

CODE: 17CD02102

M. Tech I Year I Semester Regular Examinations, February 2018

MACHINE MODELING AND ANALYSIS

(PE&D)

Time: 3 hours

Max Marks: 60

Answer all **five** units. (5 x 12 = 60 Marks)

UNIT-I

1. A 230V D.C. series motor, running at 150 radians per second, takes 20 amperes from the supply mains. The armature and field resistance are $r_a + r_f = 0.1$ ohms. Total $J = 5.4$ kg.m² and $D = 0.02$ Nm-Sec/rad.
- Calculate the rotational mutual inductance M_d and the load torque.
 - If the supply voltage is suddenly reduced to 22V with the load torque remaining constant, find the speed as a function of time.

OR

2. Draw the equivalent circuit and mention the torque equation for:
- Separate winding Excitation DC machine
 - Shunt Connected DC machine
 - Series Connected DC machine
 - Compound connected DC machine

UNIT-II

3. (a) Discuss the commonly used reference frames in the analysis of electrical machines and power system components
(b) Using concept of Park's transformation, show that current i_d and i_q are constant currents

OR

4. Discuss the following:
- Transformation between reference frames
 - Transformation of a balanced set

UNIT-III

5. (a) Draw the Steady state torque - speed characteristics of a singly excited induction machine for motoring and generator action also give the expression for maximum torque
(b) Draw the arbitrary reference frame equivalent circuit for a 3 phase symmetrical induction motor

OR

6. Derive an expression for torque in a machine variable of an induction motor

Continued in page 2

CODE: 17CD02102

UNIT-IV

7. A 3 phase, 64 pole, hydro turbine generator is rated at 325 MVA with 20 KV line to line voltage and a power factor of 0.85. The machine parameters in ohms at 60 Hz are: $r_s = 0.00234$, $X_q = 0.5911$ and $X_d = 1.0467$. For balanced steady state rated conditions calculate i) E_a ii) $E_{x'fd}$ and iii) T_e

OR

8. Derive an expression for torque expressed with the stator variable in the arbitrary reference frame for a synchronous machine

UNIT-V

9. Discuss the voltage and torque equations of a brushless d.c. motor in rotor reference frame variable

OR

10. Discuss the dynamic performance of a brushless d.c. motor
