REE 454 Power System Protection & Control
Course Project

This project requires you to design a protection and control (P&C) system for a combined-cycle power plant. The preliminary one-line diagrams and line and equipment electrical data from an actual power plant were provided last term in Blackboard in .dwg and pdf formats.

A single synchronizing panel allows synchronization of the plant's generators across the following circuit breakers: 52-1, 52-12, 52-13, B-01, and B-02. Control power for the synchronizing panel and all components (power monitoring, protection, and control) is 125 VDC provided by a station battery.

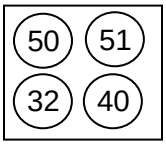
Design Scope of Work:

Create a configured one-line diagram in Easy Power using the sizes calculated and the line length and equipment data provided in Blackboard.

Perform load flow and short-circuit studies using Easy Power software for the electrical system in the one-line diagrams. Verify that the switchgear bus ratings are acceptable for the symmetrical fault current values that may be seen for each piece of switchgear.

Add microprocessor-based protection devices to the one-line diagrams for each of the buses, feeders, generators, transformers, and loads (these can be represented by boxes). Show the appropriate protection and control functions using IEEE device numbers (located inside the boxes). Show how these devices are to connect to the appropriate CTs and VTs by updating the drawings.

For example, the following is a representation of a microprocessor-based generator protection relay with instantaneous overcurrent, time overcurrent, reverse power, and loss of field excitation functions:



Use the following P&C equipment:

Intertie PC-001	Beckwith M-3520
Circuit Breakers 52-1, 52-2, 52-4	Eaton 270VCP series vacuum circuit breakers
Bus A01	SEL-487B
Bus A02	E-rated fuses
Transformer TR-R	GE T60
Transformer AT-1	E-rated fuses (13.8 kV), LVCB (480 V)
Transformer AT-2	GE 745
Generator CTG-1	SEL-300G1
Generator STG-1	SEL-300G1
Synchronizing Panel: Autosync Relay Sync Check Relay Generator Control Relay	 Beckwith M-0193B Beckwith M-0188A Beckwith M-0194
Breaker B-01, B-02, & Tie	GE Power Break II SSD series ICCBs
Remaining Low Voltage Circuit Breakers	GE Spectra series MCCBs
High Resistance Grounds (HRG)	Indicate resistor sizes that will limit ground current to 5 A for generators and 3 A for AT-1 & AT-2 transformers based on nominal L-N voltages

Produce a cost for engineering services that includes engineering and design hours. Assign one member of the group as a lead Professional Engineer (PE, $125/hour) and the other members as engineering interns (EITs, $75/hour) for the design phase.

Design Deliverables (These will be Rev. A, Issued for Review)*:*

- A Bill of Material (BOM) detailing all protection components
- The cost of the design engineering services using a work breakdown structure
- Calculation sheets that show the formulas used and the calculation results for any calculations
- An Easy Power simulation file
- A power flow analysis from Easy Power
- A short circuit analysis from Easy Power
- Check prints for all documentation
- Construction drawings
- A submittal package that shows the catalog information from the manufacturer with the configurations or sizes you would select for each protection and control device

All documents are to be submitted to the instructor for a design review as Rev. A, Issued for Review, on Tuesday, March 5th. After picking up the review comments, all documents will be allowed to be changed to Rev. 0, Issued for Construction.