



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:III
Class:SY	Program:B.Tech
Branch Code:ELE	Pattern:2022
Name of Course:Transformer and Induction Machines	Course Code:ELE222005
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

- 1a) Solve any one of the following **(6Marks)** (6) CO1

Differentiate between core type and shell type transformer.

OR

Draw the construction of single phase core type transformer and explain its working principle.

Question No. 2 Attempt following Question

- 2a) Solve any one of the following **(6Marks)** (6) CO4

A 500kVA single phase transformer has a total loss of 4.5kW on short circuit (at full load current) and 1kW on open circuit. Determine its efficiency at 0.7 power factor when transformer is loaded to half of its rating.

OR

Two single phase transformer share a load of 500kVA at 0.8 power factor lagging. Their equivalent impedance referred to secondary are $(1+j3) \Omega$ and $(2+j6) \Omega$ respectively. Calculate load share by each transformer and comment on the result.

Question No. 3 Attempt following Question

- 3a) Draw the torque-slip or speed characteristic of three phase induction motor. Explain it and also give the impact of increase in rotor resistance on torque speed characteristic. (8) CO2

OR

- 3b) A 6-pole, 50Hz, 3-phase induction motor running on full load develops useful torque of 150Nm at rotor frequency of 1.5Hz. Calculate (8) CO4

- (i) the shaft output power
- (ii) mechanical power developed if mechanical torque lost in friction be 10Nm.
- (iii) rotor copper loss
- (iv) Input power to motor if stator losses are 700W
- (v) the efficiency of motor.

3c) Derive the relation between rotor copper loss, air-gap power (rotor input) and mechanical power developed. (8) CO2

OR

3d) A 100kW, three-phase, 50Hz, 6pole induction motor has a rotor impedance of $(0.02+j0.2)\Omega/\text{ph}$ at standstill. Full load torque is obtained at 960rpm. Calculate (8) CO4

- (i) The speed at which maximum torque occurs.
 - (ii) The ratio of maximum to full load torque.
 - (iii) External resistance to be inserted to get maximum torque at starting.
- (Hint: At starting speed is zero)

Question No. 4 Attempt following Question

4a) Why the starter is necessary for three phase induction motor? With neat sketch explain star-delta starter. Also derive the ratio of starting torque to full load torque of induction motor with star-delta starter. (8) CO2

OR

4b) A 3-phase, 4 pole, 50Hz, cage induction motor has a short circuit current equal to 5 times the full load current. The full load speed of motor is 1440rpm. Find the ratio of starting torque to full load torque if motor is started by (8) CO4

- (i) Direct switching to the supply
- (ii) Star delta starter
- (iii) Auto-transformer starter with 60% tapping.

4c) List the various speed control methods used for three induction motor. Explain any one method in detail with suitable diagram (8) CO2

OR

4d) A 3-phase, 4 pole star connected induction motor is connected to 200V (Line to Line), 50Hz AC supply. The stator resistance and standstill reactance of rotor is 0.1Ω and 0.9Ω respectively. The ratio of rotor to stator turns is 0.67. Calculate (8) CO4

- (i) Torque at 4% slip.
- (ii) Maximum torque
- (iii) Speed at maximum torque.

Question No. 5 Attempt following Question

5a) With neat circuit, phasor diagram and characteristic explain capacitor start capacitor run motor. Give its advantages, disadvantages and applications. (8) CO1

OR

5b) With circuit diagram and calculation procedure explain no load and block rotor test to determine equivalent circuit diagram. (8) CO3

5c) With neat circuit, phasor diagram and characteristic explain permanent split capacitor. Give its advantages, disadvantages and applications. (8) CO1

OR

5d) A single phase induction motor gave the following test results: (8) CO3

Blocked Rotor Test: 120V, 9.6A, 460W

No Load Test: 220V, 4.6A, 125W

The stator winding resistance is 1.5Ω and during blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters. Also indicate on the equivalent diagram

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