

SPWG 170B: POWER SYSTEMS 2

Citrus College Course Outline of Record

| Heading | Value |
|-----------------------|---|
| Effective Term: | Fall 2021 |
| Credits: | 5 |
| Lecture Hours : | 72 |
| Lab Hours: | 60 |
| Hours Arranged: | 0 |
| Prerequisite: | SPWG 170A or by department consent based off of experience and/or industry certification. |
| Strongly Recommended: | ENGL 101 and MATH 144. |
| Transferable to CSU: | Yes |
| Transferable to UC: | No |
| Grading Method: | Standard Letter |

Catalog Course Description

Intended for diesel technology students seeking a career in the power generation sector, this course provides an in-depth study and hands-on activity in delivering, maintaining, troubleshooting and repairing current and legacy production Caterpillar Generator Sets operating as single units. This course is a continuation of the Power Generation series of courses designed to prepare students for the EGSA or CEP certifications. 72 lecture hours, 60 lab hours.

Course Objectives

- Properly recognize generator actual and apparent power loading.
- Identify the effects of power factor and reactive/resistive loading on the engine and generator
- Recognize different circuit breaker types
- Verify phase rotation
- Perform verification of generator synchronization adjustment
- Perform set-up and adjustments of power generators to share kW load
- Identify the principals of modern automatic load sharing
- Perform set-up and adjustments of generators to share the reactive load
- Perform set-up and adjustments of manual breaker closure to parallel generators

Major Course Content

1. AC current and voltage
 - a. Testing high output current
 - b. Adjusting high output current on generators
2. Production and legacy generator sets
 - a. Inspection and operation of generator mounted control panels
 - b. Inspection and operation of engine mounted junction boxes, including electromechanical control panels
3. Modular Control Panel

- a. Introduction to operation of EMCP3, and EMCP 4 control panels
- b. Data link diagnostics of modular control panels
- c. Programing values and parameters using data links
4. Voltage regulators
 - a. Perform voltage and frequency adjustments per system requirements
 - b. Identify and understand VR3, VR6, DVR, CDVR and IVR
 - c. Maintaining proper voltage and relationship between load of power demand and engine performance
5. Generator implementation strategy
 - a. Perform proper planned maintenance
 - b. Diagnostic measurements on generators
6. State Cat ATS models and basic controls strategy
 - a. Verification of phase rotation
 - b. Verification and adjustment of generator synchronization
 - c. Generator set-up and adjustments to share kW load
 - d. Principals of modern automatic load sharing
 - e. Set-up and adjustments of generators to share the reactive load
 - f. Set-up and adjustments of manual breaker closure to parallel generators

Lab Content

Labs will be in the form of hands on worksheets, tasks, and team; instructor led lessons.

(During lab participants will be asked to bring their safety glasses with side shields, leather boots/shoes (electrical hazard rated recommended, and work uniform.)

Testing, adjust, and troubleshoot current production and legacy generator sets, generator mounted control panels, engine mounted junction boxes, including electromechanical control panels.

1. Generator sets
 - a. Electronic Modular Control Panel II+, EMCP3, and EMCP 4 inspection
 - b. Perform the proper voltage and frequency adjustments per customer requirements for VR3, VR6, DVR, CDVR and IVR voltage regulators
 - c. Programing and adjustments of generators and generator controls via Data network
 - d. Perform proper planned maintenance and make diagnostic measurements on generators
2. ATS models and controls strategy
 - a. Verification of phase rotation
 - b. Verification and adjustment of synchronization
 - c. Set-up and adjustments to share kW load
3. Paralleling of Genset
 - a. Verify principals of modern automatic load sharing
 - b. Set-up and adjustments to share the reactive load
 - c. Manual breaker closure to generators
4. Divide engine load (KW) by making the proper governor adjustments
 - a. Adjust for minimum circulating current
 - b. Connect and adjust generators to operate in parallel using cross current compensation

- c. Parallel generators after making proper engine and generator adjustments including proper synchronization and phase rotation verification
- 5. Support systems and ancillary operations
 - a. Switch-gear components, functions, and required wiring
 - b. Principles of co-generation and peak shaving
 - c. Remote and direct interface with Generator Set Control Panel
 - d. Identify system components and parts placement

Suggested Reading Other Than Required Textbook

EMCP II P Application Notes study material LEHE7584-00 lab handout power systems calculations

Examples of Outside Assignments

Generator Characteristics sample ws CEP Quiz sample

Instruction Type(s)

Lecture, Lab