Kafrelsheikh University
Faculty of Engineering
Final Exam of 1st semester-2015-2016
Department of Electrical Engineering
Subject: **Electrical Machine3 (I.M.)** course code: EPM4116 Full Mark: 100 Marks
Year: Fourth Electrical Power (R.2007) Number of pages: 2 Time allowed: 3 hours
Exam Date: 23/1/2016

Answer as much as you can

Q1: (20 Marks)

a) Show that a rotating magnetic field can be produced by the use of 3-phase currents of equal magnitude.

b) A 3-phase, 50 Hz induction motor has a starting torque which is 1.25 times full-load torque and a maximum torque which is 2.5 times the full-load torque. Neglecting stator resistance and rotational losses and assuming constant rotor resistance, find: (i) Slip at maximum torque; (ii) The slip at full-load; (iii) The current at starting in per unit of full-load current.

Q2: (15 Marks)

A 3-phoce, 400 V, 5.6 kW, 4-pole, 50-Hz has a wound rotor, the ratio of primary to secondary turns on rotor is 2.62 / 1. When running light on 400 V. it took a current of 6 amperes at 0.087 power factor, and on standstill with the rotor locked, and an applied voltage of 100 V, the current taken was 12 A at a power factor of 0.347. The stator resistance /phase is 0.67 Ω and of rotor is 0.185 Ω. Determine: (i) Full-load current, (ii) Full-load slip, (iii) Full-load power factor, (iv) Ratio of maximum torque to full-load torque, and (v) Maximum power.

Q3: (20 Marks)

a) Explain the phenomena of cogging and crawling of induction motor

b) A 400 V, 50-Hz, induction motor, when started directly from the mains takes 4 times the full-load current and the torque produced is twice the full-load torque. Determine: (i) The motor current, the line current and the starting torque when started by means of an auto- transformer of ratio 2.5: 1. (ii) The voltage to be applied and the motor current if the full-load torque is to be obtained at starting.

Q4: (15 Marks)

a) What is Dynamic Braking? How can we harness it?

b) Design the five sections of a 6-stud rotor starter for a 3-phase wounded rotor induction motor. The slip at full load is 2% and the starting current is 1.5 times the full load current. The resistance of the rotor is 0.02 Ω/phase.

Q5: (15 Marks)

In a double cage induction motor if the outer cage has an impedance at standstill of (2+ j 1.2) Ω, determine the slip at which the two cages develop equal torques if the inner has an impedance of (0.5 + j 3.5) Ω at standstill.

Q6: (15 Marks)

A 415 V, 3-phase, 50 Hz, 6-pole delta connected induction motor has a specific magnetic loading of 0.5 Wb/m2 and specific electric loading of 24000 A/m. the stator core diameter and length are 0.275 m and 0.15 m respectively. Find the output of the machine if the full load efficiency and power factor are 0.88 and 0.89 respectively. Determine the number of stator slot, conductor per slot and the length of air gap.

With my best wishes
Dr. Eng./Mohamed I. Abd EL_Wanis