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B.Tech. IN ELECTRICAL ENGINEERING

Term-End Examination

December, 2012

**BIEE-016 : ELECTROMECHANICAL ENERGY
CONVERSION-III**

Time : 3 hours

Maximum Marks : 70

Note : Answer any seven questions and each question carries equal marks.

1. Write the voltage equations for Kron's primitive machine in matrix form. What observations are made from the impedance matrix of this machine? 10

2. Obtain expressions for the electrical torque of the Kron's primitive machine. Show that no torque is produced by interaction between the flux and current on the same axis. 10

3. Obtain identical transformations for currents and voltages from a rotating balanced 3-phase winding (a,b,c) to a rotating balanced 2-phase winding (α, β). Show that power invariance is maintained under this transformation. 10

4. For a generalized DC machine show that the motional inductance (M_d) is $M_d = \frac{\phi z}{\pi a} \frac{1}{I_f}$ 10
5. Derive an electrical equivalent circuit for a separately excited DC motor. 10
6. A 10kW, 230V, 1500rpm DC motor has the following constants; $r_a = 1.0\Omega$ $L_a = 0.10H$ $k_m = M_d I_f = 4.0$ Nm/armature amp $J = 1.0\text{kg}\cdot\text{m}^2$. The load coupled with the motor has its inertia equal to $1.0 \text{kg}\cdot\text{m}^2$. If load torque varies linearly with speed, then calculate w_n , ξ and neglect rotational losses. 10
7. Derive expressions for armature mutual inductance of a salient pole synchronous machine and explain Park's transformation equations in a,b,c variables to d, q, o variables. 10
8. Write down the voltage equations for the mathematical model of a poly phase induction machine and hence obtain an expressions for the steady state torque when balanced poly phase supply is impressed on the stator. 10

9. Explain the similarities between the Induction motor and transformer equivalent circuit. 10
10. Write short notes on *any two* topics. 10
- (a) Steady state power angle characteristics of poly phase synchronous machine.
 - (b) Linear Induction Motor(LIM)
 - (c) Scherage motor
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