CBCS Scheme

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16/17EPS12

First Semester M.Tech. Degree Examination, June/July 2018
Modeling and Analysis of Electrical Machines

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. With neat sketches, explain the basic two pole representation of a synchronous machine:
(i) Without damper bars.
(ii) With damper bars. **(08 Marks)**

b. Derive torque equation for Kron's primitive machine. What observations are made from torque equation of this machine. **(08 Marks)**

OR

2 a. With the help of mathematical modeling representation of separately excited D.C. motor, derive an expression for armature voltage during transient analysis, draw its characteristics. **(12 Marks)**

b. Explain linearization technique for small perturbations. **(04 Marks)**

Module-2

3 a. Derive the dynamic model of real time model of two phase induction machine. **(08 Marks)**

b. Derive an expression and show that a three phase to two phase transformation is possible using reference from theory. **(08 Marks)**

OR

4 a. Derive the generalized model of induction machine in arbitrary reference frames and obtain below interest:
(i) Stator reference frames model.
(ii) Rotor reference frames model. **(08 Marks)**

b. Express the flow chart for dynamic simulation of Induction machine and explain. **(08 Marks)**

Module-3

5 a. Explain the control principle of the induction machine. **(08 Marks)**

b. Derive the space phasor model with the reference of arbitrary reference frames. **(08 Marks)**

OR

6 a. Express the regulating transformers for voltage and phase angle control. **(10 Marks)**

b. Given the circuit shown in Fig. Q6 (b) pick $V_b = 100$ and $Z_B = 0.01$, find I_B, V_{pu}, Z_{pu}, I_{pu} and I. **(06 Marks)**

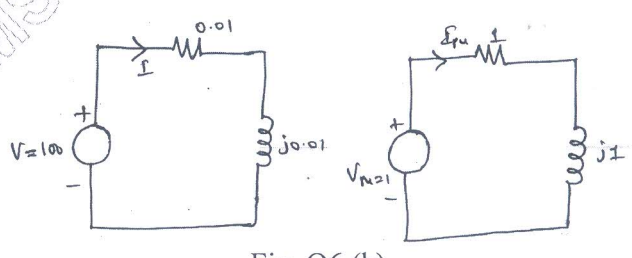

Fig. Q6 (b)

Module-4

7 a. Explain the representation of synchronous machine in pu system. **(08 Marks)**

b. A basic 3-phase, 2-pole synchronous machine of the salient pole type has the following indcutances, where θ is the angle measured from d-axis to the axis of phase A.

Phase A self-inductance

$L_a = 0.9 + 0.2\cos 2\theta$

Mutual between phase A and field winding F, $M_{af} = 8\cos\theta$.

Mutual between phase B and C, $M_{bc} = -0.4 + 0.2\cos\theta$.

(i) Write expressions for all the self and mutual inductances in terms of θ.

(ii) Determine L_θ, L_q and L_O.

(iii) Repeat parts (i) and (ii) if this machine were a cylindrical – rotor synchronous machine. **(08 Marks)**

OR

8 a. Obtain the synchronous machine voltage equation with the use of coupled – circuit theory and Park's transformation. **(08 Marks)**

b. Explain the dynamic performance of a synchronous machine during a three phase fault at the machine terminals. **(08 Marks)**

Module-5

9 a. Write a note on dynamic performance with reference of first swing transient stability limit. **(08 Marks)**

b. Draw the block diagram of simulation of machine in which abc variables are transferred directly to rotor reference frame. **(08 Marks)**

OR

10 a. Write a note on equal area criterion. **(08 Marks)**

b. Give the comparison of actual and approximate transient-torque-angle characteristics during sudden change in input torque. **(08 Marks)**

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