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Question Paper Code : 87050

M.E. DEGREE EXAMINATION, MAY/JUNE 2016

First Semester

Power Electronics and Drives

PX 7101– ANALYSIS OF ELECTRICAL MACHINES

(Common to M.E Power Systems Engineering)

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Mention the torque equation in a singly excited system.

2. Define the term "Linear transformations" as used in electrical machines.

3. Obtain the armature current equation for primitive representation of DC long shunt cumulatively compound motor.

4. A 10 kW, 230 V, 1500 rpm, DC motor has the following constants : Ra = 1.0 Ω, L_a = 0.10 H, $K_m = M_d I_f$ = 4.0 Nm/A, J= 1.0 kg-m^2. The load coupled with motor has its inertia equal to 1.00 kg-m^2. If load torque varies linearly with speed, then calculate angular frequency.

5. Mention the procedure to be adopted for the analysis of inter-connected machines.

6. Obtain the voltage equations in matrix form for double cage induction motor.

7. A 3- phase, star connected, 400 V, 50 Hz, 4-pole induction motor has the following constants in ohm per phase $R_s = 0.8$; $R_r = 0.3$; $X_s = X_r = 2.0$; $X_m = 48.0$. If the motor is operated at a reduced voltage and frequency of 200 V, 25 Hz, compute (i) current and pf at the instant of starting and maximum torque.

8. Mention the controllers used for AC voltage controller operation.

9. Define matrix converter and mention its application.

10. Derive an expression for reactive power of a non-salient pole Synchronous machine in terms of torque angle.

PART – B (5 × 13 = 65 Marks)

11. (a) (i) Describe Kron's primitive machine. **(5)**

(ii) Obtain an expression for the electromagnetic torque. **(8)**

OR

(b) Explain the importance of transformation with an example machine.

12. (a) (i) Develop from the fundamentals, the basic two-pole machine representation for the following : (i) Synchronous Machines with damper winding & (2) 3- phase Induction Machine **(8)**

(ii) Write down the voltage equations in matrix form of Kron's primitive machine model. **(5)**

OR

(b) Obtain the expression for the current transient in the armature of a suddenly short circuited separately excited DC generator. State the assumptions made.

13. (a) Explain difference between phase transformation and commutator transformation with an example.

OR

(b) (i) Mention the transformation variable from stationary to arbitrary reference. **(7)**

(ii) Brief about the variable observed from several frames of reference with an example. **(6)**

14. (a) A 3- phase induction motor has the following per phase parameters referred to stator : Stator resistance = 0.3 Ω; Rotor resistance = 0.45 Ω, Stator and Rotor leakage reactance = 2.1 Ω each and Magnetizing reactance = 30.0 Ω. Find out the parameters of an equivalent 2- phase induction motor if its's per phase turns are : (i) same as that of the 3- phase Induction motor, (ii) 3/2 times that of the 3-phase induction motor, (iii) root of 3/2 times of the 3-phase Induction motor.

OR

(b) Explain in detail about three phase induction machine.

15. (a) (i) Draw the phasor diagram for salient pole Synchronous generator and there from derive the equation for power developed. State the assumptions made.

(ii) A salient pole Synchronous generator has the following pu parameters $X_d = 1.2$, $X_q = 0.8$, R= 0.025. Compute the excitation voltage on pu basis when the generator delivers rated kVA at 0.8 pf lagging and at rated terminal voltage.

OR

(b) Analyze the steady state operation of synchronous machines.

PART – C (5 × 15 = 15 Marks)

16. (a) From the electrical performance equations of 3-phase induction motor, derive the steady state torque equation.

OR

(b) Explain the importance of digital computer simulation with an example and mention some of the software used for this applications.
