

Code No: 5643AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, January - 2020

MACHINE MODELING AND ANALYSIS

(Power Electronics)

Time: 3hrs

Max.Marks:75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

8R 8R 8R 8R **PART - A** 8R 8R 8R
5 × 5 Marks = 25

- 1.a) What is primitive 2-axis machine? How the various windings of a machine are represented by the primitive machine and write the voltage equations? [5]
- b) Briefly explain about the Linear Transformation. [5]
- c) Obtain the torque expression of 3-phase I.M. [5]
- d) What are the various basic parameters of a synchronous machine? [5]
- e) Derive the voltage equations of a brushless DC Machine. [5]

PART - B

5 × 10 Marks = 50

- 2.a) Explain the mathematical model of a DC series motor.
- b) A 10 kW, 230V, 1500 rpm separately excited DC motor has the following constants: $R_a = 1.2\Omega$; $L_a = 0.104$; $k_m = 3.00$ Nm/armature-amps; $J = 1.00$ kg-m², the load coupled with the motor has its inertia equal to 1.00 kg-m².
If the load torque varies linearly with speed, then calculate undammed natural angular frequency, damping ratio and investigate its dynamic behavior. Neglect rotational losses. [5+5]

OR

3. 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? [10]
- 4.a) Explain the method for two phase to three phase transformation.
- b) Explain the importance of phase and active transformations in case of AC motors. [5+5]

OR

5. Explain the dq 0 model based DOL starting of three phase Induction Motors. [10]
6. Obtain the state space model of a 3- ϕ induction motor with
 - a) Stator reference frame
 - b) Rotor reference frame. [5+5]

OR

7. 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 in terms of stator and rotor currents? [10]

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8. Derive the expressions for armature mutual inductances of a salient pole Synchronous Machine from a consideration of its basic parameters. [10]

OR

9. Obtain the voltage equations of 3- ϕ synchronous motor in state variable form with reference to stator reference frame. And also write the torque equation of this motor. [10]

10. Explain the modeling of Permanent Magnet Synchronous Motor (PMSM). [10]

OR

11. Explain in detail about dynamic performance about of a brushless DC Machine and derive the torque equation of a brushless DC Machine. [10]

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