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.

DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19AUB204 – AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING

II YEAR / IV SEMESTER

Unit 1 – Electrical Systems

Topic : Characteristics of Battery Rating Capacity and Efficiency of Batteries

BATTERY RATING CAPACITY

- Battery rating capacity refers to the amount of energy a battery can store and deliver.
- This rating is typically expressed in ampere-hours (Ah), milliampere-hours (mAh), watt-hours (Wh), or kilowatt-hours (kWh), depending on the size and application of the battery.

CHARACTERISTICS OF BATTERY RATING CAPACITY

- **Nominal Capacity**: This is the capacity of the battery under standard operating conditions. It represents the amount of charge the battery is designed to hold and deliver in ideal circumstances.
- **Actual Capacity**: The capacity of a battery can vary based on factors such as temperature, discharge rate, and age. Actual capacity may be lower than nominal capacity, especially under adverse conditions.

CHARACTERISTICS OF BATTERY RATING CAPACITY

- **Peukert's Law**: Peukert's law describes how the capacity of a battery changes with different discharge rates. Higher discharge rates can reduce the effective capacity of a battery, meaning it may not deliver its full nominal capacity in a short period of time.
- **Temperature Sensitivity**: Battery capacity can vary with temperature. Generally, lower temperatures reduce battery capacity, while higher temperatures can increase it. However, extreme temperatures can also degrade the battery over time.

CHARACTERISTICS OF BATTERY RATING CAPACITY

- **Cycle Life**: The number of charge-discharge cycles a battery can undergo before its capacity significantly degrades is an important consideration. As batteries are used, their capacity may decrease gradually with each cycle.
- **Depth of Discharge (DoD)**: The depth to which a battery is discharged in each cycle can impact its lifespan and effective capacity. Deeper discharge cycles typically result in shorter battery life and reduced overall capacity over time.

CHARACTERISTICS OF BATTERY RATING CAPACITY

- **State of Charge (SoC)**: The remaining charge in a battery, expressed as a percentage of its full capacity, is known as the state of charge. Understanding SoC is crucial for managing battery usage and ensuring it meets the required energy demands.
- **C-rate**: C-rate is a measure of the discharge or charge current relative to the battery's capacity. For example, a 1C discharge rate for a 1 Ah battery means discharging it at a rate that will fully deplete it in 1 hour. Similarly, a 0.5C charge rate for a 2 Ah battery means charging it at a rate that would take 2 hours to fully charge it.

CHARACTERISTICS OF BATTERY RATING CAPACITY

- **Capacity Degradation**: Over time, batteries can lose capacity due to factors such as chemical reactions within the cells, aging, and usage patterns. Monitoring capacity degradation is essential for assessing battery health and performance.

EFFICIENCY OF BATTERY

- Coulombic efficiency measures the ratio of the charge delivered during discharge to the charge required during charging.
- In ideal conditions, this ratio would be 100%, indicating that all the charge input during charging is retrievable during discharge.
- However, real-world batteries often exhibit lower coulombic efficiencies due to factors such as side reactions and internal resistance.

EFFICIENCY OF BATTERY

- Energy efficiency takes into account losses during charge and discharge cycles, including resistive losses, heat generation, and self-discharge.
- It represents the ratio of energy output during discharge to the energy input during charging.
- Like coulombic efficiency, energy efficiency is typically less than 100% due to losses incurred during the charging and discharging processes.

EFFICIENCY OF BATTERY

- Voltage efficiency refers to the ratio of the output voltage during discharge to the input voltage during charging.
- In an ideal system, the output voltage would match the input voltage, resulting in a voltage efficiency of 100%.
- However, in real batteries, there are losses due to internal resistance and other factors, leading to lower voltage efficiency.

THANK YOU !!!