EE 306: Electromechanical Devices - Semester 161

Homework #4

Problem 1

A separately excited DC generator has six poles and is running at 1150 rpm. The armature has 120 slots with 8 conductors per slot and is connected as lap winding. The generated voltage in each conductor is 1.5 V and each conductor can carry a full load current of 4 A. Determine:

a. The terminal voltage on no load,
b. The output current on full load,
c. The required flux per pole,
d. The power developed by the armature on full load.

Repeat the calculations for wave-connected armature.

Problem 2

An 8-pole DC shunt generator running at 500 rpm is supplying a load of 5 kW at 250 V. The armature resistance Ra = 0.24 Ω and the field resistance Rf = 250 Ω. Find:

a. The load, field, and armature currents,
b. The generated EMF,
c. The developed power and torque,
d. The input mechanical power (rotational losses are 645 W)

Problem 3

A DC Shunt motor of 250 V as input voltage has an armature resistance of 0.2 Ω and a field resistance of 110 Ω. While running at no load the motor consumes 1000 W at a speed of 1100 rpm. The full load input power is 14 kW at 250 V. (Armature reaction is neglected)

a. Find the motor rotational losses
b. Estimate the full load motor speed

c. Calculate the motor speed regulation
d. What will be the motor converted power and induced torque
e. Find the motor efficiency

Problem 4

A 240 V, short shunt cumulative compound generator is rated at 100 A. The shunt field current is 3 A. It has an armature resistance of 50 mΩ, a series field resistance of 10 mΩ and a rotational loss of 2 kW. When the generator is supplying the full load at the rated voltage, determine:

a. The generated voltage
b. The magnitude of the shunt field resistance
c. The developed power
d. Efficiency