SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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UNIT III: REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

TOPIC: **Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle**

Introduction

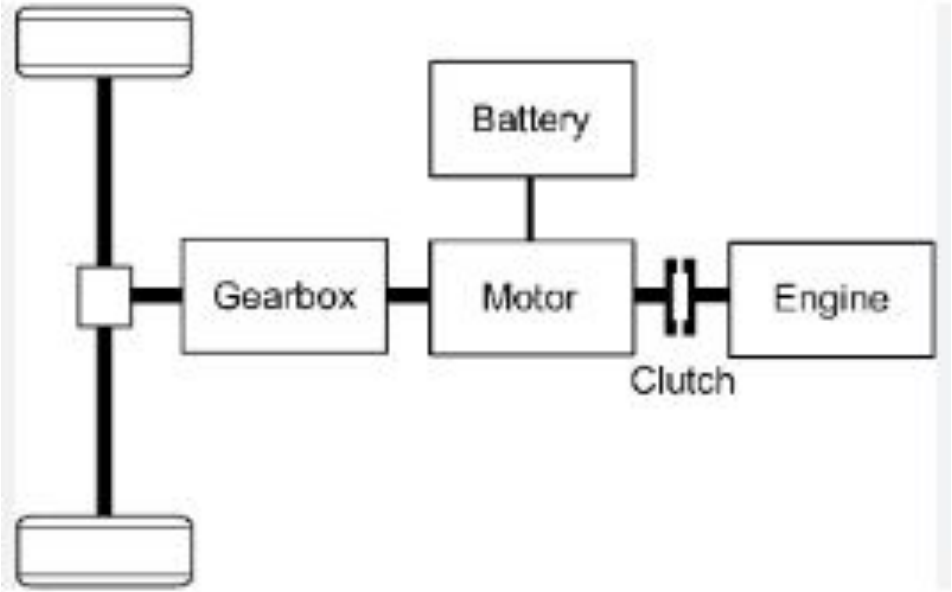
- Overview of Electric Vehicles (EVs)
- Importance of HEVs and PHEVs in Sustainable Transportation
- Key Objectives of the Presentation

Difference Between HEVs and PHEVs

Feature	Hybrid Electric Vehicle (HEV)	Plug-in Hybrid Electric Vehicle (PHEV)
Power Source	Internal Combustion Engine (ICE) + Electric Motor	ICE + Electric Motor (with larger battery)
Charging	No external charging required	Can be charged via external power source
Electric-Only Range	Limited (<2 miles)	Moderate (10-50 miles)

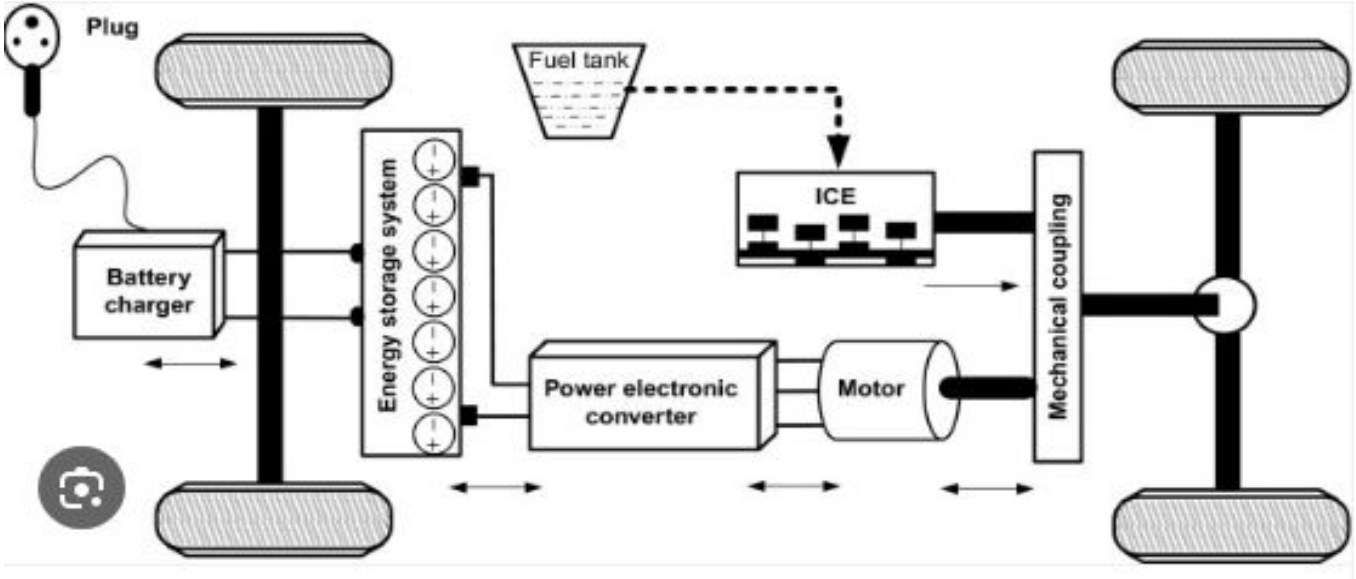
Basic Architecture of HEV

- Internal Combustion Engine (ICE)
- Electric Motor
- Battery Pack
- Power Split Device
- Regenerative Braking System



Basic Architecture of PHEV

- Larger Battery Pack than HEV
- Onboard Charger for External Charging
- Electric Motor and ICE Integration
- Electric Drive Mode vs Hybrid Mode



Design Considerations for HEVs

- **Energy Management:** Balance between ICE and Electric Motor
- **Battery Size and Placement**
- **Cooling Systems**
- **Weight Distribution**
- **Regenerative Braking Optimization**

Design Considerations for PHEVs

- **Battery Capacity and Charging Time**
- **Electric-Only Driving Range**
- **Integration with Smart Charging Infrastructure**
- **Thermal Management**

Components of HEVs and PHEVs

1. **Battery Pack:** Lithium-Ion vs. Nickel-Metal Hydride (NiMH)
2. **Electric Motor:** Permanent Magnet Synchronous Motor (PMSM) vs. Induction Motor
3. **Power Electronics:** Inverter, Converter, and Control Systems
4. **Transmission System:** eCVT vs. Multi-Speed Gearbox

Power Management Strategies

- Series Hybrid Configuration
- Parallel Hybrid Configuration
- Series-Parallel Hybrid Configuration
- Power Split Control

Environmental and Economic Benefits

- Reduction in Greenhouse Gas Emissions
- Lower Fuel Consumption
- Incentives and Subsidies for PHEV Users
- Long-term Cost Savings

Challenges in HEV and PHEV Design

- Battery Degradation Over Time
- Complexity in Control Systems
- High Initial Cost
- Charging Infrastructure Limitations for PHEVs

Future Trends

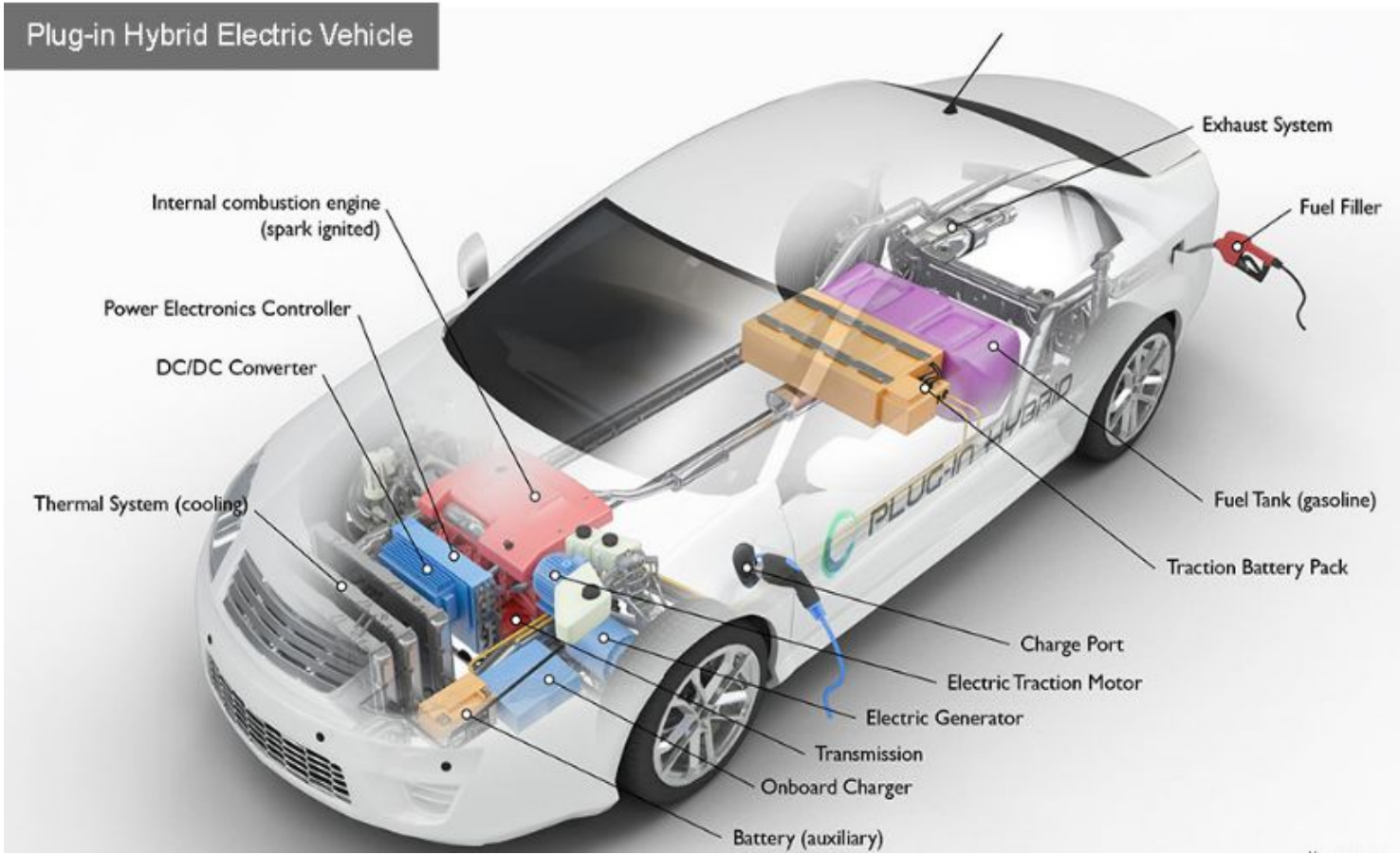
- Development of Solid-State Batteries
- Vehicle-to-Grid (V2G) Technology
- Integration of Autonomous Driving with HEVs and PHEVs
- Enhanced Range and Charging Speed

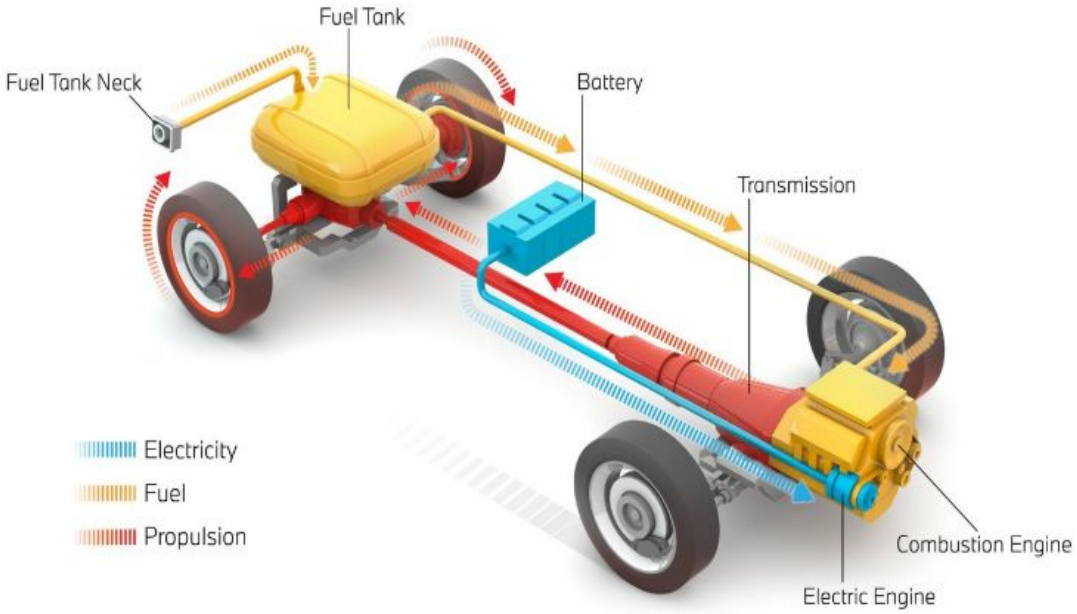
Conclusion:

Hybrid Electric Vehicles (HEVs) and Plug-in Electric Vehicles (PHEVs) play a critical role in the transition toward sustainable transportation and reducing environmental impact.

HEVs, which combine an internal combustion engine (ICE) with an electric motor, offer improved fuel efficiency and lower emissions compared to conventional vehicles, making them an ideal solution for reducing greenhouse gas emissions and fossil fuel dependency.

On the other hand, PHEVs, equipped with larger battery packs, allow for extended electric-only driving ranges and can be recharged from external power sources, further reducing fuel consumption and offering significant cost savings on fuel over time.


Plug-in Hybrid Electric Vehicle
Exhaust System
Internal combustion engine (spark ignited)
Fuel Filler
Power Electronics Controller
DC/DC Converter
Thermal System (cooling)
Fuel Tank (gasoline)
Traction Battery Pack
Charge Port
Electric Traction Motor
Electric Generator
Transmission
Onboard Charger
Battery (auxiliary)


Fuel Tank
Fuel Tank Neck
Battery
Transmission
Electricity
Fuel
Propulsion
Combustion Engine
Electric Engine

…THANK YOU