



## COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Control Engineering

Lecturer : Dr. Ahmed Kadry Abdelsalam

Course : Electrical Machines 2

Course Code : EE 322

Marks : 40

Date : 11/1/2016

Time : 2 hour

### Final Exam

Answer all the following questions

Q1 [10 marks]

A 50 kVA 11000/380 v, 50 Hz step down transformer has:

- Primary winding resistance of  $2 \Omega$ ,
- Secondary winding resistance of  $0.01 \Omega$ ,
- Primary winding inductance of  $0.03 \text{ H}$ ,
- Secondary winding inductance  $0.0015 \text{ H}$ ,
- Core loss resistance  $20000 \Omega$ , magnetizing reactance  $15000 \Omega$

At 80% loading and 0.86 lag power factor, calculate using the first approximate equivalent circuit:

- Secondary current
- Primary current
- Primary voltage
- Input power factor
- Copper loss
- Core loss
- Input power
- Output power
- Efficiency
- Sketch the transformer phasor diagram of the first approximate equivalent circuit

Q2 [5 marks]

A 120V Three phase IM 6 pole delta connected has a stator impedance of  $0.1+j0.15 \Omega$  per phase and an equivalent rotor impedance at standstill of  $0.2+j0.25$ .

At a slip of 0.286, calculate the (i) stator line current, stator copper loss, air-gap power, rotor copper loss, developed power and output power. Take the core loss of 300W and friction loss of 100W.

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**Q3 [5 marks]**

A test data for a 208V, 60Hz, Y connected IM rated at 1710rpm is as follows

No load test	450W	1.562A	208V
Locked rotor test	59.4W	2.77A	27V

Calculate the IM parameters referred to the stator side.

**Q4 [5 marks]**

Three phase 208 volt, 60Hz, 8 pole, star-connected, induction motor has negligible stator impedance of  $0.02 + j0.08 \Omega$ /phase at standstill (machine speed is zero). Determine:

- (a) Slip at maximum torque
- (b) Maximum torque
- (c) Starting torque
- (d) For a constant load of  $0.55T_{max}$  is applied, deduce if the machine will run or fails.

**Q5 [5 marks]**

Compare between the following

- (i) Autotransformer stator voltage control
- (ii) voltage/frequency control
- (iii) Y/ $\Delta$  starter

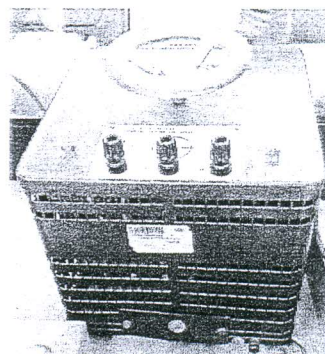
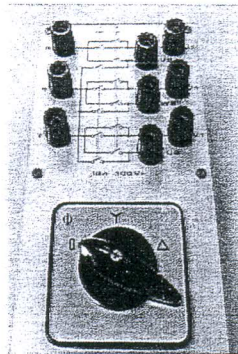
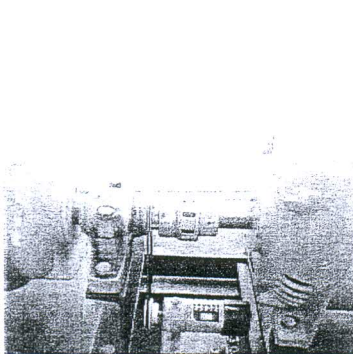
from the following points of view

- (1) theory of operation, (2) starting torque, (3) maximum torque and (4) losses

Also draw the TORQUE-SLIP characteristics for each control technique

**Q5 [10 marks]**

State the name of the following devices and its function



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