

King Fahd University of Petroleum & Minerals
Electrical Engineering Department

EE306 Problem session # 2 2014/2015 141

P1:

A 150-kVA, 2400 / 240-V, 60-Hz, transformer has the following equivalent circuit parameters:

$$\begin{array}{ll} R_c = 10000 \Omega & X_m = 1550 \Omega \\ R_1 = 0.2 \Omega & R_2 = 0.002 \Omega \\ X_1 = 0.45 \Omega & X_2 = 0.0045 \Omega \end{array}$$

The transformer delivers the rated load at 240 V and 0.8 power factor lagging. Use the approximate equivalent circuit referred to the primary to calculate the primary voltage, voltage regulation, and the transformer efficiency.

P2:

A 10-kVA, 450 / 120-V, 60-Hz, transformer gives the following test results:

Open circuit test (HV side open): 120V, 4.2A, 80W
Short circuit test (LV side short): 9.65V, 22.2A, 120W

- (a) Derive the approximate equivalent circuit referred to the high-voltage side.
- (b) Determine the voltage regulation at full load and 0.8 PF leading.
- (c) Determine the efficiency at 50% of full load and 0.8 PF lagging.

P3:

A Dc machine generator is rated 10 kW, 250V, 1750 rpm and has armature and field winding resistances of 0.2 and 125, respectively. The machine is self-excited and delivers rated load when driven at 1750 rpm. The rotational loss is 450W. Neglect the effects of armature reaction. Calculate:

- (a) The generated voltage.
- (b) The developed torque.
- (c) The voltage regulation.
- (d) The efficiency of the generator.

P4:

The no load saturation curve for a generator operating at 1800 rpm is given by the following data

Field current(A)	0	0.5	1	1.5	2	3	3.5	4.0	5	6
E.M.F.(volt)	8	40	74	113	152	213	234	248	266	278

- a) Plot the no-load saturation curve (OCC) for 1500 rpm.
- b) Calculate the generated voltage when the generator is operating on no-load with a field current of 4.6A and at a speed of 1000 rpm.
- c) What is the field current required to generate 120 V on no-load when the generator is operating at 900 rpm?

P5:

A 220-V shunt motor has armature and field winding resistance of 0.15Ω and 110Ω, respectively. At full load, the armature draws a line current of 5A while running at 1200rpm on no load. When driving a load, the input to the motor is 12kW. Calculate:

- (a) The speed of the motor.

- (b) The developed torque.
- (c) The efficiency of the motor at this load.

P6:

A DC series motor is rated 230V, 12hp, and 1200rpm. It is connected to 230V supply, and it draws a current 40A while rotating 1200rpm. The armature and series field winding resistance are 0.25Ω and 0.1Ω , respectively.

- (a) Determine the power and torque developed by the motor.
- (b) Determine the speed, torque, and power if the motor draw 20A.