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| **Menoufia University**<br>**Faculty of Engineering, Shebin El-Kom**<br>**Electrical Engineering Dep.**<br>**Academic Year: 2015-2016**<br>**First Semester** | **Subject/Code:Electrical Machines(2)/ELE 312**<br>**Time Allowed : 3 hours**<br>**Exam Date : 9 / 1 / 2017**<br>**Total Marks : 100 marks** |

**Allowed Tables and Charts: (None)**

*Answer all of the following*

| | *Question no.1* | 20 |
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| *a)* | A synchronous generator, which is synchronized and connected to 11000 V, 50 c/s infinite bus bars, has to supply 3000 kW at 0.8 lagging power factor. It has a synchronous reactance of 15 Ω and an armature resistance of 1 Ω. Find:<br>***(i)*** The value of the machine E.M.F in this case, and<br>***(ii)*** The value of E.M.F at which the machine would supply the same power at unity power factor.<br>***(iii)*** If the excitation voltage in *(ii)* is decreased by 25%, find the maximum power and the corresponding current and power factor which the machine would deliver to the bus bars before it breaks out of synchronism. | 15 |
| *b)* | Discuss and draw the constant power loci of armature current and excitation voltage of the synchronous generator. | 5 |

| | *Question no.2* | 15 |
|---|---|---|
| *a)* | Two identical alternators operating in parallel have the following data:<br>The first alternator: rated power 2500 kW , frequency drops from 60 Hz at no- load to 58 Hz at full-load.<br>The second alternator: rated power 2500 kW , frequency drops from 60 Hz at no- load to 57.5 Hz at full-load.<br>Speed regulation of prime-movers is linear in each case, calculate:<br>***(i)*** How a total load of 4000 kW is shared by each alternator.<br>***(ii)*** The operating bus-bar frequency.<br>***(iii)*** The maximum load that these two units can deliver without overloading either of them. | 10 |
| *b)* | Define the voltage regulation of an alternator. With the aid of the phasor diagrams, discuss the factors which affected on it. | 5 |

| | *Question no.3* | 15 |
|---|---|---|
| *a)* | A 6600 V, 3-phase, Y-connected synchronous motor draws a full-load of 80 A at 0.8 power factor leading. The per phase armature resistance is 2.2 Ω and synchronous reactance 22 Ω. If the constant losses of the machine are 3200 W, calculate :<br>***(i)*** The induced emf.<br>***(ii)*** The output power.<br>***(iii)*** Efficiency. | 10 |
| *b)* | Explain how the synchronous motor can be started and driven the mechanical load. | 5 |

***Question (4)***

**(4-a) Explain a starting method for three phase wound rotor induction motor. ( 6 Marks)**

**(4-b) Draw the circle diagram of a 10-hp, 200-V, 50 Hz, 3 phase slip ring induction motor with a star connected stator and rotor. The winding ratio is unity. The stator resistance is 0.38 ohm and the rotor resistance is 0.24 ohm. The tests readings are; No-Load: 200-V, 7.7-A, 0.195 pf, Short-circuit: 100-V, 47.6-A, 0.454 pf. Find; (a) starting torque. (b) maximum torque and its slip. (c) maximum power factor. (d) maximum output power. ( 10 Marks)**

***Question (5)***

**(5-a) Discuss a suitable method of speed control for three phase squirrel cage induction motor loaded by a fan load. ( 6 Marks )**

**(5-b) Draw the circle diagram of a 10-hp, 200-V, 50 Hz, 3 phase slip ring induction motor with a star connected stator and rotor. The winding ratio is unity. The stator resistance is 0.38 ohm and the rotor resistance is 0.24 ohm. The tests readings are; No-Load: 200-V, 7.7-A, 0.195 pf, Short-circuit: 100-V, 47.6-A, 0.454 pf. Find; (a) starting torque. (b) maximum torque and its slip. (c) maximum power factor. (d) maximum output power. ( 10 Marks)**

***Question (6)***

**(6-a) Discuss the operation and characteristics of single phase induction motor type who has a higher starting torque. (6 Marks)**

**(6-b) Discuss the operation and characteristics of deep bar induction motor. (6 Marks)**

**(6-c) Discuss the operation and characteristics of AC series motor. (6 Marks)**

**Good Luck .....Prof. Dr. Fathy Abdel Kader**

**Prof. Dr. Salwa Tahoun**