

USN

--	--	--	--	--	--	--	--	--	--

10EE46

Fourth Semester B.E. Degree Examination, June/July 2017
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. With phasor diagram, explain the operation of :
 - i) Ideal transformer on no load
 - ii) Practical transformer supplying a lagging load. (10 Marks)
- b. Write a note on current inrush phenomena in transformers. (05 Marks)
- c. A single phase transformer with a ratio of 440V/110V takes a no load current of 5 Amps at 0.2pf lagging. If the secondary supplies a current of 120 Amps at a pf of 0.8 lagging, estimate the current taken by the primary. (05 Marks)

- 2 a. For a two winding transformer, derive an expression for the total ohmic loss in terms of the equivalent resistance referred to either side. (05 Marks)
- b. Derive the condition for : i) maximum voltage regulation and ii) zero voltage regulation of a transformer. (05 Marks)
- c. Two 100 KW transformers, each has a maximum efficiency of 98%, but in one of the transformer the maximum efficiency occurs at full load while in the other, it occurs at half load. Each transformer is on full load for 4 hours, on half load for 6 hours and on one-tenth load for 14 hours per day. Determine the all-day efficiency of each transformer. (10 Marks)

- 3 a. Derive an expression for saving of copper when an auto transformer is used to supply a load instead of a two winding transformer and hence mention the advantages and limitations of an auto transformer. (10 Marks)
- b. Two single phase transformers A and B of equal voltage ratio are operating in parallel to supply a load of 1000 Amps at 0.8pf lag. The equivalent impedance of the two transformers are $(2 + j3) \Omega$ and $(2.5 + j5) \Omega$ respectively. Calculate the current supplied by each transformer and the ratio of the KW output of the two transformers. (10 Marks)

- 4 a. What do you mean by open delta connection? When it is used? (05 Marks)
- b. A 3-phase transformer bank is used to step-down the voltage of a 3-phase, 6600V transmission line. if the primary line current is 10A, calculate the secondary line voltage, line current and output KVA for : i) star/delta and ii) delta/star connections the turns ratio is 12. Neglect losses. (05 Marks)
- c. Two single phase furnaces A and B are supplied at 100 volts by means of a Scott-connected transformer from a 3-phase 6600volts system. The voltage of furnace A is leading. Calculate the line currents on the 3-phase side, when the furnace A takes 400 KW at 0.707 pf lagging and B takes 800 KW at unity pf. (10 Marks)

PART – B

- 5 a. Explain principle of operation of a 3-phase induction motor. (05 Marks)
 b. Draw and explain the Torque-slip characteristic of 3-phase induction motor covering motoring, generating and braking regions of operation. (05 Marks)
 c. A 4pole, 50Hz, 10h-p motor has, at rated voltage and frequency, a starting torque of 160% and a maximum torque of 200% of full-load torque. Determine : i) full-load speed ii) speed at maximum torque. (10 Marks)
- 6 a. Develop the equivalent circuit of a 3-phase induction motor and draw its phasor diagram and explain. (10 Marks)
 b. A 220V, 3-phase, 4-pole, 50Hz star-connected induction motor is rated 5hp the equivalent circuit parameters are : $R_1 = 0.45\Omega$, $x_1 = 0.8\Omega$; $R_2^1 = 0.4\Omega$, $x_2^1 = 0.8\Omega$. $B_0 = -1/30$ mho. The stator core loss is 50W and rotational loss is 150W. For a slip of 0.04, find :
 i) input current ii) pf iii) air gap power iv) mechanical power v) efficiency. (10 Marks)
- 7 Write brief notes on :
 a. Double cage induction motor
 b. Deep bar rotor
 c. Induction generator and its applications
 d. Cogging and crawling in 3-phase induction motors. (20 Marks)
- 8 a. What are the different methods of starting an induction motor? Explain star Delta starting of induction motor. (05 Marks)
 b. A 3-phse squirrel cage induction motor has a short circuit $I_{sc} = 5I_f$ ($I_f =$ full load current). Find the starting torque as a percentage of full load torque if the motor is started by :
 i) direct switching to the supply ii) a star-delta starter is used iii) an auto transformer is used iv) A resistance in the stator circuit. the starting current in iii) and iv) is 2.5 times the full load current and full load slip = 4%. (10 Marks)
 c. Why single phase induction motors are not self starting? (05 Marks)

* * * * *