Kafrelsheikh University Final Exam of 1st semester-2019-2020
Faculty of Engineering 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: 6/1/2020

This exam measure the following ILOS (a.4,13,14 b.11,12,14,15, c.3,16,17, and d.1,2)
Please, answer all of them; assume any missing data; manage your time.

Q1: (20 Marks)

a) What are the essential differences between 3-phase induction motor and a transformer? [7 Marks]

b) A 3-phase induction motor having a 6-pole, Y, 240 V, 50 Hz. The rotor resistance and standstill reactance are 0.12 Ω and 0.85Ω, respectively. The ratio of stator to rotor turns is 1.8. Full load slip is 4%. Calculate the T_d at full load, T_{max}, speed at T_{max}. [13 Marks]

Q2: (15 Marks)

a) What are the advantages of slip-ring induction motors over the squirrel cage motors? [5 Marks]

b) An induction motor has an efficiency of 0.9 when developing an output of 37 kW. At this load, the stator cu loss and rotor cu each equals the stator iron loss, the mechanical losses are one third of the no load loss. Calculate the slip. [10 Marks]

Q3: (20 Marks)

a) Prove that the locus of extremity of current drawn by a three phase induction motor under variable load conditions is a circle. [5 Marks]

b) A 3-phase, 400 V, induction motor gave the following test readings

No-load: 400 V, 1250 W, 9A.

Short-circuit: 150 V, 4 kW, 38 A.

Draw the circle diagram, if the normal rating is 14.9 kW, find from the circle diagram the full load current, pf, and slip. [15 Marks]

Q4: (15 Marks)

a) What are the functions of outer and inner winding of double cage construction? [5 Marks]

b) A 15 hp, three phase , 6-pole, 50 Hz, 400 V, Δ connected induction motor runs at 960 rpm on full load. If it takes 86.4 on direct starting, find the ratio of starting to full load torque with a Y-Δ starter. Full load efficiency and power factor are 88% and 0.85 respectively. [10 Marks

Q5: (15 Marks)

a) Why is the power factor of a 3-phase induction motor low at no-toad? [5 Marks]

b) Two 50 Hz, 3-phase induction motors having six and four poles respectively are cumulatively cascades, the 6-pole motor being connected to the main supply. Determine the frequencies of the rotor currents and the slips referred to each stator field if the set has a slip of 2 percent. [10 Marks]

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Q6: (15 Marks)

In squirrel cage rotor induction motor design, how you can calculate the following: the number of rotor bears, the bar current, cross section area, end ring current and what is shape of current distribution in squirrel cage rotor, the end ring area, and copper loss in end ring. [15 Marks]

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