Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE – SEMESTER V • EXAMINATION – WINTER - 2012**

**Subject code: 152404 Date: 16-01-2013**

**Subject Name: Electro Mechanical Energy Conversion - II**

**Time: 02:30 pm to 05:00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1 (a)** Fill in the blanks. **07**

1) Of the following statements concerning parallel operation of transformers, statement ___ is not correct.
   a) Transformers must have equal voltage ratings
   b) Transformers must have same ratio of transformation
   c) Transformers must be operated at the same frequency
   d) Transformers must have equal kVA ratings.

2) In a 3-phase induction motor, the relative speed of stator flux with respect to _____ is zero.
   a) Stator winding b) Rotor
   b) Rotor flux d) Space

3) Effect of increasing the length of air-gap in an induction motor will be to increase the _____.
   a) Power factor b) Speed
   b) Magnetizing current d)Air-gap flux.

4) The starting winding of a 1-phase induction motor is placed in _____.
   a) Rotor b) stator
   c) Armature d) field

5) The angle between the synchronously-rotating stator flux and rotor poles of a synchronous motor is called _____ angle.
   a) Synchronizing b) torque
   c) Power factor d) slip

6) The step angle of a permanent magnet stepper motor having 8 stator poles and 4 rotor poles is ___.
   a) 60 b) 45 c) 30 d) 15

7) _____ motor would be suitable where constant speed is absolutely essential to ensure a constant product.
   a) Induction motor
   b) stepper motor
   c) Permananent magnet synchronous motor
   d) Brushless dc motor

**(b)** Explain Torque – speed characteristics of Induction motor and explain **07**

different types of torque.

| | | | |
|---|---|---|---|
| **Q.2** | **(a)** | What are the effects of change in Excitation on armature current and power factor of synchronous motor ? Use necessary vector diagrams to support your answers. | **07** |
| | **(b)** | Explain working principle of Universal motor and draw its characteristics. | **07** |
| | | **OR** | |
| | **(b)** | Derive the expression for starting torque of an induction motor and also find out the condition for being it maximum. | **07** |
| **Q.3** | **(a)** | A 120-kVA, 6000 / 400-V Y/Y 3-ph, 50Hz transformer has an iron loss of 1,600 W. The maximum efficiency occurs at 3 /4 full load.<br>Find the efficiencies of the transformer at<br>a) Full-load and 0.8 power factor<br>b) Half of full-load and unity power factor. | **07** |
| | **(b)** | Why a 1-phase Induction motor is not self starting ? How it is made self-starting ? | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | A 746-kW, 3-phase , 50Hz, 16-pole induction motor has a rotor impedance of (0.02 + j0.15) ohm at standstill. Full load torque is obtained at 360 r.p.m. Calculate –<br>a) The ratio of maximum to full-load torque<br>b) The speed of maximum torque<br>c) The rotor resistance to be added to get maximum starting torque. | **07** |
| | **(b)** | Explain different types of magnetic materials. | **07** |
| **Q.4** | **(a)** | Give comparison between induction motor and synchronous motor. | **07** |
| | **(b)** | Explain blocked rotor test of an induction motor. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the No-Load test of an induction motor. | **07** |
| **Q.4** | **(b)** | Explain Scott Connection of 3-phase transformers. | **07** |
| **Q.5** | **(a)** | i) What is plugging of an induction motor ? | **03** |
| | | ii) Write a short note on Y / Δ connection. | **04** |
| | **(b)** | A 500kVA, 3-phase, 50Hz transformer has a voltage ratio (line voltages) of 333/11kV and delta/star connected. The resistance per phase are : high voltage side35 ohm, low voltage side 0.0876 ohm and iron loss is 3050W. Calculate the value of efficiency at full-load and unity power factor. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | i) what is an induction generator ? | **03** |
| | | ii) Write a short note on Δ / Y connection. | **04** |
| | **(b)** | A 3-phase, 400V star connected induction motor has a star connected rotor with a stator to rotor turn ratio of 6.5. The rotor resistance and standstill reactance per phase are 0.05 ohm and 0.25 ohm respectively. What should be the value of external resistance per phase to be inserted in the rotor circuit to obtain maximum torque at starting ? | **07** |

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