King Fahd University of Petroleum & Minerals

Electrical Engineering Department

EE306 Problem session # 2 2013/2014 132

P1:

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

R_c= 10000 Ω X_m= 1550 Ω

R_1= 0.2 Ω R_2= 0.002 Ω

X_1= 0.45 Ω X_2= 0.0045 Ω.

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

P2:

Repeat P1 using the approximate equivalent circuit referred to the primary. Compare the results with those of P1.

P3:

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.

P4:

A Dc machine 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.

P5:

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?