Sixth Semester B.E. Degree Examination, June-July 2009
Transformers and Induction Machines

Time: 3 hrs.
Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Derive the EMF equation for a single phase transformer. Distinguish between core type and shell type transformer. **(10 Marks)**

  b. Derive an equation for the output current corresponding to maximum efficiency of the transformer. **(04 Marks)**

  c. In a 25 KVA, 2000/200 V transformer the iron and copper losses are 350 W and 400 W respectively. Calculate the efficiency on u.p.f at i) full load ii) determine the load for maximum efficiency and iii) maximum efficiency at u.p.f. **(06 Marks)**

2 a. Draw the phasor diagram of a single-phase transformer under lagging p.f load condition. **(05 Marks)**

  b. State the essential and desirable conditions for the parallel operation of two transformers. **(05 Marks)**

  c. The figure Q2 (c) shows the equivalent circuit for a single-phase transformer. Figures are given are resistances and reactances in ohms in terms of the primary side. The ratio of secondary to primary turns is 10 and the load is inductive. Find i) the primary current ii) the efficiency and iii) the secondary terminal voltage. **(10 Marks)**
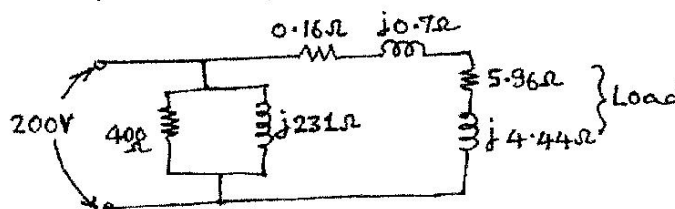

Fig. Q2 (c)

3 a. A 3 phase step down transformer is connected to 6600 V on the primary side. If the primary line current is 10 A, calculate the secondary line voltage, line current for the following connections: i) Star/Delta   ii) Delta/Star. The turns ratio is 12. Neglect losses. **(06 Marks)**

  b. Derive an expression for the saving of copper in an autotransformer as compared to an equivalent two winding transformer. **(08 Marks)**

  c. An 11500/2300 V transformer is rated at 100 KVA as a two winding transformer. If the two windings are connected in series to form an autotransformer, what will be the voltage ratio and output? **(06 Marks)**

4   Write short notes on:

  a. Sumpner's test.
  b. Welding transformer.
  c. Methods of cooling in transformer.
  d. Scott connection for 3 phase to 2 phase conversion. **(20 Marks)**

5 a. With the help of relevant phasor diagram, show that the application of three phase balanced voltages to a three phase balanced winding of an induction motor produces a rotating magnetic field in the airgap. **(08 Marks)**

  b. Derive an expression for developed torque in a 3 phase induction motor and find the condition for maximum torque. **(07 Marks)**

  c. The power input to a 500 V, 50 Hz, 6 pole, 3 phase induction motor running at 975 rpm is 40 KW. The stator losses are 1 KW and friction and windage losses are 2 KW. Calculate i) Slip   ii) Rotor copper loss   iii) Efficiency. **(05 Marks)**

6   a.   Discuss the procedure for no load test and blocked rotor test on a 3 phase induction motor. How are the parameters of equivalent circuit are determined from test results?   **(10 Marks)**

      b.   Explain torque versus slip characteristics for 3φ induction motor and mark T_{start}, T_{max} and T_{full} regions.   **(06 Marks)**

      c.   The induced emf between the slipring terminals of an induction motor at standstill is 120 V. The rotor windings are star connected and has a resistance of 0.4 Ω per phase and standstill reactance of 2.25 ohm per phase. Calculate the rotor current when the slipring terminals are short-circuited and the rotor is rotating at a slip of 4%.   **(04 Marks)**

7   a.   Explain with a diagram the working of Star-Delta starter for an induction motor.   **(06 Marks)**

      b.   State the different methods of speed control of 3 phase induction motor and discuss in detail any two methods.   **(06 Marks)**

      c.   A 3 phase squirrel cage motor has maximum torque equal to twice full load torque $r_2 = 0.2\ \Omega$ and $x_{28} = 2\Omega$. Determine the ratio of starting torque to full load torque, if it is started by

         i) direct on line starter   ii) Star-delta starter   iii) auto transformer starter with 70% tapping.   **(08 Marks)**

8   Write short notes on:

      a.   Double revolving field theory of 1φ induction motor.

      b.   Cogging and crawling.

      c.   Capacitor start induction motor.

      d.   Double cage induction motor.   **(20 Marks)**

* * * * *