Miami Dade College

Course Description

ETP2234| Power Plant Components for Operations 2 | 3.00 credits

A continuation of ETP2233 Power Plant Components for Operations 1, this course is designed for students who are preparing for careers in industrial and/or power plant operations. Students will learn to develop a deeper knowledge of electro-mechanical systems in the power plant. This course will assist in preparing students for the General Fundaments Examination (GFES). Prerequisite: ETP2233.

Course Competencies

Competency 1: The student will demonstrate an understanding of DC and AC motors and their components by:

1. Identifying the basic components of a DC motor, including a reverse contactor, tapped resistor, field rheostat, and a drive control system, and explaining their functions in motor operation
2. Identifying the components of AC motors
3. Explaining the operation of AC motors, to include:
    - slip
    - induction motors
    - synchronous motors
4. Explaining the theory behind permanent magnet motors, three-phase motors, and induction motors.
5. Discussing common failure mechanisms and operating principles of motors

Competency 2: The student will demonstrate an understanding of basic motor theory by:

1. Explaining the basic principles of motor operation
2. Distinguishing between different types of motors, identifying their characteristics, and explaining their uses.
3. Defining basic terminology specific to motors and their operation
4. Explaining the differences between alternating current (AC) and direct current (DC) motors, their characteristics, and how they operate
5. Explaining the principles of single-phase and three-phase motors
6. Applying mathematical analysis to determine quantitative circuit functioning in terms of voltage, current, and power
7. Identifying and describing the voltage and current sources and their interactions in electro-mechanical devices
8. Identifying types of switches and their uses
9. Explaining what an interlock is used for and how mechanical and electrical interlocks work
10. Explaining the principles of motor control
11. Describing the function of fuses used in electrical motors

Competency 3: The student will demonstrate an understanding of the purpose and operation of diesel motors by:

1. Describing the uses of diesel motors in a power plant
2. Identifying the components of a diesel motor, including:
    - structural components (such as frame, block, pedestal, fuel distribution system)
    - moving components (such as pistons, cylinders, crankshaft, bearings, valves, control air, turbochargers)
    - accessories and support systems (such as air start, cooling water, lube oil, electrical, fuel oil distribution)
    - speed controllers and their operation
3. Discussing the operational principles of diesel motors
4. Discussing failure mechanisms and symptoms, such as failure to start, failure to reach operating speed, failure to stop, rough idling

Competency 4: The student will demonstrate an understanding of generator theory by:

1. Describing the general operating principles of generators

2. Identifying the major components of AC generators
3. Discussing common failure mechanisms and operating principles of generators
4. Explaining the function of the generator relative to the power triangle, including the following concepts and principles:
    - apparent power
    - true power
    - reactive power
    - power factor
5. Explaining the process of paralleling AC sources, including the conditions that must be established prior to closing the breaker

Competency 5: The student will demonstrate an understanding of low and medium circuit breakers, switches, and starters by:

1. Describing the function and operation of circuit breakers including how to reset a tripped circuit breaker
2. Identifying the different types of circuit interruption devices and describing the purpose and use of each type
3. Interpreting a simple schematic of a circuit breaker control circuit
4. Describing the function and operation of medium voltage circuit breakers
5. Describing the construction, application, and operating principles for the following types of medium voltage circuit breakers:
    - air circuit switchgear
    - molded case breakers
    - low and medium power distribution breakers
6. Observing safety procedures when working with medium voltage circuit breakers
7. Identifying types of switches and their uses
8. Explaining what an interlock is used for and how mechanical and electrical interlocks work

Competency 6: The student will demonstrate an understanding of demineralizers and how they operate by:

1. Explaining the purpose of the ion exchange process and describing a typical ion exchange reaction
2. Explaining the purpose and basic principles of operation of demineralizers
3. Defining and explaining the following processes:
    - demineralization
    - leakage
    - breakthrough
    - regeneration
4. Performing calculations involving demineralizer ion removal and decontamination factor (df)
5. Explaining how the following parameters impact demineralizer operation:
    - temperature
    - ionic properties
    - differential pressure/ flow rates
    - fouling
6. Determining if a demineralizer is operating correctly and describing how to correct malfunctions

Competency 7: The student will demonstrate an understanding of neutron and radiation sensors and detectors by:

1. Describing the function, construction, and operation of:
    - the neutron monitoring system, including the instrument display units
    - the gas-filled detector
    - the fission chamber
2. Drawing, labeling, and explaining the gas-filled detector characteristic curve
3. Listing the four instrument checks required prior to the use of portable radiation monitoring instruments
4. Explaining the function, construction, and basic theory of operation of the following dosimetry devices:
    - Thermo luminescent dosimeter
    - direct reading dosimeter (DRD)
    - electronic dosimeter
    - film badge

5. Explaining the effects of core voiding on neutron detection
6. Describing the construction and explaining the basic theory of operation of:
    - a proportional counter
    - failed fuel detectors
    - a d'Arsonval meter movement

Competency 8: The student will demonstrate an understanding of the Nuclear Regulatory Commission's General Fundamentals examination topics by:

1. Applying the subtopics of pressurized water reactor components, including:
    - valves
    - sensors and detectors
    - controllers and petitioners
    - pumps
    - motors and generators
    - heat exchangers and condensers
    - demineralizers and ion exchangers
    - breakers, relays, switches, and starters
2. Applying the subtopics of pressurized water reactor theory, including:
    - neutrons
    - neutron life cycle
    - reactor kinetics and neutron sources
    - reactivity coefficients
    - control rods
    - fission production poisons
    - fuel depletion and burnable poisons
    - reactor operational physics
3. Applying the subtopics of pressurized water reactor environmental systems, including:
    - thermodynamic units and properties
    - basic energy concept
    - steam
    - thermodynamic processes
    - thermodynamic cycles
    - fluid statics and dynamics
    - heat transfer and heat exchangers
    - thermal hydraulics
    - core thermal limits
    - brittle fracture and vessel thermal stress

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Use computer and emerging technologies effectively