

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1720701

Date: 24-12-2013

Subject Name: Advanced Electrical 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.

Q.1 (a) Compare conventional DC machine and Brushless DC Machine. Discuss uni-polar and bi-polar converters used to control BLDC Motor. 07

(b) Discuss the construction and working of a brushless DC motor. State its applications 07

Q.2 (a) State different types of stepper motor. Discuss various modes of variable reluctance stepper motor operation. 07

(b) A switched reluctance can not have the equal number of stator and rotor poles. Justify. Discuss any one of its converter and speed control. 07

OR

(b) Develop the equivalent circuit of two magnetically coupled circuits with the derivation of relevant flux, flux linkage, inductances, mutual inductance etc. 07

Q.3 (a) Discuss the construction and working of a Linear induction motor. Compare the conventional Induction motor and Linear induction motor. 07

(b) Explain the concept of condition monitoring. 07

OR

Q.3 (a) Discuss fault detection techniques and suggest diagnosis methods for a transformer. 07

(b) Discuss some of the special design features and benefits of an energy efficient motor. 07

Q.4 (a) A 2-pole synchronous machine is carrying balanced 3-phase armature currents: $i_a = \sqrt{2} I_a \cos \omega t$, $i_b = \sqrt{2} I_a \cos(\omega t - 120^\circ)$, $i_c = \sqrt{2} I_a \cos(\omega t + 120^\circ)$. The rotor is rotating at synchronous speed ' ω ' and the direct axis is aligned with the stator phase -a at time $t = 0$. Find the direct and quadrature axis current components. 07

(b) Define the basic rule of electromechanical energy conversion. Derive the expression for energy stored in a magnetic field. 07

OR

Q.4 (a) Discuss the fixed speed and variable speed wind mills. State the role of a capacitor bank in a Sq. cage induction generator connected with an isolated load. 07

(b) Explain any two static VAR compensators suitable to wind mills. 07

Q.5 (a) What is the significance of transformation equations in a reference-frame? Carry out transformation of a balanced set from (a,b,c) to (d,q,0) reference frame. 07

(b) Derive the voltage and winding inductance equations of an induction machine. 07

OR

Q.5 (a) State advantages and disadvantages of Hybrid stepper motor. A single-stack, 8 phase (stator) multipole, stepper motor has 6 rotor teeth. The phases are excited one at a time. Determine (i) step size, (ii) steps per revolution, (iii) speed, if excitation frequency is 120 Hz. 07

(b) Discuss direct saving and pay back analysis of energy efficient motor. 07
