EE 64

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NEW SCHEME

Sixth Semester B.E. Degree Examination, July 2006
E E
Transformers and Induction Machines

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

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

1 a. Explain with phasor diagram how the flux in the transformer core remains fairly constant from no-load to full load assuming lagging power factor. **(06 Marks)**

b. Draw the complete phasor diagram for a transformer when the load p.f is lagging. (Take secondary terminal voltage V_2 as vertical reference) **(04 Marks)**

c. What happens when the primary of a power transformer is connected to DC supply of the same voltage rating? **(04 Marks)**

d. A single phase transformer has percentage regulation of 4 and 4.4 for lagging power factors of 0.8 and 0.6 respectively. The F.L copper loss is equal to iron loss. Calculate i) the lagging P.f at which F.L regulation is maximum ii) The F.L efficiency at unity P.f. **(06 Marks)**

2 a. Draw the approximate equivalent circuit of a transformer referred to the primary side and indicate how it differs from the exact equivalent circuit. **(05 Marks)**

b. What are the different losses occurring in a transformer on load? How can these losses be determined experimentally? **(07 Marks)**

c. A ' $\Delta - \Delta$ ' bank consisting of three single phase 20 KVA, 2300 / 230V transformers supplies a load of 40 KVA. If one transformer is removed, find for the resulting V-V connection .

i) KVA load carried by each transformer

ii) Total KVA rating of the V-V bank.

iii) Ratio of the V-V bank to ' $\Delta - \Delta$ ' bank transformer ratings. **(08 Marks)**

3 a. Explain with necessary diagrams how two. 3 – phase transformers can be used to convert a 3 phase supply to a 2 phase one. If the load is balanced on one side, show that it will be balanced on the other side. **(10 Marks)**

b. Two – 100 kw transformers each has a maximum efficiency of 98% but in one the maximum efficiency occurs at F.L while in the other it occurs at half load. Each transformer is on F.L. for 4 hrs, on half load for 6 hrs and one-tenth load for 14 hrs per day. Determine the all day efficiency of each transformer. **(10 Marks)**

4 a. Discuss the necessary conditions for the parallel operation of 2 transformers. **(05 Marks)**

b. Consider a 4 KVA, 200 / 400 V single phase transformer supplying full – load current at 0.8 lagging p.f. The OC / SC test results are as follows .

OC test : 200 V , 0.8 A, 70 w

SC test : 20 V , 10 A, 60 w (HV side)

Calculate i) efficiency and secondary voltage.

ii) the load at u.p.f corresponding to maximum efficiency. **(08 Marks)**

c. Two 2200 / 110 V transformers are operated in parallel to share a load of 120 KVA at 0.8 p.f lagging. Transformers are rated as below.

A : 100 KVA : 0.8 % Resistance and 10 % Reactance.

B : 60 KVA : 1 % Resistance and 5 % Reactance.

Find load carried by each transformer. **(07 Marks)**

Contd...2

5 a. Explain with the help of neat sketches the differences between the 3 phase slip ring induction motor and the 3-phase squirrel cage I.M. **(06 Marks)**

b. Derive the expression for developed torque in a 3 phase I.M and find the condition for maximum torque. **(06 Marks)**

c. Calculate the torque exerted by an 8 pole 50 Hz, 3 phase I.M operating with a 4 percent slip which develops a maximum torque of 150 kgm at a speed of 660 rpm. The resistance per phase of the rotor is 0.5 Ω . **(08 Marks)**

6 a. Draw and explain the phasor diagram and equivalent circuit of a 3 phase I.M. **(08 Marks)**

b. A 20 hp, 400 V, 50 Hz. 3 phase star connected I.M. has the following test data.
No – load test : 400 V, 9A, Cos ϕ = 0.2.
Blocked rotor : 200 V, 50 A, Cos ϕ = 0.4.
Draw a circle diagram and determine i) line current ii) P.f. iii) Slip and iv) efficiency at F.L. **(12 Marks)**

7 a. Why starter is necessary to start an I.M? Explain in detail auto-transformer method of starting a cage I.M. **(10 Marks)**

b. An 18650w, 4 pole, 50 Hz, 3 phase I.M. has friction and windage losses of 2.5 percent of the output. The F.L slip is 4 %. Compute for F.L i) the rotor copper loss
ii) the rotor input iii) the shaft torque. **(10 Marks)**

8 Explain any Four of the following :

a. Double revolving field theory of 1 phase I.M.

b. Induction generator.

c. Welding Transformers.

d. Methods of cooling in Transformer.

e. Auto transformer. **(20 Marks)**

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