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10EE46

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Transformer 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. Derive EMF equation of a single phase transformer. Draw the vector diagram of a practical transformer for leading power factor. **(08 Marks)**

b. Distinguish between core type and shell type transformers. **(07 Marks)**

c. An ideal 25 KVA transformer has 500 turns on primary winding and 40 turns of secondary winding primary is connected to 3000V, 50 Hz supply, calculate :
   i) Full load primary and secondary current
   ii) Secondary induced emf
   iii) Maximum flux in the core. **(05 Marks)**

2 a. Explain how the flux in the core of transformer remains constant, from no load to full load. Develop the phasor diagram of an actual transformer when it is inductively loaded. **(07 Marks)**

b. Find the all day efficiency of a transformer having maximum efficiency of 98% at 15 KVA at upf and loaded as follows :
2 KW at 0.5 pf lag for 12 Hrs
12 KW at 0.8 pf lag for 6 Hrs
No load for 6 Hrs. **(06 Marks)**

c. The results obtained from open circuit and short circuit tests on 10 KVA, 450/120V, 50 Hz transformer are :

O.C. test	120 V	4.2 A	80 W	Instruments placed on lv side
S.C. test	9.65 V	22.2 A	120 W	With lv winding short circuited

Compute :
   i) Equivalent circuit constants
   ii) Efficiency and voltage regulation at full load 0.8 pf lag
   iii) Efficiency at half full load and 0.8 lagging pf. **(07 Marks)**

3 a. Derive an equation for KVA sharing of both the transformer when they are connected in parallel, assuming both transformer have equal voltages ratio. Also mention the conditions for parallel connection. **(06 Marks)**

b. Explain working of auto transformer and show the copper required for auto transformer is less in comparison with two winding transformer for the same rating **(06 Marks)**

c. With the help of relevant circuit diagram, explain back to back test. Mention the advantages of this test. **(08 Marks)**

4 a. Show that open delta connection of 3 phase transformers has KVA rating of 58% of that of delta–delta connection. **(05 Marks)**

b. Explain with circuit diagram and phasor diagram the method of conversion of 3 phase to 2 phase supply. Show that load is balanced on both sides. **(10 Marks)**

c. Two 100V, 1 phase furnaces take loads of 600 KW and 900 KW respectively at a power factor of 0.707 lagging and are supplied from 6600V, 3 phase supply through a scott connected transformer. Calculate the line currents in the 3 phase side. **(05 Marks)**

PART – B

5 a. Explain the concept of rotating magnetic field and hence, explain the principle of operation of 3–phase induction motor. **(10 Marks)**

b. Sketch the torque–slip characteristic of a 3-phase induction motor indicating there in the starting torque, maximum torque and operating region. **(04 Marks)**

c. An 18.65 KW, 4 pole 50 Hz, 3–phase induction motor has a friction and windage losses of 2.5% of output. The full load slip is 4%, calculate :
   i) The rotor copper loss
   ii) The rotor input
   iii) Shaft torque
   iv) The gross electromagnetic torque for full load. **(06 Marks)**

6 a. Explain the phenomenon of cogging and crowling in 3 - ϕ induction motor. **(08 Marks)**

b. Draw the circle diagram from no load and short circuit test of a three phase, 20 HP (14.92 KW), 400V, 6 pole induction motor from the following results. (line values) no load test : 400 V, 09A, $\cos\phi = 0.2$, short circuit test : 200 V, 50 A, $\cos\phi = 0.4$
From the diagram, Find :
   i) Line current and power factor at full load
   ii) The maximum HP
   iii) Maximum torque. Assume stator and rotor copper losses are equal at standstill. **(12 Marks)**

7 a. With a neat sketch, explain the working of a double–cage induction motor. Draw its equivalent circuit. **(10 Marks)**

b. Explain the working operation of induction generator, with a neat sketch. **(10 Marks)**

8 a. Explain the following speed control methods of 3–phase induction motor :
   i) Stator voltage control
   ii) Rotor resistance control. **(06 Marks)**

b. Why single phase induction motor is not self starting? Explain the double revaluing field theory. **(08 Marks)**

c. What is the necessity of starter for a 3 – phase induction motor? Explain the star- delta starter. **(06 Marks)**

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