M.E. First Semester (First Year) (Electrical (Electronics & Power) Engg.) (New - CGS)
13317 : Modelling & Analysis of Electrical Machines : 1 EEPME 5

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Time : Three Hours   Max. Marks : 80

Notes :   1.   Due credit will be given to neatness and adequate dimensions.
          2.   Assume suitable data wherever necessary.
          3.   Illustrate your answer necessary with the help of neat sketches.

1.   a)   Obtain an expression for the electrical torque of the Kron's primitive machine. Show that   7
          no torque is produced by intraction between the flux and current on the same axis.

     b)   Explain how a rotating commentator winding can be represented by a pseudo-stationary   7
          coil on the moving element. Enumerate the properties possessed by the coil.

OR

2.   a)   Draw the.   7
          i)   Basic two pole machine diagram.
          ii) Primitive machine diagram for UC compound machine and describe how these are
               obtained.

     b)   With the help of suitable diagram, describe the common essential features of rotating   7
          machines.

3.   a)   Deduce Park's transformation relating the 3-phase current of a synchronous machine to its   13
          corresponding d.g. axis current. Express three phase current its inverse.

OR

4.   a)   What do you understand by term 'Linear transformation' used in electrical machine?   7
          Illustrate your answer with suitable example.

     b)   Explain the term Invariance of power as applied in electrical machines.   6

5.   a)   Draw the equivalent circuit for a polyphase induction motor and state what is represented   7
          by the various parameter involved in this circuit.

     b)   Enumerate the most common problems concerning the dynamics of induction motor.   6

OR

6.   a)   Explain the term air-gap power pg. internal mechanical power developed pm and shaft   7
          power psh how are these term related with each other?

     b)   Draw the generalized mathematical model of a polyphase induction machine. Write down   6
          the voltage equation for this model and obtain therefrom the equivalent circuit for a
          polyphase induction motor.

7. a) Derive expressions for armature mutual inductance of a salient pole synchronous machine from a consideration of its basic parameters.   7

    b) Define the short-circuit ratio of synchronous generator. Show that SCR is equal to reciprocal of per unit value of direct axis synchronous reactance Xd.   7

OR

8. a) Explain how Park's transformation transform equation in a, b, c variables to d, a, o variables.   7

    b) A 3 phase star connected, 4 pole 50 Hz alternator develops as open circuit voltage of 12.5kV for an applied field voltage of 400V for a field circuit resistance of 10Ω. Calculate the amplitude of armature to field mutual inductance and motional inductance.   7

9. a) Explain what you know about forced oscillation in synchronous machine?   7

    b) Show that $Td'' = T do'' \cdot \dfrac{Xd''}{Xd'}$.   6

OR

10. a) What are the causes of disturbance in synchronous machine.   7

    b) "At a time of synchronizing, the frequency of incoming machine should be slightly higher than of infinite bus justify this statement.   6

11. a) Explain the changes that must be made in linearized equation of 3 phase induction machine.   7

    b) Explain the various reactance and time constants from the d axis equivalent circuit of a 3 phase synchronous machine.   6

OR

12. a) Explain Taylor's expansion procedure to obtain the linearized machine equation.   7

    b) Calculate the eigen values for the 3Hp IM for stator voltage of frequencies of ¼, ½ and ¾ noted. Assume the amplitude of the applied voltage decreases linearly with frequency.   6

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