The Ohio State University
Department of Electrical Engineering

EE 341

Energy Conversion

Home work Set # 6

Print Your Name

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The Last Four Digits of Your SSN:

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1. Problem 5-3 on textbook (Chapman, page 318)
   A 480-V, 200-kVA, 0.8-PF-lagging, 60-Hz, two-pole, Y-connected synchronous generator has a synchronous reactance of 0.25 Ω and an armature resistance of 0.04 Ω. At 60 Hz, its friction and windage losses are 6kW, and its core losses are 4kW. Assume that the field current of the generator has been adjusted to a value of 4.5 A (**so that the open-circuit terminal voltage of the generator will be about 477 V**).
   (a) What will the terminal voltage of this generator be if it is connected to a Δ-connected load with an impedance of $5/\underline{30}^{o}$ Ω?
   (b) Sketch the phasor diagram of this generator.
   (c) What is the efficiency of the generator at these conditions?
   (d) Now assume that another identical Δ-connected load is to be paralleled with the first one. What happens to the phasor diagram for the generator?
   (e) What is the new terminal voltage after the load has been added?
   (f) What must be done to restore the terminal voltage to its original value?

2. Problem 5-7 on textbook (Chapman, page 319)
   A 13.5-kV, 20-MVA, 0.8-PF-lagging, 60-Hz, two-pole, Y-connected steam-turbine generator has a synchronous reactance of 5.0 Ω per phase and an armature resistance of 0.5 Ω per phase. This generator is operating in parallel with a large power system (infinite bus).
   (a) What is the magnitude of E_A at rated conditions?
   (b) What is the torque angle of the generator at rated conditions?
   (c) If the field current is constant, what is the maximum power possible out of this generator?
   (d) At the absolute maximum power possible, how much reactive power will this generator be supplying or consuming? Sketch the corresponding phasor diagram. (Assume I_F is still unchanged.)