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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Electrical & Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE3PCTIM **Max Marks: 100**
Course: Transformers & Induction Machines **Date: 15.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1	a)	With the help of phasor diagram, explain the operation of single phase transformer on load at i) Lagging pf ii) Leading pf	**08**
	b)	Starting from the fundamentals, develop the exact equivalent circuit and approximate equivalent circuit of a single phase transformer referred to primary.	**08**
	c)	The no-load current of a transformer is 10A at a power factor of 0.25 lagging, when connected to 400V, 50Hz supply. Calculate i) magnetising component of no load current ii) iron loss iii) maximum flux in the core. Assume primary winding turns as 500.	**04**

OR

2	a)	The OC and SC test on a 10 KVA, 125/250V, 50 Hz single phase transformer gave the following results OC Test : 125 V, 0.6A, 50W (on LV side) SC Test : 15 V, 30A, 100W (on HV side) Calculate i) Copper loss at FL ii) Half FL efficiency at 0.8 pf lag iii) Regulation at FL 0.9 leading.	**08**
	b)	Derive an expression for the saving of copper in an autotransformer. Take step down configuration.	**06**
	c)	A 40KVA transformer with a ratio of 2000/250V has a primary resistance of 1.15Ω and a secondary resistance of 0.0155Ω. Calculate i) total resistance in terms of secondary winding ii) total resistance drop on full load iii) total copper loss on full load	**06**

UNIT - II

3	a)	Discuss the necessary conditions for parallel operation of transformers.	**04**
	b)	Explain with necessary diagram how two single phase transformers can be used to convert a 3-ph Supply to a two phase supply. If the load is balanced on one side, show that it will be balanced on other side.	**08**

c) Two electric furnaces are supplied with a single-phase circuit at 80V from a 3-ph, 11000V system by means of two single phase scott connected transformers with similar secondary windings. When the load on one furnace is 500KW and on the other 800KW, what current will flow in each of the three lines at i) upf ii) 0.5 pf lag. **08**

UNIT - III

4 a) Derive the equation for torque developed by the 3 phase Induction motor. Draw typical torque- Slip characteristics curve indicating all regions of operation. **07**

b) A 400V, 4 pole, 3 phase, 50Hz star connected induction motor has a rotor resistance and reactance per phase equal to 0.01ohm and 0.1ohm respectively. Determine : **06**

i) Starting toque

ii) Slip at which maximum torque occurs

iii) Speed at which maximum torque occurs. Assume ratio of stator to rotor turns as 4.

c) Draw and explain phasor diagram, equivalent circuit of a 3 phase Induction motor. **07**

OR

5 a) Obtain the relation between rotor input, rotor copper loss and Gross mechanical power developed with slip of an Induction motor. **08**

b) Explain the phenomenon of Cogging and crawling in 3 phase Induction motor. **08**

c) The power input to a 500 V, 50 Hz, 6 pole, 3 phase, Induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and friction & windage losses total are 2 kW. Calculate i) slip ii) The Rotor copper loss **04**

UNIT - IV

6 a) Draw the circle diagram from No – load and blocked motor test of a 3 - phase, 50 Hz, 15 kW, 400 V, 4 poles Induction motor using the following results. **10**

No – load test (line values): 400 V, 9 A, 1310 W

Blocked rotor test (line values): 200 V, 50 A, 7100 W

Rotor copper loss at stand still in half the total copper loss. From the diagram find (i) Line current (ii) Slip (iii) Efficiency (iv) Torque (v) power factor at full load.

(Choose a current scale – 1cm = 5A)

b) Explain the following **10**

1. Frequency control method of speed control of 3-phase Induction motor
2. Star-delta starter to start 3-phase Induction motor

UNIT - V

7 a) Explain the principle of operation of a 1 - ph Induction motor using double revolving field theory and prove that it cannot produce any starting torque. **10**

b) With neat sketch, explain the construction and working of; **10**

i) Split – phase Induction Motor ii) Shaded pole Induction Motor.

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