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Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. With a neat sketch, explain the construction and working principle of core type and shell type of transformer. (08 Marks)
- b. With a phasor diagram, explain the operation of practical power transformer on load condition (i) inductive load and (ii) resistive load. (08 Marks)
- c. The transformer has a primary winding of 800 turns and secondary winding of 200 turns. When the load current on the secondary is 80 A at 0.8 pf lagging, the primary is 25A at 0.707 p.f lagging. Determine no load current of the transformer and its phase with respect to voltage. (04 Marks)

- 2 a. Draw equivalent circuit of single phase transformer referring the primary side quantities to secondary side and explain it. (06 Marks)
- b. The following readings were obtained from O.C and S.C tests on 8 KVA, 400/120 V, 50 Hz transformer.
O.C test: (L.V. side) : 120 V, 4A, 75W
S.C. test: (h.V. side) : 9.5 V, 20A, 110 W.
Calculate: i) The equivalent circuit constants
ii) Voltage regulation efficiency full load 0.8 pf load
iii) The efficiency at half full load 0.8 pf load (08 Marks)
- c. A 15 KV 2000/200 V, transformer has on iron loss of 250 W and full load copper loss 350 W. During the day it is loaded as follows:

No. of hours	Load	p.f.
9	1/4 load	0.6
7	Full load	0.8
6	3/4 full load	1.0
2	No load	-

Calculate all day efficiency. (06 Marks)

- 3 a. Discuss the need and conditions to be satisfied for parallel operation of single phase transformer. (04 Marks)
- b. Show that on 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. With the help of connection diagram and phasor diagram, explain how a two phase supply can be obtained from a three phase supply. (08 Marks)
- b. A delta-delta bank consisting of three single phase 20 kVA, 2300/230 V, transformer supplies a load of 40 kVA. If one transformer is removed, find for the resulting V.V. connections:
 - 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 rating. (08 Marks)
- c. What are the advantages of V-V connection? (04 Marks)

PART – B

- 5 a. Show that a rotating magnetic field can be produced by the use of 3-phase currents of equal magnitude. When flowing through the stator winding of a 3 phase induction motor. (08 Marks)
- b. Draw the complete torque-slip characteristics of a 3- ϕ I.M. indicating all the regions and explain. (06 Marks)
- c. A 3- ϕ , 6-pole, 50 Hz induction motor has 160 N-m as its useful load torque. The rotor emf is observed to make 90 cycles/minutes. Calculate:
- Motor output in KW
 - Copper losses in rotor
 - Motor input
 - Efficiency if mechanical torque lost in friction and windings is 20 N-m and stator losses are 800 W. (06 Marks)
- 6 a. Show different power stages of 3- ϕ induction motor. (04 Marks)
- b. Discuss cogging and crawling in 3- ϕ induction motor. (06 Marks)
- c. The following test data was obtained for a 3.73 KW, 200 V, 50 Hz, 4 pole, 3-phase star connected induction motor. (All are line values).
 No load test: 200V, 5A, 350W
 Block rotor test: 100V, 26A, 1700W.
 Draw the circle diagram and estimate from the diagram for full load condition of the following:
- Line current
 - Power factor
 - Maximum torque in terms of the full load torque
- The rotor copper loss at stand still is half of the full load copper loss. (10 Marks)
- 7 a. Describe with sketch the construction of a double cage induction motor. (08 Marks)
- b. A 36 KW, 3- ϕ , 4-pole, 50 Hz induction motor has a full-load efficiency of 84%. The friction and winding losses are $1/3^{\text{rd}}$ of the no load losses and rotor copper losses equal the iron loss at full load. Find the full load speed. Neglect the stator resistance. (12 Marks)
- 8 a. Draw the star-delta starter for 3-phase induction motor with necessary circuit diagram and explain its operation. (07 Marks)
- b. Explain any two methods of speed control of 3- ϕ cage type motors. (06 Marks)
- c. With connection diagram, explain the construction and working of a 1- ϕ capacitor start induction motor. (07 Marks)
