NR

Code No: 52101/MT

M.Tech. I-Semester Regular Examinations, March-2008.

MACHINE MODELLING & ANALYSIS
(Common to Power Electronics & Electric Drives, Power & Industrial Drives, Power Electronics)

Time: 3 hours **Max. Marks: 60**

Answer any FIVE questions
All questions carry equal marks.

1.a) What is generalized machine theory? What are the restrictions of generalized machine theory?
b) At what conditions the basic G.M.Theory can be applied?
c) Write the voltage equations for Kron's primitive machine in matrix form. What observations are made from the impedance matrix of this machine?

2.a) Obtain mathematical modeling in matrix form for a given separately excited d.c.motor.
b) Obtain the transfer function of a d.c. separately excited motor. Neglect only frictional torque and also write the formulae for undamped natural angular frequency and damping factor.

3.a) The parameters of a 5 h.p d.c. shunt motor are $r_a = 0.6\Omega,\ L_{AA} = 0.012H,\ R_f = 120\Omega;\ L_{FF} = 120H;\ L_{AF} = 1.8H$ *and* $V_a = V_f = 240V$. Calculate the steady state rotor speed ω_r for I_t=0.
b) Develop machine model for a d.c. compound motor, with the help of neat schematic diagram and primitive diagram. Arrange the final equations in state space form.

4.a) What do you understand by the term 'Linear Transformation' as used in electrical machines?
b) Explain the term "invariance of power" as applied to electrical machines.
c) Explain phase transformation and Active transformation used in a.c. machines.

5.a) Draw the basic circuit model for a 3-phase induction motor for stator as well as rotor and obtain voltage equations in the form of matrices interms of stator and rotor currents.
b) Derive and obtain expressions for flux linkages in the two axis model for a 3-phase induction motor from ψ_a, ψ_b, ψ_c values.

(Contd...2)

6.a) Obtain the expressions for a 3-phase induction motor (Voltage and current) in state variable form in
   i) stator reference frame and
   ii) synchronously rotating frame.

b) Obtain the torque equation of 3-phase induction motor from mathematical modeling of motor.

7.a) 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?

b) 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. Obtain the expressions for a poly phase synchronous motor (voltage and current) in state variable form in i) stator reference frame and ii) rotor reference frame.

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