

Time: 3 hours

Max. Marks: 80

Answer any five questions
All questions carry equal marks

- 1.a) Derive an expression for the induced emf of a transformer.
- b) A single phase transformer is rated 660/200 V, 25 kVA, 50 Hz. The transformer is supplying full load on secondary side at 0.707 pf lagging. What is the load impedance? Assuming the transformer to be ideal what impedance is seen on the primary side, also the primary current and its pf.
- 2.a) Explain determination of equivalent circuit, regulation and efficiency of a single phase transformer by conducting OC and SC tests.
- b) Find all day efficiency of a transformer having maximum efficiency of 98% at 15 KVA at upf. It is loaded as follows:
12 hrs: 2 KW at 0.5 pf lag; 6 hrs: 12 KW at 0.8 pf lag; 6 hrs: no load.
- 3.a) Explain how Sumpner's test is conducted on two identical single phase transformers?
- b) Two single phase transformers A and B of equal voltage ratio are running in parallel and supplying a load requiring 500 A at 0.8 power factor lagging at a terminal voltage of 400V. The equivalent impedances of the transformers referred to secondary windings are $(2 + j3)$ and $(2.5 + j5)$ ohms. Calculate the current supplied by each transformer.
- 4.a) Explain about three phase to two phase conversion.
- b) Explain off load and on load tap changing of three phase transformers.
- 5.a) How is a rotating magnetic field produced in a three phase induction motor? Explain how torque is produced in an induction motor?
- b) A 3-phase, 460V, 100 hp, 60 Hz, 4-pole induction machine delivers rated output power at a slip of 0.05. Determine:
 - i) Synchronous speed and motor speed
 - ii) Speed of the rotating air gap field
 - iii) Frequency of the rotor circuit
 - iv) Slip speed
 - v) Speed of the rotor field relative to the (x) rotor structure (y) stator structure (z) stator rotating field.
 - vi) Rotor induced voltage at the operating speed, if the stator-to-rotor turns ratio is 1 : 0.5.

- 6.a) Draw the torque-slip characteristics of a 3-phase slip-ring induction motor for different values of rotor external resistance.
- b) A three phase, 50 Hz induction motor has 4 poles and runs at a speed of 1440 rpm when the total torque developed by the rotor is 70 N-m. Calculate:
- The total input (in Kilowatts) to the rotor;
 - The rotor copper loss in watts.
7. Explain the No-load and blocked rotor tests. Sketch the circle diagram showing various salient components of the diagram and mention the use of the circle diagram.
- 8.a) Describe the method for the speed control of a 3-phase slip ring induction motor.
- b) Calculate the relative values of:
- The starting torque and
 - The starting current of a 3-phase cage-rotor induction motor when started by: direct switching, a star-delta starter, and an auto-transformer having 30% tapings.

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