



# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



## UNIT V: REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

TOPIC: **DESIGN OF PLUG IN ELECTRIC VEHICLES**





# PLUG IN ELECTRIC VEHICLE

A Plug-In electric vehicle is a vehicle that is designed to be plugged into an electrical outlet/charging station to charge the on-board battery while the vehicle is "off".

By charging the batteries with an exterior source, the vehicle can operate using electric power only, for longer times (vs ICE hybrid).





# IDENTIFYING A PHEV

Since PHEV's are basically the same as a HEV, there are only a few ways to identify them.

They are as follows;

1. Badging
2. Second "Fuel Door" (used for the plug-in port)





# PHEV DIFFERENCE

The operation of a Plug-In hybrid vehicle is very similar to a HEV. The main difference is the charging port, larger battery, and an on-board charging module.

Service or maintenance is performed with the same procedures as HEV.





# PHEV BATTERY

- The size of a battery determines how far that vehicle can travel, and how long it takes to recharge.
- Larger batteries (higher kilowatt-hour) weighs and costs more.
- Smaller batteries (lower kilowatt-hour) have less range.
- The standard HEV Prius has a 1.3 kWh battery.
- The Plug-In version has a 4.4 kWh battery.





# CHARGING OF PHEV

- After the battery has been discharged, the ICE is used to keep the battery charged enough to propel the vehicle, but it does not fully recharge the battery.
- To fully charge the high-voltage battery in a plug-in hybrid (PHEV) it must be plugged into an external power source.
- Charging times vary on size of battery and level of charger. There are three levels of chargers, they are as follows;

Charging Level	Power Supply	Charger Power	Miles of Range for 1 Hour of Charge	Charging Times From Empty to Full*	
				BEV	PHEV
Level 1	120VAC Single Phase	1.4 kW @ 12 amp (on-board charger)	~3 - 4 miles	~17 Hours	~7 Hours
Level 2	240VAC Single Phase up to 19.2 kW (up to 80 amps)	3.3 kW (on-board)	~8 - 10 miles	~7 Hours	~3 Hours
		6.6 + kW (on-board)	~17 - 20 miles	~3.5 Hours	~1.4 Hours
DC Fast Charge Level 2	200 – 450 VDC up to 90 kW (approximately 200 amp)	45 kW (off-board)	~50 - 60 miles (~80% per 0.5 hr charge)	~30 - 45 Minutes (to ~80%)	~10 Minute (to ~80%)



# LEVEL-1

Level 1 chargers use 110 volt standard outlets. This charging method takes the longest but is the cheapest to install and operate. (16 amp max)



# LEVEL-2

Level 2 chargers use 220 volts. These chargers can be added to your house, allowing a faster recharge time, but at a higher installation cost (typically \$2K+). This is the most commonly used level for public charging stations. (80 amp max)





# LEVEL-1 AND 2 CHARGER PLUG

SAE J1772 standard plugs



**AC PLUG**

**AC/DC PLUG**





# LEVEL-3

Level 3 chargers use 440 volts. These chargers can charge most vehicles to 80% in less than 30 minutes! This high-charge rate may be harmful to the battery. These chargers are professionally installed and cost around \$50K. (200 amp max, DC current)



**CHAdeMO Plug**

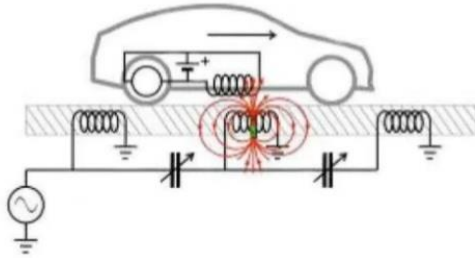


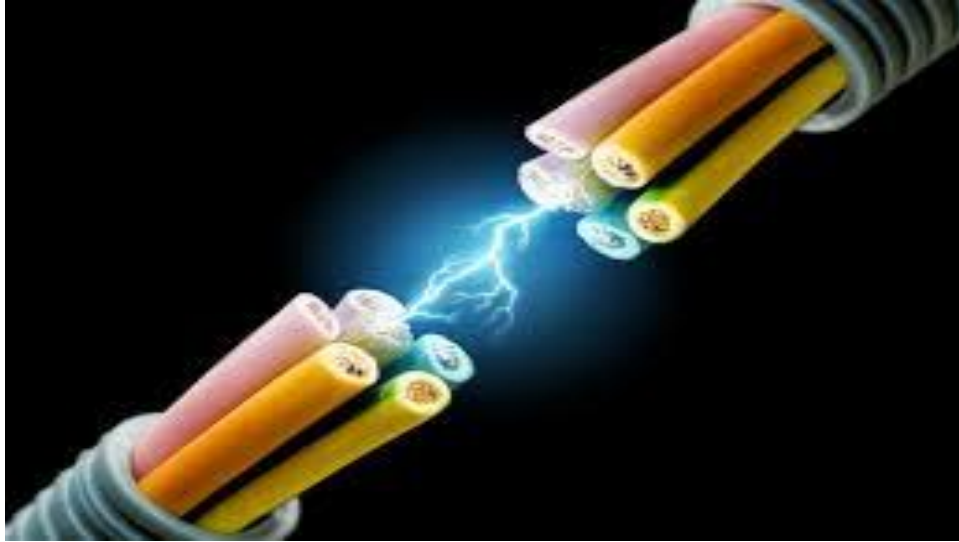
**CHAdeMO is a Japanese abbreviation of "CHARGE de MOve" which can be translated to "Charge for moving" (fast charge)**



# INDUCTIVE CHARGING (Wireless)

- Some old technology is making a comeback with inductive wireless charging.
- GM EV-1 wireless charging. (equivalent to Level 2)





# ...THANK YOU