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10EE46

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Transformers & Induction Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the emf equation of a single phase transformer. **(04 Marks)**

b. Explain the operation of a single phase transformer on inductive load with a phasor diagram. **(08 Marks)**

c. The maximum efficiency of a 100 kW transformer is 98% and occurs at $\frac{3}{4}$ full load. The transformer is on full load for 4 hrs, on $\frac{3}{4}$ load for 6 hrs half load for 6 hrs and $\frac{1}{10}$ load for remaining part of the day. Determine its all-day efficiency. **(08 Marks)**

2 a. Explain OC and SC test for predetermination of efficiency and regulation. **(06 Marks)**

b. Define voltage regulation and derive an expression for voltage regulation. What is the condition for zero regulation? **(06 Marks)**

c. The efficiency at 0.8 pf lag of a 6600/384 V, 200 KVA, 1 ϕ transformer is 98% both at full load and $\frac{1}{2}$ full load. The pf. on no load is 0.2 and full load regulation at a lagging pf of 0.8 is 4.5%. Draw the equivalent circuit referred to LV side and insert all values. **(08 Marks)**

3 a. Show that an auto transformer will result in saving of copper instead of 2-winding transformer. **(06 Marks)**

b. List out and explain the conditions for parallel operation of single phase transformers. **(06 Marks)**

c. Two transformers having equivalent impedances referred to secondary of $(0.3+j3)\Omega$ and $(0.2+j1)\Omega$ are sharing a common load of impedance $(8+j6)\Omega$. Determine the current delivered by each transformer if the open circuit emf are 6600 V and 6400 V. **(08 Marks)**

4 a. Explain the operation of scott connections for balanced and unbalanced load with the help of phasor diagrams. **(12 Marks)**

b. A Δ - Δ bank consisting of three 1ϕ transformers, 20 KVA, 2300/230 V ratings 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 Δ-Δ bank transformer ratings. **(08 Marks)**

PART – B

5 a. Explain the constructional details of different types of 3ϕ Induction motors. **(08 Marks)**

b. Explain the different regions of torque-slip characteristics of a 3ϕ induction motor and mark all the points on the characteristics. **(08 Marks)**

c. An 8-pole 50 Hz induction motor has a full load slip of $2\frac{1}{2}$% and a maximum torque of twice full-load torque. At what value of slip does maximum torque occur? **(04 Marks)**

6 a. Develop the phasor diagram and equivalent circuit of a 3φ induction motor. **(06 Marks)**

b. Draw the circle diagram for a 5 h.p. 200 V, 50 Hz, 4 pole, 3φ star connected induction motor from the following test data:
No load : 200 V, 5 A, 350 W
SC test : 100 V, 26 A, 1700 W
Estimate the line current and power factor for full load and also maximum torque and starting torque interms of full load torque. The rotor copper loss at stand still is half the total copper loss. **(14 Marks)**

7 a. Explain the construction and operation of a double cage induction motor. **(08 Marks)**

b. Explain the phasor diagram and torque – slip characteristics of an induction generator. **(08 Marks)**

c. Why a starter is required for starting a 3φ IM? **(04 Marks)**

8 a. Explain briefly the operation of a Y-Δ starter with a neat diagram. **(08 Marks)**

b. Give a comparison between speed control of a 3φ induction motor by stator voltage control and rotor resistance control. **(04 Marks)**

c. Explain the constructional and operational features of a capacitor start and run single phase induction motor. **(08 Marks)**

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