

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 714504N**Date: 06-01-2014****Subject Name: Modeling and Analysis of 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)** The energy stored in the coupling field of a magnetically linear system with two electrical inputs may expressed $W_f(\lambda_1, \lambda_2, x) = \frac{1}{2}B_{11}\lambda_1^2 + B_{12}\lambda_1\lambda_2 + \frac{1}{2}B_{22}\lambda_2^2$ **07**

Express B_{11} , B_{12} , and B_{22} in terms of inductances L_{11} , L_{12} , L_{22} .

- (b)** Derive the expression of electromagnetic force and electrostatic force for electromechanical system having one electrical and one mechanical input. **07**
- Q.2 (a)** Derive the transformation equation of stationary circuit variables having the elements (1) only inductor and (2) only capacitor; into arbitrary reference frame. Hence explain the terms speed voltages and speed currents associated with these circuits. **07**
- (b)** The voltage vector are defined as $V_{as} = \cos t$, $V_{bs} = 2t$ and $V_{cs} = \sin t$. Determine V_{qdos} in the stator reference frame. **07**

OR

- (b)** For a 4-pole, 3 phase symmetrical induction machine, derive the voltage equations in machine variables. Then, derive the expression for the electromagnetic torque in stator reference frame. **07**
- Q.3 (a)** Draw the equivalent ckt. For steady state operation of a symmetrical induction machine and find out its parameters from tests details given below. The following test data are given for a 5 hp, 4-pole, 220 volt, and 3-phase, 60Hz induction machine where all ac voltage and currents are rms values. **07**

Dc test	Vdc=13.8V	Idc =13.0A		
No Load Test	Vnl=220V	Inl=3.86A	Pnl=200W	F=60Hz
Blocked Rotor Test	Vbr=23.5V	Ibr=12.9A	Pbr=469W	F=15Hz

- (b)** Explain the computer simulation of symmetrical induction machine in stationary reference frame using appropriate block diagram. **07**

OR

- Q.3 (a)** For an electromagnetic system show that the mechanical work done is equal to the area enclosed between the two magnetisation curves at open and closed positions of the armature and the ψ -i locus during the armature movement. **07**
- (b)** Draw the (i) basic two-pole machine diagrams and (ii) primitive machine diagrams for the following machines :Polyphase synchronous machine and d.c shunt machine. **07**
- Q.4 (a)** Derive voltage equation to represent two magnetically coupled circuits with leakage. Assume magnetic system to be linear. Draw equivalent T-circuit with coil 2 as the reference coil. **07**
- (b)** Prepare time domain block diagram pertaining to DC series motor. **07**

OR

- Q.4 (a)** Explain the following: **07**
(i) Significance of park's transformation in the analysis of synchronous machines.
(ii) Explain the terms rotor angle and angle between rotors.
- Q.4 (b)** Explain the mathematical model of switch reluctance motor. **07**
- Q.5 (a)** Derive the torque speed characteristics of PMBL machine and define common mode of operation. **07**
- (b)** Draw and explain the Steady state operating characteristics of a shunt connected dc machine with constant source voltage. **07**
- OR**
- Q.5 (a)** Derive voltage equations of salient pole synchronous machine in rotor reference-frame variables. **07**
- (b)** Derive voltage and torque equations in machine variable for permanent magnet brushless dc machine. **07**
