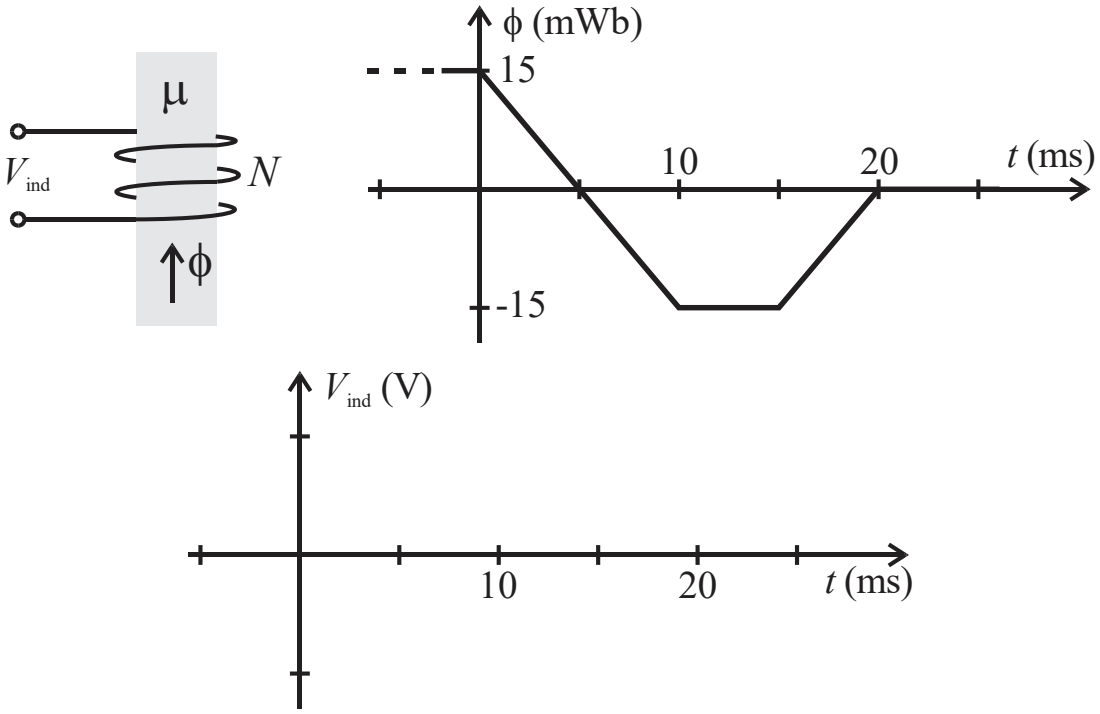
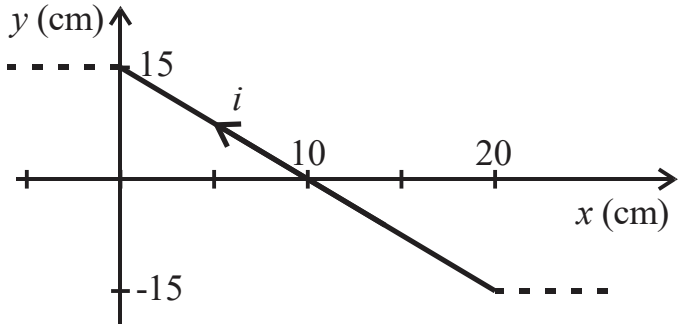
EE 330 Energy Systems (Fall 2026)
Homework 2
Wednesday, September 9, 2026

1) 1-10 Show voltage polarity on the figure.

2) A 40-turn coil of copper magnetic wire is tightly-wound about a magnetic core as shown. If the core carries the magnetic flux ϕ shown, determine the polarity of the voltage induced V_{ind} at the wire terminals (show polarity on figure) and sketch on the provided axes.



3) The wire section shown (solid line) is exposed to a magnetic field of $19.1\,\hat{a}_x$ (kA/m) in air. If the wire carries a current of 12 A, find: a) the magnetic flux density vector, b) length vector of the wire section, and c) the vector magnetic force on the wire.



4) A 60 Hz, 208 V_{rms} single-phase source (assume 0 degree phase angle) initially supplies two loads ($\overline{Z}_1 = 16\angle 60^\circ\,\Omega$ & $\overline{Z}_2 = 16 + j8\,\Omega$) connected in parallel. a) Find the phasor current (rms) and real, reactive, & apparent powers as well as the power factor for load 1. b) Repeat for load 2. c) Find the phasor line current (rms) as well as the real, reactive, & apparent powers supplied by the source. Also, find the power factor 'seen' by the source. d) We desire to achieve a PF ≥ 0.9 by connecting a capacitive load in parallel. What range of capacitance values will work?

5) A 60 Hz, 120 V_{rms} single-phase source (assume 0° phase angle) is connected to three loads connected in parallel. Load 1 consumes 12 kW of power and has a power factor pf_1 = 0.866 leading. Load 2 draws 156 A_{rms} of current and has pf_2 = 0.85 lagging. Load 3 uses 20 kvar of reactive power and has a power factor pf_3 = 0.6 lagging. Determine: a) the complex power consumed, phasor current (rms) drawn by, and impedance of load 1, b) repeat for load 2, c) repeat for load 3, d) the total complex power and phasor current (rms) supplied by the source, and e) the overall power factor 'seen' by the source.

6) It is desired to correct the overall power factor of the prior problem to unity by connecting a reactive load in parallel with loads 1 – 3. a) Will the reactive load need to be an inductor or capacitor? Explain. b) Determine the value of the reactive load (i.e., *L* or *C*) required, reactive power used, and phasor current (rms) supplied to the reactive load. c) Determine the new complex power and phasor current (rms) supplied by the source. By what percent was the source current magnitude reduced (e.g., $|I_{old} - I_{new}| / I_{old} * 100\%$)?

Due Monday, September 14, 2026.