

ECE 333

First Exam - Spring 2001 - Closed book, closed notes (one 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, delta-connected inductive load draws 6 A of line current and 1,700 W (3-phase) of power when the line-to-line voltage is 208 V.

- Find:**
- (a) What is the phase current of this load?
 - (b) Compute the size of the capacitor/phase (connected in a delta) necessary to correct the power factor to unity. Give the answer in Micro-Farads.
 - (c) What is the line current with the capacitors installed?
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Problem #2 (25 points)

Given: The following test results were found for a single-phase, 60 HZ, 50 KVA transformer with voltage ratings 12,470/240 Volts (assume 1 is the high-voltage side):

Open-circuit test: $V_2 = 240 \text{ V}$, $I_2 = 12 \text{ A}$, $P_2 = 620 \text{ W}$

Short-circuit test: $V_1 = 520 \text{ V}$, $I_1 = 4 \text{ A}$, $P_1 = 1,250 \text{ W}$

For all parts, use the approximate equivalent circuit with the shunt elements moved directly across the source.

- Find:**
- (a) What is the efficiency when it is serving a load connected to the 2 side at rated voltage and 50% rated current, 0.9 power factor lag?
 - (c) What is the percent Z of this transformer?

(OVER)

Problem #3 (50 points)

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

DC test: $r_1 = 0.9 \text{ Ohm}$

No-load test: $V(\text{line-line}) = 230 \text{ V}$, $I(\text{line}) = 3 \text{ A}$, $P(3\text{-phase}) = 140 \text{ W}$

Blocked rotor test: $V(\text{line-line}) = 42 \text{ V}$, $I(\text{line}) = 12 \text{ A}$, $P(3\text{-phase}) = 680 \text{ W}$

For all parts, use the approximate equivalent circuit with the shunt elements moved directly across the source,

- Find:**
- (a) What is the starting line current of this machine if it is started at rated voltage?
 - (b) What is the line current at a speed of 1160 RPM?
 - (c) What is the torque to the shaft at 1160 RPM?
 - (d) What is the maximum torque this machine can provide to the shaft as a motor when connected with rated voltage?