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06EE46

Fourth Semester B.E. Degree Examination, December 2010
Transformers and Induction Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Write the equilibrium equations in a coupled circuit. Derive the expressions for effective inductance when two inductors are connected in : i) Series opposing ii) Parallel aiding. **(10 Marks)**

b. Write a brief note on :
i) Power transformer ii) Constant voltage transformer. **(10 Marks)**

2 a. Develop the exact equivalent circuit of a single phase transformer. From this, derive the approximate and simplified equivalent circuits of a transformer. State the various assumptions made. **(10 Marks)**

b. Develop the phasor diagram of a single phase transformer under load condition. Assume lagging power factor load. **(05 Marks)**

c. 3300 /300 V single - phase 300 KVA transformer has 1100 primary turns. Find
i) Transformation ratio ii) Secondary turns iii) Voltage /turn iv) Secondary current when it supplies a load of 200 kW at 0.8 pf. lagging. **(05 Marks)**

3 a. Explain the Sumpner's test for testing two single – phase transformers. Also explain why this is beneficial for finding efficiency of transformers. **(08 Marks)**

b. Two single-phase transformers are operating in parallel. Derive an expression for the current drawn by each, sharing a common load, when no – load voltages of these are equal. **(06 Marks)**

c. A 5 KVA distribution transformer has a full load efficiency of 95% at which Cu-loss is equal to the iron loss. The transformer is loaded for 24 hours as under :
No load for 10 hours, one – fourth full load for 7 hours, halffull load for 5 hours and full load for 2 hours. Calculate the all-day efficiency of the transformer. **(06 Marks)**

4 a. Explain with the help of connection and phasor diagrams, how Soctt connections are used to obtain two phase supply from three phase supply mains. **(08 Marks)**

b. Discuss the essential and desirable conditions to be fulfilled for operating two three phase transformers in parallel. **(06 Marks)**

c. A balanced three phase load of 30 KVA, at a power factor of 0.866 lagging, is connected to two transformers connected in open-delta, to a five 230 V three phase system. Find the power delivered by each transformer. **(06 Marks)**

PART – B

5 a. Give the equivalent circuit and applications of a 3 – winding transformer. **(08 Marks)**

b. Show that a rotating magnetic field can be produced by the use of 3 – phase currents of equal magnitude. **(08 Marks)**

c. What are the advantages of skewed slots in the rotor of a squirrel cage motor? **(04 Marks)**

6 a. Develop the equivalent circuit for a 3 –phase induction motor. Explain how the mechanical power developed is taken care of in the equivalent circuit. **(10 Marks)**

b. A 4-pole, 50Hz, 3-phase induction motor develops a maximum torque of 110 Nm at 1360 rpm. The resistance of the star connected rotor is 0.25 Ω /phase. Calculate the value of resistance that must be inserted in series, with each rotor phase, to produce a starting torque equal to half of the maximum torque. **(10 Marks)**

7 a. Explain the phenomenon of cogging and crawling in a 3-phase induction motor. **(08 Marks)**

b. A 400 V, 11 kW, 3-phase, 50Hz, 4-pole delta-connected induction motor gave the following test data :
No load test : 400 V, 8 A, 1000 W
Locked rotor test : 100 V, 25A, 1750 W
Construct the circle diagram and determine :
i) Fuel load current and the power factor
ii) Maximum possible power output
iii) The best possible operating power factor. **(12 Marks)**

8 a. Using double revolving field theory, explain the principle of operation of an I – phase induction motor. **(10 Marks)**

b. A three–phase delta–connected cage type induction, motor when connected directly to a 400 V, 50Hz supply, takes a starting current of 100 A, in each stator phase. Calculate
i) The line current for 'direct–on–line' starting.
ii) Line and phase starting currents for star–delta starting
iii) Line and phase starting currents for a 70% tapping on auto-transformer starting. **(10 Marks)**

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