Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1720701 Date: 16-06-2014

Subject Name: Advanced Electrical Machines

Time: 02:30 pm - 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)** Justify that BLDC machine is AC machine. Explain working of BLDC machine with 120^0 conduction. **07**

(b) The transformation for a two phase set to arbitrary reference frame is: **07**

$f_{qds} = K_{2s}\, f_{abS}$, Where $[f_{qds}]^T = [f_{qs} \quad f_{ds}]$ and

$[f_{abs}]^T = [f_{as} \quad f_{bs}]$; $K_{2s} = \begin{bmatrix} \cos\theta & \sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$ And

$\theta = \int_0^t \omega(x)\, dx + \theta$ Show that $f_{as}^{\,2} + f_{bs}^{\,2} = f_{qs}^{\,2} + f_{ds}^{\,2}$

Q.2 **(a)** Derive expression of total energy supplied to the coupling field for electromechanical system with magnetic and electric field. **07**

(b) Explain the term vector rotator. Derive expression of vector rotator and explain its significance. **07**

OR

(b) Why reactive power compensation is required for the windmill generator? How it can be obtained? **07**

Q.3 **(a)** Explain fault detection and diagnosis technique for 3 phase Induction motor. **07**

(b) Explain segregation method of efficiency evaluation technique. **07**

OR

Q.3 **(a)** What is DGA? What is $\tan\delta$ test? Explain any one method of condition monitoring for transformer. **07**

(b) Explain direct saving and pay back analysis of energy efficiency motor. **07**

Q.4 **(a)** Define (i) Detent torque, (ii) start-stop mode, (iii) slewing mode, (iv) pull in-torque in a stepper motor **07**

(b) Explain significance of measuring shaft flux and shaft current in condition monitoring of rotating electrical machines. **07**

OR

Q.4 **(a)** Discuss the concept of discharge monitoring. Mention various category of discharge. Explain RF coupling method for the detection of early discharge. **07**

(b) Differentiate linear induction machine with conventional induction machine. Explain its working principle and mention its applications. **07**

Q.5 **(a)** Discuss construction and working of hybrid stepper motor. Compare it with other types of stepper motors. **07**

(b) Comment on number of stator and rotor poles of SRM. Mention merits, limitations and applications of SRM. **07**

OR

Q.5 **(a)** How stepper motor is different than SRM? Discuss operation of variable reluctance stepper motor. **07**

(b) How unidirectional torque can be obtained in SRM. Explain energy conversion in SRM. **07**

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