

Q1

Ans: A BMS manages a battery pack by protecting the battery from operating outside its safe operating zone by monitoring its state controlling its environment and balancing the lithium-ion cells inside the battery pack.

Types

1) Hardware BMS - A hardware BMS performs basic protection functions to keep the battery pack functioning as healthy as possible. The basic functions includes:

- Overvoltage cut-off
- undervoltage cut-off
- continuous current
- over current detection
- over temperature cut-off.

2) Software/Smart BMS - It has all the features of the hardware BMS, but additionally can collect data, can have memory to store data and can transmit data via CAN, Bluetooth, etc.

Q2)

Ans

- chemistry of cells fixes the voltage range.

$$V_{\text{pack}} = N/V_{\text{cell}}$$
- For high current the cells need to be stacked in parallel.

$$I_{\text{pack}} = N/I_{\text{cell}}$$
- Module Voltage $< 50V$ for safety.
- Pack Voltage $< 600V$ as power electronics is expensive.
- Need to keep current small $\rightarrow$ To reduce wire diameter r
 $\rightarrow$ To reduce resistive heat loss.

Q3)

Ans) . Communication is used for communication b/w devices

- It can continuously transmit data of the battery's thermal profile and monitor its temperature continuously.
- It uses the collected data points to estimate the state of charge, state of health, etc of the battery pack.
- Types $\rightarrow$ CAN (Control Area Network) $\rightarrow$ A robust, vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer.

- Bluetooth : It is something that sends the data to the end users on their cell phone app. we saw the data as a screenshot of a cell phone in the smart BMS topic.
- IoT cloud connectivity : It requires wireless internet and can transmit data to the cloud and it can be viewed remotely by anybody with an access.