

ECE 333

Second 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, symmetrical, round-rotor, 3-phase, 60 HZ, 6-pole, Y-connected, synchronous generator is being driven at synchronous speed. It delivers 2,160 Watts (3-phase) of real power at 208 Volts (line-line) with 6 Amps of line current and 4.5 Amps of field current. From the open-circuit test, the generator produces this same voltage with a field current of only 3.5 Amps. Use a linear model for this problem and neglect the armature resistance.

Find: The field current needed to maintain the terminal voltage at the given value if the load is slowly changed to be 2,700 Watts (3-phase) at 0.9 power factor lag.

Problem #2 (25 points)

Given: The synchronous machine of Problem #1 is changed into a motor with constant terminal voltage and its field current is changed. When it is mechanically loaded suddenly from 250 to 1300 Watts (3-phase), the torque angle changes by -34 electrical degrees.

Find: The absolute maximum real power (3-phase) that this motor can deliver with this new value of field current.

(OVER)

Problem #3 (25 points)

Given: A self-excited shunt DC generator has a residual voltage of 8 Volts at 1200 RPM when the shunt field current is zero. It has a no-load terminal voltage of 240 Volts when the total shunt field resistance is 150 Ohms and it is driven at 1200 RPM. Use a linear model for this problem and neglect armature resistance.

Find: The value of shunt field resistance necessary to obtain 240 Volts at no-load if it is driven at 1000 RPM

Problem #4 (25 points)

Given: A shunt DC motor has the shunt field winding with rheostat connected directly across the armature with 240 Volts applied. The rheostat is set such that the speed is 1200 RPM at no load. Use a linear model and neglect residual voltage. The armature resistance is 2 Ohms.

Find: The speed in RPM when it is loaded at 7.5 Newton-Meters