Code No: 124AB **R15**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech II Year II Semester Examinations, April/May - 2023**
**ELECTRICAL MACHINES – II**
**(Electrical and Electronics Engineering)**

**Time: 3 hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

## PART - A

**(25 Marks)**

1.a) Draw the phasor diagram of transformer on no load? [2]
b) Explain how to minimize hysteresis and eddy current loss in case of single-phase transformer? [3]
c) Why is SC test performed normally on HV side? [2]
d) Discuss the effect of circulating current at no-load, in two single phase transformers operating in parallel? [3]
e) List the advantages of AT over conventional two winding transformer? [2]
f) What are the advantages of single three phase transformer unit over a bank of single-phase transformers? [3]
g) What is cogging? [2]
h) What are fixed and variable losses in a three-phase induction motor? Give power flow diagram of induction motor? [3]
i) Why starting methods are needed for 3-Phase induction motor [2]
j) Explain induction generator principle? [3]

## PART - B

**(50 Marks)**

2.a) Derive an expression for the emf induced in a transformer winding. Show that emf per turn in primary is equal to emf per turn in the secondary
b) A single phase 150 kVA transformer has efficiency of 96 % at full load, 0.8 pf and at half load, 0.8 pf lagging. Find maximum efficiency of transformer and corresponding load. [5+5]

**OR**

3.a) Explain the effect of variations of frequency & supply voltage on iron losses?
b) The constants of a single phase 50Hz, 2200/220V transformer are as follows:
h.v. side : $r_1 = 0.21\ \Omega$; $x_1 = 3.84\ \Omega$ $R_C = 4800\ \Omega$ ; $X_m = 3500\Omega$
l.v. side: $r_2 = 0.006\ \Omega$ : $x_2 = 0.022\Omega$ .Find the equivalent circuit parameters referred to i) h.v. side and ii) l.v. side. [5+5]

4.a) What parameters of the equivalent circuit of a transformer can be determined from open-circuit and short circuit tests? Explain. With the help of neat circuit diagrams?

b) Following are the test results for the 4KVA, 200/400V, 50Hz, single phase transformer.
**O.C test:** 200V, 0.8A, 70 W **S.C test :** 17.5V, 9A, 50 W.
Calculate the parameters of equivalent circuit of a transformer. [5+5]

**OR**

5.a) Describe the method by which the separation of core losses of a transformer is achieved

b) With the instruments located on the high-voltage side and the low-voltage side short-circuited, the short-circuit test readings for the 50-kVA 2400:240-V transformer are 48 V, 20.8 A, and 617 W. An open-circuit test with the low-voltage side energized gives instrument readings on that side of 240 V, 5.41 A, and 186 W. Determine the efficiency and the voltage regulation at full load, 0.80 power factor lagging. [5+5]

6.a) Write a brief note on tap changing transformers.

b) A bank of three single phase transformers has its hv terminals connected to 3 wire 3 phase, 11kV system. Its lv terminals are connected to a 3 wire 3 phase load rated at 1500kVA, 2200V. Specify the voltage, current and kVA ratings of each transformer for both hv and lv windings for Y- Δ connection. [5+5]

**OR**

7. What is the three-winding transformer? What is the third winding called as? Why third winding is needed? [10]

8.a) Draw and explain the Phasor diagram of a three-phase induction motor?

b) A 40 Hp three-phase induction motor has a full load slip of 4%. The stator losses amount to 4% of the input and the mechanical losses are 1% of the output. If the current in each phase of the rotor is 50 A. Find the resistance per phase of the rotor and the efficiency of this machine? [5+5]

**OR**

9.a) Discuss briefly about the deep bar and double cage rotor of three-phase induction motor.

b) A 3 phase 4-pole 400 V 50 Hz induction motor develops 15 hp at 1425 rpm with a power factor of 0.8. The mechanical losses amount to 0.75 hp. Determine for this load
i) Slip (ii) rotor losses (iii) gross torque developed in synchronous watt and (iv) line current. Take the stator losses equal to 1200 W. [5+5]

10.a) With neat diagram, explain the various tests to be conducted on 3-phase IM to plot the circle diagram.

b) The short circuit current of SCIM on normal voltage is 3.5 times the full load current and the full load slip is 4%. Determine the percentage tapping required to an autotransformer starter to start the motor against $1/3^{rd}$ full load torque. Neglect magnetizing current. [5+5]

**OR**

11. Explain the following methods of speed control with slip-torque characteristics.
a) Frequency control
b) Stator voltage control. [5+5]

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