

**KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT**

EE 306 – Term 192

HW # 4: DC Machines

Due Date: (UT-Classes, March 22, 2020; MW-Classes, March 23, 2020)

Problem # 1:

A 220 V shunt motor has armature and field resistance of 0.2Ω and 220Ω respectively. The motor is running at 1000 rpm and drawing 10 A current from the supply to drive a constant load torque. Calculate the new speed and armature current if an external armature resistance of value 5Ω is placed in the armature circuit. Neglect armature reaction and saturation.

Problem # 2:

Separately excited dc generator is rated for a load voltage of 150 V for a full load current of 20 A at 1500 rpm. With the load disconnected, the output voltage is 160 V.

a. Determine the voltage regulation, the load resistance, the armature resistance, and the developed torque at full load.

b. The speed of the generator is decreased to 1200 rpm, and the load resistance is unchanged. Determine the load current, the load voltage, and the developed power.

Problem # 3:

A shunt-connected 5-hp dc motor is rated for operation at $V_T=200$ V, $I_L=23.3$ A, and $n_m=1500$ rpm. Furthermore, $I_F=1.5$ A and $R_A=0.4 \Omega$. Under rated conditions find:

- A. the input power;
- B. the power supplied to the field circuit;
- C. the power lost in the armature resistance;
- D. the rotational loss;
- E. the efficiency

Problem # 4:

A 240V series motor. The armature resistance is 0.42Ω and a series field resistance is 0.18Ω . The speed is 500rev/min when the current is 36A. What is the motor speed when the load reduces the line current to 21A. Assume 3V brush drop and the flux is proportional to the current.

Problem # 5:

A long-shunt DC generator running at 1000 rpm supplies 22 kW at a terminal voltage of 220 V. The armature, shunt, and series resistances are 0.05, 110, and 0.06Ω respectively. The efficiency of the generator is 88%. Find: -

- (a) Copper loss
- (b) Rotational loss
- (c) Input torque