EE306 Energy Conversion

HW4 Due UT Classes March 12th 2019; MW Classes March 13th 2019

Problem 1:

An 8-pole separately excited DC generator is lap wound with 480 conductors. The magnetic flux and the speed are such that the average EMF generated in each conductor is 2.2 V, and each conductor is capable of carrying a full-load current of 100A . Calculate:

(a) the terminal voltage on no load,
(b) the output current on full load,
(c) the power developed by the armature on full load.

Problem 2:

A4-pole, 500V DC separately excited generator is running at a speed of 450 rpm. Its field and armature resistances are 35 and 0.007 ohms respectively. If the generator is supplying a 750 kW load and the rotational power loss is 12180 W, find:

a) The armature induced voltage,
b) The input power

Problem 3:

A 500 V, 450 rpm, 750 kW, separately excited DC generator operates at rated conditions with a rotational losses of 12180 W. The armature resistance R_a= 0.007 Ω and the field resistance R_f = 35 Ω . Assume that the armature reaction is negligible, then find at rated conditions:

(a) the generated EMF,
(b) the input mechanical power,
(c) the input shaft torque,
(d) the efficiency if the field resistance draws a current of 15A.
(e) if the speed is changed to half rated value without adjustment of field current, find the maximum electrical power output possible without overheating armature winding, i.e., with the same full load armature current.

Problem 4:

A 5-hp 120-V 41-A 1800 r/min shunt dc motor is operating at full load. Its armature resistance is 0.30 ohm, and its field resistance is 120 ohm.

a) What is the efficiency of this motor? What is its total rotational loss?

b) Assuming constant rotational losses and a linear magnetization curve, what will the machine's speed be after a 1 percent increase in field resistance?

Problem 5:

A 250 V DC shunt motor has an armature resistance of 0.25 ohms and a variable field resistance. At a certain loading condition, the motor’s generated (induced) voltage is 245 V. Find what will be the motor’s new armature current when there is 1% decrease in the flux value?