

ECE 215/S – Principles of Electronic Cyber Warfare

Block 1: Resistive Circuits and Power Distribution

Lesson 13: Project 1 Workday 1

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Today's Plan

- **First 10 minutes** — requirements walkthrough and the two questions teams always get wrong
- **Rest of class** — team work time. Instructors circulating
- **Last 5 minutes** — checkpoint. Every team states where they are

Submission 1 is due Mon 14 Sep, 2359.
Today's class is your last work period.

Requirements Recap

Your design must:

- Energize all **eight loads** (A–H) to the specifications in Table 1
- Be powered by a generator drawing no more than **30 kW real power**
- Attach the generator to either a **240 V** or **120 V** bus
- Include the 0.016–$0.022\,\Omega$ **wiring-loss resistor** between generator and first bus
- Use **only the COTS converters** in Table 2
- Give every load, bus, and converter its **own circuit breaker**
- Stay under **$500,000** and **25 m^3**

Check compliance before you optimize. A cheap non-compliant design scores zero, not second place.

Which Objective Applies Where

What you are computing	Objective
Load current from a kW or kVA rating and a power factor	1.4
Load current from an hp rating and an efficiency	1.5
Load current from a resistance or a wattage	1.1
Converter input power from output power	1.7
Power lost in the wiring resistor	1.1, 1.6
Total real power at the generator	1.4, 1.5
Breaker rating for each load, bus, and converter	1.2
Comparing your design to the others	1.8

If you are stuck on a load, find its row and re-read that lesson's method frame.

Work Backward, Always

1. Start at each **load** and find the real power and current it demands
2. Group loads onto **buses** by voltage — that is what the bus is for
3. Work back through each **converter**: $P_{\text{in}} = P_{\text{out}}/\eta$
4. Sum at each bus, then step back to the generator
5. Add the **wiring resistor loss** last: $P = I^2 R$ using the *generator* current
6. Verify the generator total is under **30 kW**

If you start at the generator you will iterate forever. Start at the loads.

The Two Mistakes Teams Make Every Semester

- **Summing apparent power to size the generator.**
  - The 30 kW limit is on **real power**. Load B is given as 12 kVA at pf $= 0.6$ — that is 7.2 kW real, not 12
  - Sum P, not S, against the limit. But size the *wiring* using the actual current, which follows S
- **Using load current in the wiring-resistor loss.**
  - The resistor sits between the **generator** and the first bus, so it carries the **total** generator current
  - Use the current in *that* segment, exactly as in Lesson 9

Real power for the generator limit. Segment current for every I^2R.

Checkpoint for Today

By the end of class your team should have:

- ☐ Real power and current computed for **all eight loads**
- ☐ A **first-draft block diagram** showing buses, converters, and breakers
- ☐ A **running total** of generator real power, cost, and volume
- ☐ A named owner for each remaining piece of work

If you are behind on the first item, ask now — not the night it is due.

Wrap-Up

Reminders:

- **Submission 1** (group system design) is due **Mon 14 Sep, 2359**
- Design must be legible and clearly labeled — see the example bus diagram in Figure 1 of the Project 1 handout
- Mathematical analysis is graded alongside the diagram. Show the work
- **GenAI Level 2 only** on this project, and document any use

Next lesson:

- **Lesson 14 — Project 1 Workday 2**, working Parts 2–3. Your instructor gives your team Part 2 once you submit Part 1
- **Quiz 3** (Objectives 1.6–1.7) is due **Mon 21 Sep, 2359**