

electrical machines & drive control course

Pre-request: basic knowledge of electrical machines

Course duration: 36 Hours

On completing this course you will be able to:

- **Understand** all technical details about three phase induction motor
- **Understand** all technical details about single phase induction motor
- **Understand** all technical details about power factor correction
- **Understand** all technical details about three phase induction Generators
- **Understand** all technical details about universal motor
- **Understand** all technical details about DC motor and DC Generators
- **Understand** all technical details about synchronous motor and Generators
- **Understand** all technical details about Diesel Generators
- **Understand** all technical details about Special motors
- **Understand** all technical details about **classic control component**
- **Understand** all technical for **Classic control application (handwork)**
- **Understand** all technical details about **drive control system**
- **Able To Installation** of the drive system
- **Able To How to drive 3 phase induction motors**

Course Content:

Part 1 electrical machines

Introduction and Concepts of magnetic circuits

1- Three phase induction motor

- Construction and design
- Equivalent circuit and parameters calculation and Tests
- Types of 3ph IM (slip rings - squirrel cage - deep bar- double cage)
- The motor characteristics for Power & torque _ speed& current _ speed
- Starting methods
- Speed control and Torque control
- Winding rules
- Electrical power recovery
- Electrical braking of induction motor
- 3 phase motor converted to single phase
- power factor correction

2- Single phase Induction motors

- Theory of work and Circuit analysis
- Equivalent circuit
- Capacitor run motor
- Capacitor start motor
- Capacitor start Capacitor run motor
- Split phase motor
- Shaded pole motor
- 3ph winding for single phase motor
- Starting and speed control and Torque control
- Winding rules

3- Universal motor

Series universal motor

- Construction and Applications
- Examples
- Speed control and Torque control

Differential universal motor

- Theory of work
- Construction and Applications

Schrage motor

- Theory of work
- Construction and Applications

4- Three phase induction Generator

- Theory of work
- Equivalent circuit and parameters calculation
- Types of excitation for induction Generator

5- DC generators

- Theory of working
- Construction
- Armature reaction and how it affects
- Types of dc generators and methods of excitation
- Electrical external curves
- voltage regulation
- Calculations and examples
- Applications

6- DC motors

- Theory of working
- Construction
- Electro motive force & torque equation
- Types of dc motors
- Speed and torque curves
- Calculations and Applications
- Starting & reverse direction
- Speed control of dc motors
- Electrical braking of dc motors

7- Synchronous Generators

- Theory & construction
- Equivalent circuit
- Vector diagram and Tests
- Voltage regulation and Power & torque
- **Parallel operation**

8-Synchronous Motors

- Theory & construction
- Starting methods
- Power factor with synchronous motor
- Calculations of Power , torque and efficiency

9- Diesel Generator

- Theory & construction
- AVR
- load sharing of generators
- Maintenance of diesel generator

10- Special machines

- **Stepper motor**
- **Tachogenerator**
- **Servo motor**
- induction servo motors
- Dc servo motors

Part 2 Classic Control

1-classic control component

- switches
- Relay and Contactor
- Overload(thermal relay) and fuse
- circuit breaker types
- timers (on delay timer-off-delay timer)
- limit switch
- sensors

2- Simulation of Classic control

3- Classic control application (20 applications handwork)

- Control circuits for DC motors
- Control circuits for single phase motors
- Control circuits for three phase motors
- Forward and reserve for three phase motors
- Control circuits (Delta/star) three phase motors
- Control circuits for Dahlander motors

Part 3 Drive system

- Introduction
- Drive system components
- What is difference between inverter and a Soft Starter
- What is difference between inverter and frequency converter
- Block diagram of electric drive system
- Calculations
- Characteristic curves
- How to read the motor correctly?
- How to choose the drive type?
- Choosing type of control and protections
- Installation of the drive system
- Wiring and connections
- How to use digital inputs and analogue inputs to control the drive
- How to have a feedback from the drive and to use it in other process
- How to have a feedback from PLC
- How to collect your calculations before programming start
- Before you begin
- Steps for setting up
- Parameter setting method
- Frequency Setting via keypad & operating via terminals
- Basic Functions and Function list
- Drive Group
- Function group
- I/O configuration

- Inserting the motor data
- Calculations and insertion of protection currents
- Choosing direction of motion for forward and reverse directions
- Motion curves of acceleration and deceleration
- Motor control
- Types of stopping
- Ramp shape
- Brake release and brake engage
- Dc injection
- High speed
- **more exercise for application on 3 phase induction motors**