King Fahd University of Petroleum and Minerals

Homework 3

EE-306 – Electromechanical Devices - Semester 172

Submission Deadline: 11 March 2018 (ST classes) & 12 March 2018 (MW classes)

Note: You must submit this cover page along with your solution

Student Name	ID	Sr. #	Section

Total Marks Obtained ‖   /   ‖

Problem 1 [4+1+4+1 = 10 points]

A single-phase distribution transformer of 100 kVA, 1000/100 V, 60 Hz has been tested for open and short circuit tests and the following data are recorded:

Test	Voltage (V)	Current (A)	Power (W)
Open-Circuit (Heavy Voltage Side Open)	100	6	400
Short-Circuit (Low Voltage Side Shorted)	50	100	1800

(a) Determine the approximate equivalent circuit parameters of this transformer referred to the high-voltage side.

(b) Draw and label the circuit clearly with all given and calculated variables.

(c) Determine the voltage regulation at full load with 0.6 PF leading.

(d) Draw the corresponding phasor diagram.

Problem 2 [10 points]

A 150 kVA, 2400/240 V transformer has the following parameters referred to the primary side: $R_{eq} = 0.5 \ \Omega$ and $X_{eq} = 1.5 \ \Omega$. The shunt magnetizing impedance is very large and can be neglected. At full load, the transformer delivers rated kVA at 0.85 PF lagging and the secondary voltage is 240 V.

Determine the efficiency of the transformer assuming core losses amount to 600 W.

Problem 3 [4+2+2+2 = 10 points]

A single-phase transformer of 30 kVA, 2400/240 V, 60 Hz, has the following characteristics:

Core losses = 400 W
Copper losses at Full-Load = 1200 W

(a) Determine the efficiency of the transformer at 70% of rated output power with 0.7 PF leading

(b) Determine the output power at which **maximum efficiency** occurs

(c) Determine the value of **maximum efficiency**

(d) Determine the percentage of full load power where **maximum efficiency** occurs

!End of Homework Problems!