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10EE46

Fourth Semester B.E. Degree Examination, Dec.2014/Jan.2015

## Transformers and 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. What are the differences between shell type and core type transformers? (06 Marks)
- b. The no-load current of a transformer is 5A at 0.3 power factor when supplied at 230 V, 50 Hz. The number of turns the primary winding is 200. Calculate:
  - i) The maximum value of flux in the core.
  - ii) The core loss.
  - iii) The magnetizing current. (06 Marks)
- c. Derive EMF equation of a single phase transformer. Draw the vector diagram of a practical transformer for leading power factor. (08 Marks)
- 2 a. Derive the condition for maximum efficiency of a transformer. (04 Marks)
- b. Develop the equivalent circuit of a transformer referred to primary and explain. (06 Marks)
- c. A 20 kVA, 2200/220 V, 50 Hz single phase transformer gave the following readings:
 

OC test: 220 V, 4.2 A, 148 W (LV side open)

SC test: 86 V, 10.5 A, 360 W (LV side shorted)

Determine:

  - i) The equivalent resistance and reactance referred to the secondary.
  - ii) The voltage regulation on full load, 0.8 power factor lagging.
  - iii) The efficiency at full load and half the full load at 0.8 power factor lagging. (10 Marks)
- 3 a. Discuss the need and conditions to be satisfied for parallel operation of single phase transformer. (04 Marks)
- b. Show that an auto-transformer will result in saving copper in place of two winding transformer. (06 Marks)
- c. With the help of relevant circuit diagram, explain back to back test. Mention the advantages of this test. (10 Marks)
- 4 a. Two transformers connected in open delta supply a 400 KVA balanced load operating at 0.866 power factor lagging. The load voltage is 440 V. Find the:
  - i) KVA supplied by each transformer.
  - ii) KW supplied by each transformer. (08 Marks)
- b. Explain with neat diagram, the Scott connection of three single phase transformer to convert three phase to two phase. (08 Marks)
- c. What is the difference between a three-phase transformer bank and three-phase transformer unit? What are the advantages of three-phase unit transformer over three single phase transformer bank of the same KVA ratings? (04 Marks)

### PART – B

- 5 a. Explain the concept of rotating magnetic field in three-phase induction motor. (08 Marks)
- b. Compare Squirrel Cage and Wound three-phase induction motor with reference to construction, performance and application. (06 Marks)

- c. The power input to the rotor of a 440 V, 50 Hz, 3 phase, 6 pole induction motor is 60 KW. It is observed that rotor EMF makes 90 complete cycle/minute. Calculate: i) Slip, ii) Rotor copper loss and iii) Mechanical power developed. (06 Marks)
- 6 a. A 20 HP, 400 V, 50 Hz, 3 phase star connected induction motor has the following test data:  
 No load test = 400 V, 9A,  $\cos \phi_0 = 0.2$   
 Blocked rotor test: 200 V, 50 A,  $\cos \phi_s = 0.4$   
 Draw the circle diagram to determine:  
 i) Line current  
 ii) Power factor at full load  
 iii) The maximum power output.  
 The stator copper loss and rotor copper losses are divided equally in blocked rotor test. (14 Marks)
- b. Write a short note on cogging and crawling in a three-phase induction motor. (06 Marks)
- 7 a. Explain the working operation of induction generator, with a neat sketch. (10 Marks)
- b. With a neat diagram, explain the construction and working principle operation of high starting torque rotors. Draw its slip-torque characteristics. Also draw its equivalent circuit. (10 Marks)
- 8 a. Why single-phase induction motor is not self starting? Explain the working operation of the following:  
 i) Single-phase capacitor start induction motor  
 ii) Shaded pole induction motor. (08 Marks)
- b. What is the necessity of starter for a three-phase induction motor? Explain the star delta (Y -  $\Delta$ ) starter? (06 Marks)
- c. Explain any two methods of speed control of three phase cage type motors. (06 Marks)

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