Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014**

**Subject code: 714504N** **Date: 05-12-2014**

**Subject Name: Modeling and Analysis of Electric Machines**

**Time: 10:30 am - 01:00 pm** **Total Marks: 70**

**Instructions:**

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

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|---|---|---|---|
| **Q.1** | **(a)** | For a doubly excited magnetic system, derive the relation for the magnetic stored energy in terms of reluctance. | **07** |
| | **(b)** | Obtain the equivalent d-q model of induction machine in rotor reference frame. Support your answer with necessary diagrams. | **07** |
| **Q.2** | **(a)** | Obtain the expression of torque in terms of flux linkages and d-q currents for Synchronous rotating reference frame. | **07** |
| | **(b)** | Derive winding inductance and voltage equations for three phase synchronous machine. | **07** |
| | | **OR** | |
| | **(b)** | Explain the significance of Park's transformation in the analysis of synchronous machines. | **07** |
| **Q.3** | **(a)** | Explain generalized theory of rotating electrical machine and Kron's primitive machine. | **07** |
| | **(b)** | Explain the computer simulation of three phase symmetrical induction machine in balanced stator and rotor condition in arbitrary reference frame. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Derive winding inductance and voltage equations for three phase symmetrical induction machine. | **07** |
| | **(b)** | Explain the computer simulation of three phase synchronous machine into rotor reference frame using suitable block diagram. | **07** |
| **Q.4** | **(a)** | Write the voltage equations in the capacitive and resistive elements together. Determine the voltages in qd0 frame and hence obtain the impedance matrix into qd0 frame. | **07** |
| | **(b)** | Draw and explain the steady state operating characteristics of a shunt connected DC machine with constant source voltage. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Draw and explain the steady state torque speed characteristic of a singly excited induction machine. Discuss the effect of frequency on the steady state torque speed characteristic. | **07** |
| | **(b)** | Describe Ward Leonard system. Prepare time domain block diagram for same. | **07** |
| **Q.5** | **(a)** | Explain the mathematical model of switch reluctance motor. | **07** |
| | **(b)** | Derive the torque speed characteristics of Brushless DC Machine and define common mode of operation. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Explain electromechanical energy conversion process in electric drives. | **07** |
| | **(b)** | Derive voltage and torque equation of Brushless DC Machine in machine variables and in rotor reference frame variables. | **07** |

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