

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, APR 2021/DEC 2021

Branch: ELECTRICAL & ELECTRONICS

Stream(s):

1. **POWER SYSTEM & CONTROL**
2. **POWER SYSTEMS**
3. **ELECTRICAL MACHINES**
4. **POWER ELECTRONICS & DRIVES**

Course Code & Name: 01EE6301 MODELLING OF ELECTRICAL MACHINES

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60

Duration: 3 hours

PART A

1. a. Explain about general conventions in generalized machine theory (3)
b. From the voltage equations, prove that Law of conservation of power satisfied in the analysis of unified model. (6)
2. a. What are the significance and advantages of p.u system in Generalized machine (2)
b. Explain Park transformations by deriving the transformation for currents between 3 phase rotating axes to 2 phase stationary axes. (7)
3. a. Explain the term power invariance in 3 phase rotating axes to 2 phase rotating axes (4)
b. Derive the transformed impedance and connection matrix in Series coupled coils (5)

PART B

4. a. Obtain the transfer function and draw the block diagram of separately excited DC generator for ON load operation (4)

- b. A 230 V separately excited dc motor is driving a constant load torque with the following data

$$r_a = 0.4\Omega; L_a = 0.01H; r_f = 115\Omega$$

Motor torque constant . $K_m = 2Nm/A$

Friction and windage constant $D=0$. The armature current is 50 A, with rated voltage across the armature and field. Determine the magnitude of constant load torque. If the armature voltage is suddenly reduced by 20 volts, find the speed as a function of time. Total $J=12 \text{ kgm}^2$ (5)

5. a. Explain about synchronous machine parameters (3)
b. Derive and draw the power angle characteristics of synchronous machine (6)
6. a. Write voltage equation in synchronous machine in unified model (3)
b. Derive and Draw the phasor diagram of synchronous generator (6)

PART C

7. a. Prove $p_g: p_m: \text{rotor cu loss} = 1:(1-s): s$ in 3 phase induction machines using unified model. (3)
b. From the voltage equations, derive and draw the equivalent circuit of 3 phase induction machine using unified model. (9)
8. a. Derive and draw torque slip characteristics of 3 ph induction motor from equivalent circuit (6)
b. Derive and write the voltage equation of Double cage induction motor using unified model (6)
9. a. Compare single phase and three phase induction motor (3)
b. Using cross field revolving theory, derive the voltage equation of 1 phase Induction motor (6)
c. Explain double field revolving theory of 1 phase Induction motor (3)