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Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2014
(2013 Scheme)
Branch : ELECTRICAL AND ELECTRONICS ENGINEERING
Streams : Power Control and Drives, Electrical Machines, Power System Control, Power Systems
EMC 1002 : Modeling of Electrical Machines

Time : 3 Hours Max. Marks : 60

***Instruction** : Answer **any two full** questions from **each** Module.*

MODULE – I

1. a) What is Kron's primitive machine ? How are the various windings of a machine represented by the primitive machine ? 5

   b) Write the voltage equations for Kron's primitive machine in matrix form. 5

2. a) Derive the transformations for currents between a rotating balanced 2 phase (α, β) winding and a pseudo stationary two phase (d, q) winding. Assume equal turns on all coils. 5

   b) For steady state balanced operation with

   $i_\alpha = I_m \cos(\omega t + \phi)$ and $i_\beta = I_m \sin(\omega t + \phi)$ determine the primitive coil current i_d and i_q and show that these are steady dc values. 5

3. a) List the various restrictions in representing a rotating electrical machine by primitive machine model. 3

   b) What do you understand by the term linear transformation as used in electrical machines ? Show that the transpose of the transformation matrix should be equal to its inverse to ensure power invariance in transforming one set of variables to another. 7

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MODULE – II

4. A separately excited DC motor is at rest with its field winding excited.
   i) If armature voltage is suddenly impressed across the armature terminals obtain an expression for variation of speed with time.
   ii) With motor running at constant no load speed if load torque T_L is suddenly applied obtain the variation of speed with time. **10**

5. Obtain an expression for the variation of armature voltage when
   i) a sudden step excitation is given to the field of a separately excited dc generator running on no load and at constant speed
   ii) when an inductive load is connected across the terminals of a separately excited dc generator. **10**

6. Obtain an expression for synchronous power of a salient pole synchronous machine and therefrom obtain the synchronous power of a cylindrical rotor machine. Draw the power angle characteristics in both cases. **10**

MODULE – III

7. Draw the primitive machine diagram of a $3-\phi$ induction machine and hence obtain the voltage equations. **10**

8. Obtain the expression for torque of a polyphase induction motor. Show that torque is produced due to interacting magnetic fields. **10**

9. Draw the primitive machine diagram of single phase induction motor and obtain the expression for electromagnetic torque. **10**