charging mixed, NIMH, and Li-ion, battered.

A high charging current provides a quick charge but also significantly affects the battery's ageing process. A low charging current provides high capacity utilization, but also produces a very slow charge, which is inconvenient for EV applications.

2.Constant voltage (CV) battery charging technique:

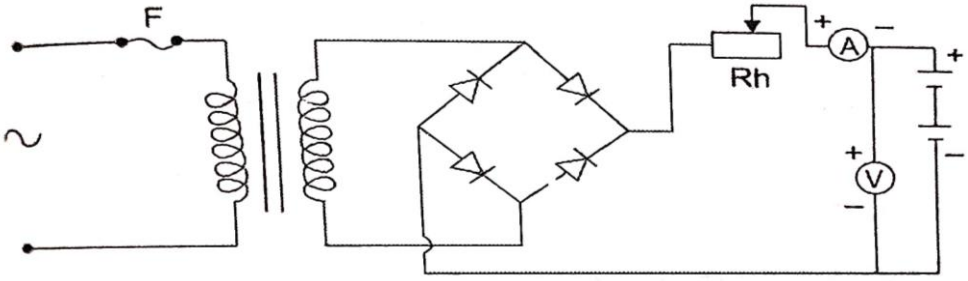


The constant voltage (CV) battery charging technique, regulates a predefined constant voltage to charge batteries.

- First check the electrolyte level, if necessary top up with distilled water.
- When it is necessary to charge more than one battery, the batteries are connected in parallel.
- Switch on the charger and set the current rating. 7.5 volt for 6 volt batteries and 15 volt for 12 battery.
- During this type of charging high rate of charring current will flow into the battery.
- When the battery nears its charge, its terminal voltage will increase with increase in opposition to charging current.
- This means that the charging current tapers off as the battery reaches the charged condition.
- Check the temperature and specific charge for every hour. If the electrolyte temperature increases above 45°, stop the charging and allow it to cool and then charge again.

3.Trickle charging:

Trickle charging means charging a fully charged battery at a rate equal to its self discharge rate.



It is defined as a continuous, slow charge supplied to a storage battery to keep it in a fully charged state.

- A charging cell may lose its charge slightly when kept idle for a brief period or when kept in floating conditions.
- A low current charge is given to such cells occasionally to compensate for the slight loss of charge. This charging action is called trickle charging.

- Provision for d.c. regulation may be available continuously by varying a.c. voltage input to bridge rectifier.

4.Battery swapping techniques:

Battery swapping (switching) technique, is a technique, to refuel the energy source of EV's, mechanically swapping the discharged batteries with fully charged batteries. The discharged batteries will either be charged at the service station or centrally collected charged at the swapping station. Simply, swapping refers to exchange of two or more things.

Advantages

- Eliminates long refueling time
- Automation

Disadvantages

- More complex
- Costly
- Bulky
- Resource intensive

5.DC charging:

DC charging is the method of charging the DC current directly into the battery. The DC charging or so called fast charging is done using a DC charging station, which can charge the alternating current (ac) to direct current (dc). It then 'bypass' the on-board charger of the electric car and send this dc (direct current) via battery management A charging station using DC power is much faster than an system (BMS) to the battery. AC charging station as there is less resistance for the current to flow.

Advantages:

- Fast charging.
- Solar charging is possible

Disadvantages:

- Expensive to install than an AC charging station.

6.Wireless charging

The wireless charging (or) Inductive charging (or) cordless charging, is a type of wireless power transfer. It uses EM induction to provide electricity to portable devices.

- It has two main components namely charging pad and receiver.
- The charging pad is fixed in the ground above where the car is parked.
- The receiver is fixed in the chassis.
- It transfer energy through inductive coupling.

- First, ac passes through an induction coil in the charging station or pad.
- The moving electric charge creates a magnetic field, which fluctuates in strength, because the electric current's amplitude is fluctuating.
- This changing magnetic field creates an alternating electric current in the portable device's induction coil, which in turn passes through a rectifier to convert it to direct current. Finally, the dc charges a battery or provides operating power.

Advantages

- Protected connections
- No corrosion
- No cables or plugs
- Intermittent recharging
- Low infection risk
- Durability
- Increase convenience
- Aesthetic quality
- Automated high power inductive charging
- Automatic operation

Disadvantages

- Slower charging
- More expensive
- Less efficient.

Applications

- Smart phones.
- Smart watches.
- Tablets
- EVs.

14. (a) (i) Discuss about the global scenario on EV adoption. **(7 Marks)**

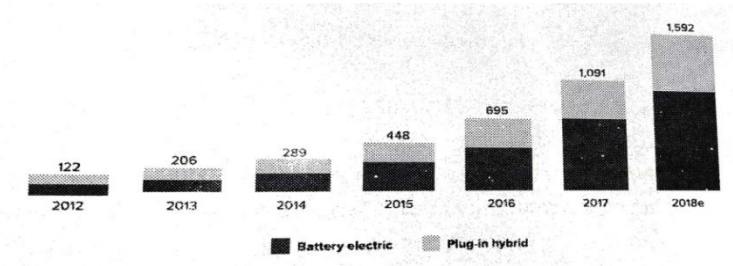
According to the various reports, if the governments will range up their efforts to meet international climate goals, then the number of global electric vehicles will increase to 230 million by2030. Currently, there are 10 million electric cars on road. The financing challenges, for EV customers are,

- Limited financing options
- High interest
- High insurance cost
- Limited loan opportunities

If the EV's gain widespread adoption the above financing challenges can hinder EV's widespread adoption in the country. As many as 13 countries managed to path EV's past 10% of new light vehicle in 2020.

- Norway - 75%
- Iceland - 45%
- Sweden - 32.2%
- Motherlands - 24.9%
- Finland - 18%
- Denman - 16.4%
- Switzerland - 14.3%
- Portugal - 13.5%
- Germany - 13.5%
- Mxemboury - 11.4%
- France - 11.3%

GLOBAL EV SALES (IN THOUSANDS)



(ii) Discuss about National Electric Mobility Mission Plan 2020. **(7 Marks)**

National Electric Mobility Mission Plan (NEMMP) 2020:

The NEMMP, 2020 lays down vision and roadmap for EV penetration in India.

The plan was adopted by the Government of India in 2013.

The plan aims at national energy security, mitigation of adverse impacts of vehicular growth on environment and growth of domestic manufacturing capabilities.

The plan focuses on providing upfront and continued support for promoting electric vehicle technologies in the country and targets 6-7 million EV penetration by 2020.

The NEMMP (National electric mobility mission plan) 2020 aims to achieve national fuel security by promoting hybrid and electric vehicles in the country.The government of India seeks to realize the electric dream of 400 million customers by the year 2030. Government aims to provide fiscal and monetary incentives to kick start this latest technology.

The objectives of NEMMP 2020 are,

- To provide vision for EV of HEV's
- Roadmap for faster adoption of EV of HEV'S
- To encourage reliable, affordable, efficient EV'S
- To meet consumer performance of price expectations
- To contribute national fuel security, etc.,

14. (b) (i) Explain about the Global impacts on electric mobility. **(7 Marks)**

Global Impacts:

Electric vehicles have a fewer moving parts then a conventional vehicle and fewer parts means less labour. Conventional vehicles require thousands of workers to make combustion power trains and their parts.

The analysis show that the move towards EV's creates a benefit over and above the reductions in greenhouse gas emissions. Sales of plug-in HEV's are up by 4.1% in that time, white HEV sales have skyrocketed by 98.2%

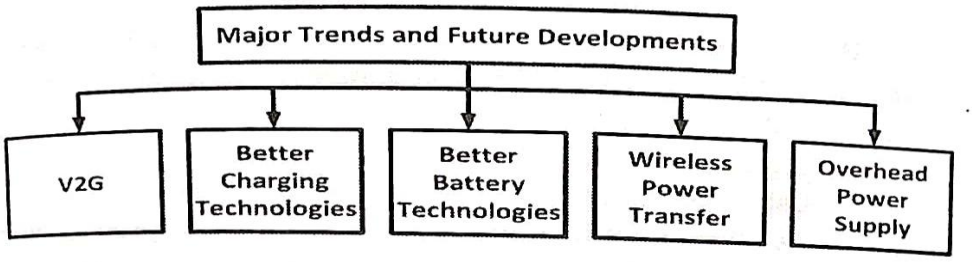
The global EV outlook is an annual publication that identities and discusses recent developments in electric mobility across the globe. It is developed with the support of the members of EVI (Electric vehicles Initiative).

The various global impacts an electric mobility are,

- The global EV fleet expanded significantly over the last decade
- Global sales were sluggish.
- Public accessible charging points are outpacing
- Leads in electrifying all vehicles
- Electrifying of heavy duty trucks, air and seaport operations Environmental and sustainability objectives
- Policies are being tailored to support market transition Government response to covid - 19 will influences the pace of transition to EV'S
- Adoption of electric drive trains accelerates
- Cost reductions, boosts deployment across all vehicle categories
- EV's increases electricity demand
- EV's reduce oil demand and well - to - wheel greenhouse gas emissions
- Battery capacity increases
- Pushing up demand for materials Improvement in battery technologies
- Battery costs drop
- EV's continue to contribute to sustainability goals, the life cycle.
- Policy landscape for battery end-of-life is enduring in key regions etc.

(ii) Discuss about the trends and future developments on EV mobility in India. **(7 Marks)**

In technology wise EV trends and future developments will be like this.



The various trends and future developments in electric mobility are,

- Increases in EV's
- Increases in registration of electric cars
- Sale of EV's makes a reward
- Consumer spending on EV's continues to rise
- Stability in government support
- More models are available
- Automakers entice customers with wide menu
- Largest OEM's have committed to increase the offer and sales of EV's
- Manufacture's electrification targets align with the IEA's sustainable development scenario.
- Heavy EV's registrations are expanded
- Electric heavy duty vehicle models are broadening
- Types of zero emission HDV's expand, of driving range lengthens
- Climate groups EV100 initiative update on private sector commitments
- Battery demand logged EV sales
- Spreading of popularity of electric micro mobility
- A lead in deploying fuel cell EV's
- Publicity accessible show and fast chargers increased .
- Planning needs to start now for mega chargers to enable long distance trucking.

By volume, the EV market expected to reach 233.9 million units by 2027, at a CAGR of 21.7% during the fore cast period by 2020 to 2027.Probably the biggest charge in the 100 plus year history, shift to EV's shaking up auto industry. By 2025, UBS predicts that 20% of all new cars sold globally will be electric. That number is expected to jump to about 50% by 2030, and some experts predict 100% of all new cars will be electric by 2040.

year	%
2025	20%
2030	50%
2040	100%

15. (a) Discuss about the demand side incentives and supply side incentives offered to promote EV manufacturing in Tamilnadu. (14 Marks)

Policy Measures

The government of Tamilnadu focus on policy interventions intended to encourage EV manufacturing as well as EV marketing in the state. The various concessions will be offered for EV vehicle manufacturers including the manufacturers of related items of EV vehicle.

1.Demand side incentives to promote EV manufacturing.

2. Supply side incentives to promote EV manufacturing.

Demand side incentives to promote EV manufacturing

The Table shows the various incentives offered by Tamilnadu Government for the various class of vehicles from demand side.

S.No	Class of Vehicles	Incentives offered by Government of Tamil Nadu
1.	Purchase of Electric two-wheelers	1.100% Road Tax exemption up to 30.12.2022. 2. Waiver of Registration charges as per GOI notification.
2.	Three seater auto Richshaws	1.Waiver of E-auto permit fees up to 30.12.2022. 2. 100% Road Tax exemption up to 30.12.2022. 3. Waiver of Registration charges as per GOI notification.
3.	Transport vehicles (Taxi, Tourist-Cars etc.	1.Waiver of Taxi permit fees up to 30.12.2022. 2. 100% Road tax exemption up to 30.12.2022. 3.Waiver of registration charges as per GOI notification. 4. Subsidy for STU Operated vehicles
4.	Light Goods carries including (three wheelers)	1.No requirement of permit. 2.100% Road Tax exemption upto 30.12.2022. 3. Waiver of registration charges as per GOI notification.
5.	Private cars	1.Owners will be encouraged to switch over to electric cars. 2. Waiver of registration charges

		as per GOI notification. 3.Road Tax exemption entered from 50% to 100% up to 30.12.2022.
6.	Charging Stations	1. Adequate policy support for development of charging infrastructure. 2.State's active thrust with TANGEDCO and privates. 3. Capital subsidies to private operators. 4.Provision for charging station in commercial Buildings. Incentives offered by Government of Tamil Nadu. 5.To setup 3 x 3 Grid charging to major cities. 6. To setup one charging station for each 25kms intervals on both sides of NHAI & state highway. 7. To provide charging station at Government office parking lots. 8. TANGEDCO to invest to setup both slow and fast charging networks. 9.Investment for infrastructure development of charging stations by TANGEDCO with private operators in Public private partnership model. 10. EV charging service providers can setup their own renewable energy generating stations. 11. LT twiff - IA - 230V/415V as per tariff order TP No: 1 of 2017 Dt:11.8.2017 for private charging station. 12. LT tariff - V of TAGEDCO for commercial buildings. 13. Tariff for supply of electricity to public charging station (PCS) to be determined by TNERC. 14. Supply of Renewable energy on preferential basis with zero connection cost.

Supply side incentives to promote EV manufacturing

The Government of Tamilnadu offers attractive incentives to promote new industrial investments in the state under the Tamilnadu Industrial policy.

The condition of eligibility for quality incentives under the special package are

1. Units engaged in EV.
2. Components manufactured.
3. Charging infrastructure.
4.Investments about Rs. 50 crores.
5. To create at least 50 direct jobs.

The table shows the various incentres offered for the various categories from supply side.

S.No	Title of the category	Incentives offered by Government of Tamilnadu
	SGST	1.Reimbursement 100% of SGST provide on hole of EV's manufactured, sold and registered for use in the state. 2. Effective upto 31.12.2030.
	Capital Subsidy	1.In the case of intermediate products used in the manufacture of EVs and charging infrastructure, 15% on eligible investments over 10 years (where 100% reimbursement of SGST is not applicable) 2. Effective upto 31.12.2025.
	Electricity Tax	1.100% Exemption. 2.Effective upto 31.12.2025.
	Stamp duty	1.100% Exemption 2.Effective upto 31.12.2022.
	Cost of Land	1. 15% subsidy on the cost of land obtained from SIPCOT, SIDCO, etc., 2. 50% subsidy if the investment in southern districts. 3.Effective upto 31.12.2022.
	Employment	1. Reimbursement of employer's constitution of EPF for all new jobs 2.Effective upto 31.12.2025

		3.Maximum of Rs.48,000/-Per employee
	EV Battery manufacturing	1.Special package 2.Higher capital subsidy of 20% 3. For about 20 years 4.50% subsidy in lower in districts 5.Effective upto 31.12.2015
	Creation of EV parts and vender Eco system	1.Development of EV parks 2.Common facilities will be provided, for prototyping, testing, training, etc., 3.Applicable MSME sectors 4.Plug and play manufacturing facilities will be created. 5. Promote logistic parks and free warehousing zones.
	MSME sector	1.20% additional capital subsidy 2.6% interest subvention will be provided 3.Effective upto 31.12.2025
	Transition support	1.One-time re-skilling allowance, forevery existing employee in the production line
Institutional mechanism	1. The incentives mentioned in class 1 to 10 above belongs to EV special manufacturing package Recommendation from Tamil Nadu Industrial Guidance and Export promotion Bureau. 2. Existing MSME facilities also applicable to EV sector also. 3. Single window clearance facility	

15. (b) (i) Discuss about the revision of transport regulation of EV. **(7 Marks)**

To distinguish the Electric vehicles (battery operated vehicles) from other vehicles, Registration mark (vehicle number plate) shall be exhibited in

1. Yellow color on a green background for transport vehicles

2. White color on green background for all other EV's

All the vehicles should fulfill conditions stipulated to register under central motor vehicle rule (CMVR)

City building codes:

The various city building codes are,

1. Amendment to building and construction laws will be made to ensure that charging infrastructure is integrated at the planning stage itself for all new construction and apartments in cities.
2. All existing apartment associations with 50+ families will be encouraged to provide charging points in parking lots.
3. Existing residential townships with 500+ families will be encouraged to install charging stations.
4. At least 10% of parking space will be earmarked for EVS in commercial buildings such as hotels, shopping malls, cinema halls, apartments etc. and charging stations will be set up in the earmarked space.

(ii) Explain about the capacity building and charging structure of EV in Tamilnadu. **(7 Marks)**

Capacity building

- Tamil Nadu has a good young demographic and skilled manpower in all trades which is critical to support any industrial operations.
- The state will identify the nature and level of skills required by the EV industry to develop and execute training programmes on EV design, development, & manufacturing through various channels.
- Higher education development will redesign the curriculum in engineering as well as polytechnic colleges in electrical and electronics, ECE, ICE, mechanical and automobile courses to suit to the EV industry requirements, including setting up of centres of excellence. Similarly, ITI curriculum will also be updated accordingly.
- The TNSDC (Tamil Nadu skill Development Corporation), in- line with NSDC (National Skill Development Corporation), provides skill training to required industries (EV's).
- It provides 1.Finishing skilling 2.Short term skilling, programmes to the existing technical person on EV, based on the skill qualification.
- Here, this subject "E-vehicle technology and policy" is desired for ECE, EEE, mechanical, automobile and ICE branches.

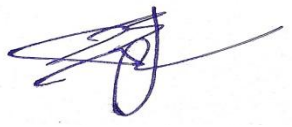
Charging structure:

The charging structure is designed and implemented with the formation of high level committee, (steering committee) to monitor the implementation of E vehicle.

1. The chief secretary, govt, of Tamil Nadu (chairman)
2. Committee members are,

- Additional chief secretary, Home dept
- Principal secretary, Transport dept
- Principal secretary, Finance dept
- Principal secretary, Energy dept
- Principal secretary, Highways dept
- Principal secretary, Industries dept
- Principal secretary, MA&WS dept
- The chairman, TANGEDCO
- The chairman, Transport dept
- MD & CEO, TN Industrial guidance Bureau
- Five experts from various fields pertaining to E-vehicles manufacturing, battery charging, etc.

Prepared by



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