Menoufiya University
Faculty of Engineering
Shebin El-Kom
First Semester Examination
Academic Year: 2013-2014

Minufiya University

Year: 2014
Department: Electrical Engineering
Subject: Theories of Electrical Machines, ELE 602
Time Allowed: 3 hours
Date: 21/1/2014

Allowed Tables and Charts: None

Answer the following:

Question (1) ***(20 Marks)***

Transform the balanced two – phase induction machine of Figure 1 to axes stationary relative to the stator as shown in Figure 2.

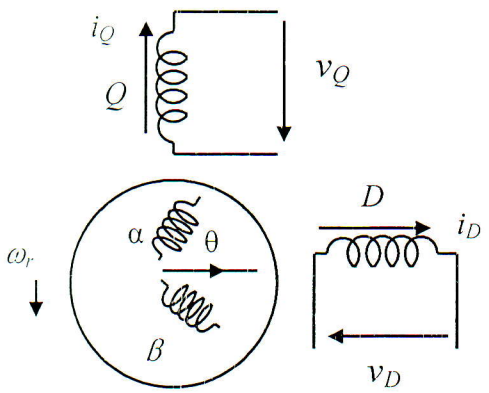

Figure 1

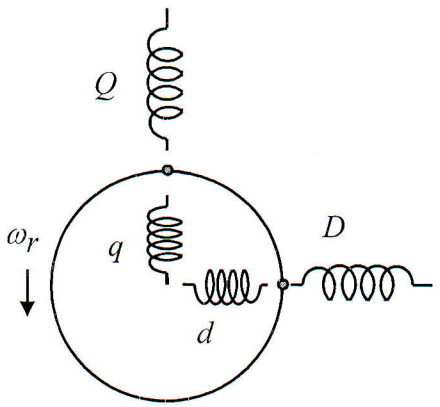

Figure 2

Question (2) ***(20 Marks)***

A 500 V, three phase 50 Hz, 8 pole, star connected induction motor has the following equivalent circuit parameters: $R_1 = 0.13\ \Omega$, $R_2 = 0.32\ \Omega$, $x_1 = 0.6\ \Omega$, $x_2 = 1.48\ \Omega$ and the magnetizing branch admittance $Y_m = 0.004 - j\,0.05\ \Omega^1$ referred to primary side (the stator). The full load slip is 5%. Determine the full load electromagnetic torque, stator input current and power factor using both the *"approximate"* and the *"exact"* equivalent circuits as well as the general machine theory if the effective (stator/rotor) turns ratio per phase is $k = 1/1.57$ and mechanical loss is to be neglected.

Question (3) ***(20 Marks)***

Calculate the torque of a 3 – phase, 4 - pole induction motor, 50 Hz when it is fed from: (i) symmetrical 3 phase 400 V supply at 0.05 slip, (ii) asymmetrical 3 phase voltages to neutral, and running with the same speed where the three voltages are $V_a = 240\angle 0^\circ$, $V_b = 183\angle 229^\circ$, $V_c = 183\angle 113^\circ$, and motor parameters are $X_s = X_r^{'} = 4\,\Omega$, $R_s = R_r^{'} = 1\,\Omega$, $X_m = 100\,\Omega$.

Question (4) ***(20 Marks)***

Let us consider a certain synchronous generator having X_d = 0.9 p.u. and X_q = 0.6 p.u. is operating at full load, 0.8 pf lagging. It is required to calculate the excitation E_f in terms of the terminal voltage, the load angle δ, and the value of I_d and I_q by means of the classical method and the general machine method. Neglect armature resistance and saturation.

Question (5) ***(20 Marks)***

The salient pole, two phase synchronous machine of Figure 3 is transformed into stationary axes as shown in Figure 4, write the transient voltage equation in matrix form for Figure 4.

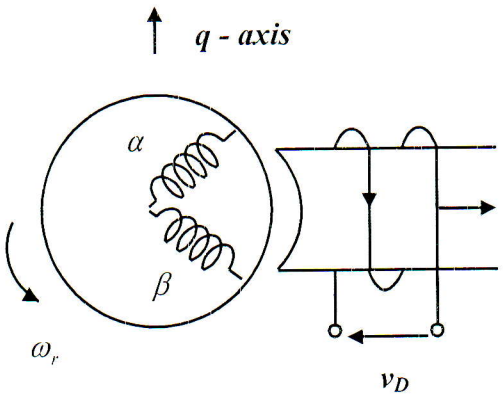

Figure 3

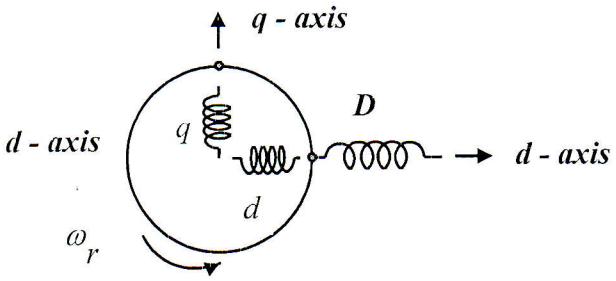

Figure 4

Good Luck Every One

This exam measures the following ILOs

Question number	1	2	3	4	5
Ilos	a1-1, a3-1	b1-2, b2-1	C4-1	b1-2, b2-1	a1-1, a3-1, d2-1