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10EE46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Transformers and Induction Machines

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.

PART – A

1 a. Explain the transformer action on no load and on load conditions. Draw the necessary vector diagrams. **(06 Marks)**

   b. Distinguish between :
      i) Power transformer and distribution transformer
      ii) Current transformer and voltage transformer. **(06 Marks)**

   c. A 2200/220V , 50Hz, single phase transformer has exciting current of 0.6A and a core loss of 361W, when its H.V side is energized at rated voltage. Calculate the two components of the exciting current (b) If the transformer of part (a) supplies a load current of 60A at 0.8pf lag on its I.V side, then calculate the primary current and its power factor. **(08 Marks)**

2 a. Derive the condition for maximum efficiency of a single phase transformer. **(04 Marks)**

   b. Describe the test on a single phase transformer that gives ohmic losses and core losses. **(08 Marks)**

   c. The following results were obtained on a 50KVA, 2400/120V transformer.
      O.C. Test 396W, 9.65A, 120V – I.V. side
      S.C. Test 810W, 20.8A, 92V – H.V. side
      Determine :
      i) the circuit constants
      ii) the efficiency at full load, 0.8pf lag
      iii) approximate voltage regulation
      iv) draw the equivalent circuit referred to the secondary side. **(08 Marks)**

3 a. Why parallel operation of two transformers is necessary. **(04 Marks)**

   b. Deduce the expression for the load shared by two transformers in parallel when the no load voltages are equal. **(08 Marks)**

   c. Two single phase transformers share a load of 400 KVA at a power factor of 0.8 lagging. Their equivalent impedances referred to secondary windings are $(1 + j2.5)\Omega$ and $(1.5 + j3)\Omega$ respectively. Calculate the load shared by each transformer. **(08 Marks)**

4 a. Write a note on auto transformer. **(06 Marks)**

   b. What is an open delta system? What are the applications of this system? **(06 Marks)**

   c. A 3-phase transformer is used to step down the voltage of a 3 - ϕ, 11KV feeder line. Per phase turns ratio is 12. For a primary line current of 20A, calculate the secondary line current, voltage and output KVA for the following connections : i) star delta ii) delta – delta iii) delta – star iv) star star. **(08 Marks)**

PART – B

5 a. Differentiate between slip ring and squirrel cage induction motor. Mention two applications for each. **(06 Marks)**

b. Derive the relationship for torque developed by a 3-phase induction motor. Draw a typical torque slip characteristic and deduce the condition for maximum torque. **(08 Marks)**

c. A 3-phase, 4-pole 1440rpm, 50Hz, induction motor has star connected rotor winding, having a resistance of 0.2Ω per phase and a standstill leakage resistance of 1Ω per phase. When the stator is energized at rated voltage and frequency, the rotor induced any at standstill is 120V per phase. Calculate the rotor current rotor power factor and torque both at starting and at full load. **(06 Marks)**

6 a. Draw the induction motor phasor diagram at :
   i) Standstill   ii) at a full load slip S.
   Draw the equivalent cc diagram of the induction motor. **(06 Marks)**

b. Explain the no load and blocked rotor test on a 3-phase induction motor. How are the parameters of equivalent circuit determined from the test results? **(06 Marks)**

c. The power input to a 6-pole, 3-phase, 50Hz induction motor is 42 KW, the speed is 970 rpm. The stator losses are 1.2KW and the friction and wind age losses are 1.8 KW. Find : i) slip ii) the rotor copper loss iii) the BHP iv) efficiency. **(08 Marks)**

7 a. Describe with sketches, the construction of a double cage induction motor and point out its advantages compared with a single cage motor. **(08 Marks)**

b. Why starters are necessary of starting induction motors? Name different starting methods for 3-phase induction motor. **(06 Marks)**

c. At standstill, the equivalent impedances/phase of the inner and outer cages of a double cage rotor as referred to stator are $(0.4 + j2)\Omega$ and $(2 + j4)\Omega$ respectively. Calculate the ratio of torques produced i) at standstill ii) at 5% slip. **(06 Marks)**

8 a. Write the speed equation of the 3-phase induction motor. Explain the method of speed control of 3-phase induction motor by varying the rotor resistance. **(06 Marks)**

b. Why single phase induction motor are not self starting. Explain different methods of starting the single phase induction motor. **(08 Marks)**

c. Write the note on circle diagram of an induction motor. **(06 Marks)**

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