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NEW SCHEME

Sixth Semester B.E. Degree Examination, Dec. 06 / Jan. 07
Electrical and Electronics Engineering
Transformer and Induction Machine

Time: 3 hrs.] [Max. Marks:100

Note : *1. Answer any FIVE full questions.*

1 a. Develop an equivalent circuit of a single phase transformer and show that the parameters of the primary and secondary winding may be combined to give a simplified equivalent circuit referred to primary side. **(10 Marks)**

b. In a 25 kVA; 2000/200 V transformer the iron and copper losses are 350 and 400 W respectively. Calculate the efficiency on u.p.f at i) F.L ii) ½ load iii) determine the load for maximum efficiency and the iron and copper losses in this case. **(10 Marks)**

2 a. Describe in detail Sumpner's test for determining the efficiency of a transformer. What are the limitations of this test? **(10 Marks)**

b. Two transformers A and B are connected in parallel to a load of $(2 + j\ 1.5)\ \Omega$. Their impedances in secondary terms are $Z_A = (0.15 + j\ 0.5)\ \Omega$ and $Z_B = (0.1 + j\ 0.6)\ \Omega$. Their no load terminal voltages are $E_A = 207\ \angle 0^\circ$ V and $E_B = 205\ \angle 0^\circ$ V. Find the power output and power factor of each transformer. **(10 Marks)**

3 a. Derive an expression for saving of copper when an auto transformer is used and hence discuss its applications. **(10 Marks)**

b. The primary and secondary voltages of an auto transformer are 230 V and 75 V respectively. Calculate the currents in the different parts of the winding when load current is 200 A. Also calculate the saving of copper. **(05 Marks)**

c. A 3 phase step down transformer is connected to 6600 V mains and takes 10 A. Calculate the secondary line voltage, line current and output for the following connections :
   i) Delta/Delta
   ii) Star/Star
   iii) Delta/Star
   iv) Star/Delta. **(05 Marks)**

4 Write short notes on :
   a. Welding transformer
   b. Constant current transformer
   c. Parallel operation of 1 Ph transformer
   d. All day efficiency of a transformer. **(20 Marks)**

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5 a. Show that a rotating magnetic field can be produced by the use of 3 phase currents of equal magnitude and explain how this principle of rotating field is applied to the case of an induction motor.

b. Draw the no load and short circuit diagram for a 20 HP, 400V, 50 Hz, 3 phase star connected induction motor, from the following data (fine values)

No load test	:	400 V	9 A	$\cos\Phi = 0.2$
Short circuit test	:	200 V	50 A	$\cos\Phi = 0.4$

From the diagrams find i) the line current and P.F at F.L
ii) the maximum horse power. **(10 Marks)**

6 a. State the various losses that occur in an induction motor. Explain how they vary with frequency, voltage and load. **(07 Marks)**

b. With the help of a phasor diagram, describe the performance of an induction motor as a generator. **(08 Marks)**

c. The rotor of a 4 pole, 50 Hz slip ring IM has a resistance of 0.25 Ω per phase and runs at 1440 rpm at full load. Calculate the external resistance per phase which must be added to lower the speed at 1200 rpm, the torque being the same as before. **(05 Marks)**

7 a. Explain the principle of operation of a 1 Ph IM using double revolving field theory. **(10 Marks)**

b. A 250 W, 230 V, 50 Hz, 1 Ph capacitor start IM has the following constants for the main and auxiliary windings. Main winding $Z_m = (4.5 + j\ 3.7)\ \Omega$, auxiliary winding $Z_a = (9.5 + j3.5)\ \Omega$. Determine the value of the capacitor that will place the main and auxiliary winding currents in quadrature at staring. **(10 Marks)**

8 Write short notes on

a. Explain crawling and cogging.

b. What are the limitations and applications of shaded pole IM?

c. Deep bar rotor IM.

d. Star-Delta starter for 3 Ph IM. **(20 Marks)**

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