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M.Tech.(EE) (2013 Batch) (Sem.–2)

MODELING AND DYNAMICS OF ELECTRICAL MACHINES

Subject Code : MTEE-203

M.Code : 71358

Time : 3 Hrs. Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

1. a) What is generalized machine theory? What are the restrictions of generalized machine theory?

   b) Obtain the transfer function of a D.C. separately excited machine. Neglect only frictional torque and also write the formulae for undamped natural angular frequency and damping factor.

2. a) Develop machine model for a D.C. compound machine, with the help of neat schematic diagram and primitive diagram. Arrange the final equations in state space form.

   b) For a voltage-fed synchronous motor develop the relevant voltages in state variable form.

3. a) What do you understand by the term 'Linear Transformation' as used in electrical machines?

   b) Obtain the expressions for a 3-phase induction motor (Voltage and current) in state variable form in:

      i) Stator reference frame

      ii) Synchronously rotating frame.

4. a) Derive and obtain expressions for flux linkages in the two-axis model for a 3-phase induction motor from ϕ_a and ϕ_b and ϕ_c values.

   b) Discuss linearized and non-linearized analysis of induction machine?

5. a) Derive torque equation for a 3-phase synchronous motor model and obtain steady state power angle characteristics based on its torque expression.

   b) Explain phase transformation and Active transformation used in a.c. machines.

6. a) Derive the circuit model of a 3-phase synchronous motor and mention few salient features from its model.

   b) Derive expressions for armature to field mutual inductances and armature self-inductances for a salient-pole synchronous machine. How are these inductance expressions modified for a cylindrical rotor synchronous machine?

7. A 3-phase, 50Hz cylindrical rotor synchronous machine has the following parameters :

   Self-inductance for phase 'a' = 3.15 mH.

   Armature leakage inductance = 0.35 mH.

   For this machine, calculate the mutual inductance between armature phases and its synchronous reactance.

8. Write notes on the followings :

   a) Transient stability of synchronous machines

   b) Basic challenges in computer simulations

   c) Circuit oriented simulator Pspice

   d) Surge voltage transients in transformers.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.