

Tutorial -3 (Electrical Energy Management)

- 1) A 1250 kVA, 3.3kV, 3 phase, 50Hz self excited hydro generator is operating at a speed of 1000rpm. Calculate the number of poles of the generator?
- 2) At a location in India, it is necessary to supply 300 kW of 60-Hz power. The only power sources available operate at 50 Hz. It is decided to generate the power by means of a motor-generator set consisting of a synchronous motor driving a synchronous generator. How many poles should each of the two machines have in order to convert 50-Hz power to 60-Hz power?
- 3) A 200-kVA, 480-V 50-Hz, Y-connected synchronous generator with a rated field current of 5 A was tested, and the following data were taken:
  - (i)  $V_{T,OC}$  at the rated  $I_f$  was measured to be 540 V.
  - (ii)  $I_{L,SC}$  at the rated  $I_f$  was found to be 300 A.
  - (iii) When a dc voltage of 10 V was applied to two of the terminals, a current of 25 A was measured. Find the values of the armature resistance and the approximate synchronous reactance in ohms that would be used in the generator model at the rated conditions
- 4) Three physically identical synchronous generators are operating in parallel. They are all rated for a full load of 3 MW. The no-load frequency of generator A is 51 Hz, and its speed droop is 3.5 percent. The no-load frequency of generator B is 51.5 Hz, and its speed droop is 3 percent. The no-load frequency of generator C is 50.5 Hz, and its speed droop is 2.5 percent.
  - A. (i) If a total load consisting of 7 MW is being supplied by this power system, what will the system frequency be and how will the power be shared among the three generators?
  - (ii) Is this power sharing in (i) acceptable? Why or why not?
  - (iii) What actions could an operator take to improve the real power sharing among these generators?
  - B. Consider two generators of the same size are operating in parallel. What happens (i) if an increase in governor set points on one of them, (ii) if the field current of one generator is increased?
- 5) Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5%, respectively, from no load to full load. The speed changers are so set that the generators operate at 50 Hz sharing the full load of 600 MW in the ratio of their ratings. If the load reduces to 400 MW, how will it be shared among the generators now and what will the system frequency be? The speed changers of the governors are reset so that the load of 400 MW is shared among the generators at 50 Hz in the ratio of their ratings. What are the no load frequencies of the generators.