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**Fourth Semester B.E. Degree Examination, June/July 2015**  
**Transformers 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. Describe the operation of a single-phase transformer, explaining clearly the functions of the different parts. (06 Marks)
  - b. Explain the operation of transformer under load condition and hence develop the phasor diagram of a single phase transformer under load condition. (08 Marks)
  - c. A 125 kVA transformer having primary voltage of 2000V at 50Hz has 182 primary and 40 secondary turns. Neglecting losses, calculate: i) full load primary and secondary current; ii) no load secondary induced e.m.f. and iii) the maximum flux in the core. (06 Marks)
2.
  - a. Develop the exact equivalent circuit of a 1-phase transformer. From this derive the approximate and simplified equivalent circuits of the transformer. State the various assumptions made. (08 Marks)
  - b. Derive the condition for maximum efficiency. (04 Marks)
  - c. A 2300/230 V, 500 kVA, 50 Hz distribution transformer has core loss of 1600 W at rated voltage and copper loss 7.5 kW at full load. During the day it is loaded as follows:

% load	0%	20%	50%	80%	100%	125%
p.f.	-	0.7 lag	0.8 lag	0.9 lag	1	0.85 lag
Hours	2	4	4	5	7	2

Determine the all day efficiency of the transformer. (08 Marks)

3.
  - a. Derive an expression for the saving of copper of autotransformer as compared to an equivalent two-winding transformer. (06 Marks)
  - b. With neat sketch, explain working of constant voltage transformer. (06 Marks)
  - c. Two single phase transformers share a load of 400 kVA at power factor of 0.8 lag. Their equivalent impedances referred to secondary winding are  $(1 + j2.5) \Omega$  and  $(1.5 + j3) \Omega$  respectively. Calculate the load shared by each transformer. (08 Marks)
4.
  - a. Draw the Scott connection of transformers and mark the terminals and turn ratio. What are the applications of Scott connection? (08 Marks)
  - b. Discuss the essential and desirable conditions to be fulfilled for operating two three phase transformers in parallel. (04 Marks)
  - c. A 400 kVA load at 0.7 pf lagging is supplied by three single phase transformers connected in  $\Delta - \Delta$ . Each of  $\Delta - \Delta$  transformers is rated at 200 kVA, 2300/230 V. If one defective transformer is removed from service, calculate for V – V connection:
    - i) The kVA load carried by each transformer.
    - ii) Percent rated load carried by each transformer.
    - iii) Total kVA ratings of the transformer bank in V – V.
    - iv) Ratio of V – V bank to  $\Delta - \Delta$  bank transformer ratings. (08 Marks)

## PART – B

- 5 a. Draw and explain the complete torque-speed characteristic of three phase induction machine for all ranges of speed. (06 Marks)
- b. Explain the concept of rotating magnetic field in 3-phase induction motor. (06 Marks)
- c. A 746 kW, 3-phase, 50Hz, 16-pole induction motor has a rotor impedance of  $(0.02 + j0.15) \Omega$  at stand still. Full load torque is obtained at 360 rpm. Calculate:  
 i) The speed at which maximum torque occurs; ii) The ratio of maximum to full-load torque; iii) The external resistance per phase to be inserted in the rotor circuit to get maximum torque at starting. (08 Marks)
- 6 a. Explain cogging and crawling phenomenon in 3- $\phi$  induction motor. (06 Marks)
- b. A 50 kW, 6-pole, 50 Hz, 450 V, 3- $\phi$  induction motor furnished the following test figures: No load test: 450 V, 20A, p.f. = 0.15. Blocked rotor test: 200V, 150A, pf = 0.3. The ratio of stator to rotor copper losses on short circuit was 5:4. Draw circle diagram and determine from it.  
 i) Full load current and p.f.  
 ii) Maximum torque and maximum power input.  
 iii) Slip at full load.  
 iv) Efficiency at full load. (14 Marks)
- 7 a. Describe with sketch, the construction of a double cage induction motor. (07 Marks)
- b. Explain with sketch deep-bar cage motor. (06 Marks)
- c. Explain theory of self excited induction generator. (07 Marks)
- 8 a. With neat sketch, explain auto transformer starter. (06 Marks)
- b. With neat diagram, explain shaded pole single phase motor. (06 Marks)
- c. Briefly explain different speed control methods of 3- $\phi$  induction motor. (08 Marks)

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