

ECE 333

First Exam - Spring 2000 - Closed book, closed notes (official class sheet allowed), 55 min.

Problem points (out of 100) are indicated. Work all problems in exam booklets.

Problem #1 (25 points)

Given: A balanced, 3-phase, 60 HZ load draws 6 A of line current and 484 W (1-phase) of power when the line-to-line voltage is 208 V.

- Find:**
- (a) What is the power factor of this load? (Do not specify lead/lag)
 - (b) Assume that the load is inductive and compute the size of the capacitor/phase (connected in a delta) necessary to correct the power factor to unity.
 - (c) What is the source current if you use this capacitance in each phase and the load really is inductive?
 - (d) What is the source current if you use this capacitance in each phase and the load is really capacitive?
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Problem #2 (25 points)

Given: A single-phase transformer nameplate shows: 2400/120 Volts, 10KVA, 5% impedance. Assume that the % impedance is pure reactance.

- Find:**
- (a) What is the Voltage Regulation when a source is applied to the high voltage side so that the load voltage is 120 V when the transformer is loaded to rated current at unity power factor?
 - (b) What is the short-circuit current on the low-voltage side if the low-voltage side is shorted while the 2400 Volts is applied to the high-voltage side?

(OVER)

Problem #3 (25 points)

Given: The following test results were found for a balanced, symmetrical, 3-phase, 60 HZ, 6 pole, 230 V (line-line), 5 HP induction motor:

DC test: $r_1 = 1.3 \text{ Ohm}$

No-load test: $V(\text{line-line}) = 230 \text{ V}$, $I(\text{line}) = 3 \text{ A}$

Blocked rotor test: $I(\text{line}) = 12 \text{ A}$, $P(1\text{-phase}) = 430 \text{ W}$

Find: Estimate the line current magnitude when the motor is loaded such that the RPM is 1100 with rated voltage applied.

Problem #4 (25 points)

Given: A balanced, symmetrical, 3-phase, 4 pole, 25 HP induction motor is driven by a variable speed drive. At 60 HZ, the drive output voltage is 480 V (line-line).

Full load is defined to be 25 HP out.

Assume an efficiency of 85% at full load, 60 HZ.

Assume a power factor of 0.8 at full load, 60 HZ.

Find:

- (a) Estimate the full-load line current when the drive is set for 60 HZ?
- (b) Repeat (a) if the drive is set for 40 HZ, assuming constant efficiency and power factor.
- (c) Do you think the assumption of constant efficiency and constant power factor for both 60 HZ and 40 HZ was good? Explain.