Badge I: Power Fundamentals
UH Faculty Modules

1B) Intro to Electrical Engineering

Key Priorities

- Introduction to electrical engineering fundamentals.
- Learn about circuit theory basics, and definitions of current, voltage, power, energy, etc.
- Study complex numbers and phasor forms.
- Introduction to basic properties of various power system components like transformer and cables.
- Learn power system fundamental physical laws: Ohms law, KCL, and KVL.

Key Learnings

- Getting an overview of electrical engineering fundamentals along with widely-used circuit theory.
- Understanding the basics of power system components and analysis methods.
- Learning the fundamentals of power system physical laws.

1C) Three Phase Circuits

Key Priorities

- Introduction to three phase circuits and advantages over single phase systems and importance of phase sequence
- Calculation of the three-phase power and understanding kW and KVA ratings.
- Learn the Star and Delta connection configurations, Active and Reactive power Calculations
- Develop a basic understanding of harmonics in 3 phase circuits.

Key Learnings

- Getting overall understanding of three phase ac systems and its importance
- Understanding the different connection configurations and power calculations
- Understanding the phase sequence, active power, reactive power, and their practical importance

1D) Electric Power Systems

Key Priorities

- Introduction to traditional three-phase power generation systems and ac power system frequency.
- Learn about high-voltage meshed transmission systems and low-voltage radial distribution systems.
- Study three phase system and positive sequence network.
- Learn about electrical network properties, power balance requirements, and power flow analysis .
- Introduction to multi-time-scale power system operations.

Key Learnings

- Gaining a fundamental understanding of power system structure with various voltage levels.
- Understanding power system basic operational strategies and reliability standards.
- Developing preliminary skills to conduct power system analysis.

1E) Power Electronics

Key Priorities

- Introduction of power converter components such as semiconductor devices, capacitors, inductors, etc.
- Get an overview of the main non-isolated and isolated DC-DC converters along with their design principles.
- Learn the main converter topologies used for designing DC-AC inverters and AC-DC rectifiers.
- Develop a basic understanding of harmonics, losses, gate drivers, control system design, etc.

Key Learnings

- Getting a high level overview of power electronics along with the most important types of operations possible.
- Understanding the primary design considerations and challenges when developing power converters.
- Learning the basics of simulating power converters.

1F) Electric Machines

Key Priorities

- Introduction to electric machines and understanding the difference between generator and motor, and types of electric machines
- Basic operation and Characteristics of dc and ac machines. Power and Torque calculations
- Characteristics and power phase equivalent circuit of induction machines. Applications
- Characteristics and power phase equivalent circuit of permanent magnet machines. Applications

Key Learnings

- Gaining a fundamental understanding of electric machines, characteristics, and applications
- Understanding the types, basic operation and control characteristics
- Understanding the selection criteria for machines for various applications