

Second Hour Exam

April 28, 1995

55 minutes, closed book, closed notes, open mind
work problems in exam books - 25 points each

#1

Synchronous Generator:

Test data for a round rotor, 8 pole, 60 Hz,
3 phase synchronous machine is:

$$\text{O.C. } V_{ll} = 480\text{V} \quad I_L = 0\text{A} \quad I_f = 2\text{A}$$

$$\text{S.C. } V_{ll} = 0\text{V} \quad I_L = 10\text{A} \quad I_f = 0.8$$

How much field current do you need to make
the terminal voltage be 480V (l-l) when it
is loaded as a generator with 9000 Watts
(3 phase) at 0.85 power factor lagging?

#2

Synchronous motor:

A 2 pole, 60 Hz, 3 phase, 230V (l-l) synchronous
motor has zero line current (no load).

When the field current is 1.8 Amps. When
the field current is reduced to zero while
it is unloaded the line current goes up
to 7 Amps.

(a) What is the maximum real power load the motor
can deliver with 3 Amps of field current?

(b) At the maximum loading condition of part
(a) is it overexcited or underexcited? Explain.

#3

DC Generator:

The internal voltage of an unloaded self-excited shunt dc generator is

approximated at 1200 rpm as $E_A = \frac{250 I_{SH}}{3 + I_{SH}}$

The armature resistance is 1Ω

(The residual voltage has been neglected)

- (a) What is the terminal voltage at 1300 rpm if the shunt field resistance is 25Ω and it is loaded with 8 Amps terminal current? (neglect armature reaction)
- (c) If you consider armature reaction, would the correct answer to (a) be higher or lower than what you computed? Explain briefly

#4

DC motor:

Given that a 240V shunt dc motor comes to a no-load speed of 1257 rpm when

$R_{SH} = 80 \Omega$ (Assume $E_A = k \omega I_{SH}$), $R_A = 1 \Omega$

How fast will it go when you load it down with a torque of 20 Nm?