

**University of Technology-Electromechanical Engineering Dept.**  
**Final Exam-First Attempt – 2013-2014**

Class: 3<sup>rd</sup> year

Subject: Synchronous and Special machines

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Time: 3 hours

Date: 15 / 6 / 2014

Notes: 1- Answer Five questions only.

2- 12 Marks For any question, 8 for A & 4 for B

Name:

ID No.

Signature

**Q1 A):** A three phase synchronous generator contains (108) slots, 1620 conductor, 12 poles, Y-connected. Find:

- 1-Rotor speed at Frequency 50 Hz.
  - 2-The line E.M.F is generated at No-Load if the magnetic flux in air gap 0.028 Weber/pole and full pitch coil
  - 3-The magnetic flux is required the generate EMF (3KV) at frequency 60 Hz.
- B)** Explain construction, operation and characteristics of hysteresis motor?

**Q2:** A four pole ,115 V ,60 Hz ,1710 rpm ,capacitor start single phase induction motor has the following parameters :  $R_1=1.5 \Omega$ ,  $\bar{R}_2=1 \Omega$ ,  $X_1=2.6 \Omega$ ,  $\bar{X}_2=1.6 \Omega$ ,  $X_m=40 \Omega$ . If the rotational losses 40 watt. Find the following:

- 1-Slip 2-Stator current 3-Converted power 4- Shaft torque 5- The efficiency.

**Q3:A)** A 74.6 Kw ,440 V , $\Delta$  connected ,3 $\phi$ ,4-pole ,50 Hz synchronous motor has armature resistance  $0.22 \Omega$  and synchronous reactance  $3\Omega$ . The line current of motor at rated condition is (136 A) .Find:1-The input power 2-The rotation speed, and 3-Gross torque. (NOTE: Iron, friction and excitation losses are neglected).

**B)** Plot the phasor diagram of a non-salient pole synchronous generator.

**Q4:A):** A 3- $\phi$  ,600 KVA ,3.3 KV ,Y- connected Synchronous generator having armature resistance  $0.37 \Omega/\text{phase}$  .find the synchronous reactance of the generator if the full load at unity power factor and the no load EMF voltage is increased 165 V on the terminal line voltage .

**B)** Drive the equation of mechanical power developed by synchronous motor?

**Q5: A)** A) 208V, 11.19Kw,  $\Delta$ connected, 8pole,60 Hz,synchronous motor has  $X_s=2.5\Omega/\text{phase}$ ,  $R_a=0.2 \Omega/\text{phase}$ . Its friction and windage losses (1.5kw) and iron losses (1kw ) at 0.8 leading power factor. Find:- 1- Armature current 2- Back EMF/phase 3-Load angle 4-What type of excited in this case.

**B)** What type of motor would you select to perform each of following jobs? Why?

- 1-Vacuum Cleaner. (Universal motor, hysteresis motor, capacitor start motor).
- 2-Clock. (split motor, universal motor , hysteresis motor)
- 3-Air conditioner compressor. (Universal motor, hysteresis motor, capacitor start motor)

**Q6A):** 480V, 1MVA, 60Hz, Y- connected, 4 pole , synchronous generator, has direct axis reactance  $0.1 \Omega$  and quadrature axis reactance  $0.075 \Omega$  . Determine the power due to excitation and due to saliency of the machine at full load and the power factor 0.8 leading. (Neglect armature resistance).

**B):** Explain the construction of: 1-Shaded pole motor 2-Reluctance motor.

**Good luck**