

M. TECH. DEGREE EXAMINATION

First Semester

Model Question Paper

Branch: Electrical and Electronics Engineering

Specialization: Industrial Drives and Control

MEEID 103 DYNAMICS OF ELECTRICAL MACHINES

(Regular - 2013 Admission Onwards)

Time: Three Hours

Maximum Marks: 100 Marks

1. (a) Show that the magnitude of the speed voltages is maximum when the moving coil is magnetically at right angles to the other coil and magnitude of transformer voltage is maximum when the coils are aligned magnetically along the axis. (10)

(b) What is Kron's primitive machine? How are the various windings of a machine represented by the primitive machine? (7)

(c) Write the voltage equations for Kron's primitive machine in matrix form? What observations are made from the impedance matrix of this machine? (8)

OR

2. (a) Show that the development of electrical torque T_e requires the interaction between two currents which must be in quadrature. Currents on the same axis do not contribute to the production of the electrical torque. (10)

(b) Obtain identical transformations for currents and voltages from a rotating balanced three phase (a, b, c) winding to rotating balanced two phase (α, β) winding. Show that power invariance is maintained under this transformation. (10)

(c) Sketch the schematic representation and basic representation of the following machines:

1. DC shunt machine with interpoles
2. Synchronous machine with and without damper
3. Three phase induction machine (5)

3. (a) Derive the expressions for armature terminal voltage and armature current of a separately excited dc generator with displaced brushes by an angle α . (10)

(b) Discuss the effect of sudden short circuit on a separately excited dc generator. Obtain approximate solutions for the resultant armature current after the short circuit. (10)

(c) Derive the equivalent circuit for a separately excited dc motor. (5)

OR

4. (a) Discuss the details of a steady state and transient analysis of a separately excited dc generator. Derive the expressions for armature voltage with time and armature current with time. (15)

- (b) Derive the transfer function of a separately excited dc motor. (5)
- (c) Derive the expression for motional inductance (M_d) for dc machines. (5)
5. (a) Derive the expressions for various self and mutual inductances of a three phase synchronous machine. (10)
- (b) From the torque matrix of three phases salient pole synchronous machine and its phasor diagram, obtain an expression for synchronous power in terms of load angle. (10)
- (c) What is meant by SCR? What is its effect on the performance of a synchronous machine? (5)

OR

6. (a) A three phase salient pole synchronous generator without dampers is developing rated voltage at its terminals when running on no load .A three phase symmetrical short circuit occurs at the generator terminals. Neglecting all winding resistances, develop expressions for armature and field current following the short circuit as a function of time. (10)
- (b) For both the motor and generator operation, show that an overexcited synchronous machine delivers reactive power to the supply system, an under excited synchronous machine absorbs reactive power from thee supply. (10)
- (c) A salient pole synchronous motor delivers rated mechanical output at rated voltage drawing rated current at 0.8pf leading. Compute the motor excitation voltage, if $X_d=1.25$ pu and $X_q=1$ pu. (5)
7. (a) Derive the equivalent circuit of a double cage poly phase induction motor with the help of its generalized mathematical model. (10)
- (b) Draw the equivalent circuit for a single phase induction motor based on the two revolving field theory and identify the various parameters involved in it. With this equivalent circuit prove that forward flux wave is several times greater than the backward flux wave at normal motor speed. (10)
- (c) Develop an expression for the resultant torque of a single phase induction motor running with slip s . Explain how the core losses are accounted for in determining the shaft power output. (5)

OR

8. (a) From the equivalent circuit for a poly phase induction motor, derive an expression for the air gap power in terms of rotor resistance, slip etc. (10)
- (b) Explain how the stationary, pulsating mmf wave of a single phase induction motor can be considered as equivalent to two equal but oppositely rotating mmf waves. (10)
- (c) Briefly explain the vector control of induction motors. (5)