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EE64

Sixth Semester B.E. Degree Examination, June/July 08
Transformer and Induction Machine

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. Draw the sketch of core type and shell type transformer. Draw 1 - ϕ as well as 3 - ϕ cores. What are the advantages of each over the other? **(08 Marks)**

b. What are the applications of transformer? **(04 Marks)**

c. The emf per turn of a 2200/220V, 50 Hz transformer is 12 V. Calculate i) The number of primary and secondary turns ii) The net cross -- sectional area of core for a maximum flux density of 1.5T. **(08 Marks)**

2 a. What are the characteristics assumed for an ideal transformer? Draw the phasor diagram of an ideal transformer having load with leading power factor. **(06 Marks)**

b. What are the losses in a transformer? How each loss can be minimised? **(06 Marks)**

c. A 2300/230V, 500 KVA, 60 Hz distribution transformer has 1.8 kW of core loss and 8.2 kW of copper loss at rated load. The transformer is loaded in 24 hours as below.

No load				2 hours
20% of full load	at	0.7 p.f.	for	4 hours
40% of full load	at	0.8 p.f.	for	4 hours
80% of full load	at	0.9 p.f.	for	6 hours
Rated load	at	Unity p.f.	for	6 hours
125% full load	at	0.85 p.f.	for	2 hours

Assuming constant input voltage calculate all – day efficiency. **(08 Marks)**

3 a. What are the conditions to operate two transformers in parallel? **(06 Marks)**

b. Define voltage regulation of the transformer. Derive the equation of the same in terms of transformer parameters and load p.f. **(06 Marks)**

c. A 50 KVA, 2200/110V transformer when tested gave the following results:
OC test, with HV open : 400 W, 10 A, 110V
SC test, with LV short : 808W, 20.5A, 90V.
Compute all the parameters and draw the equivalent circuit as referred to HV side. **(08 Marks)**

4 a. Draw and discuss the connection diagrams of Y–Y, Δ - Δ and Y - Δ three phase transformers. **(06 Marks)**

b. Draw the circuit diagram and explain 3- phase to 2- phase conversion. **(06 Marks)**

c. An ideal 3- phase transformer connected delta/star delivers power to a balanced 3- phase load of 120 kVA at 0.8 p.f. The input line voltage is 11 kV and the phase – to – phase turns ratio $\frac{N_1}{N_2}$ is 10. Determine the line and phase voltages, line and phase currents on both the primary and the secondary sides. **(08 Marks)**

5 a. Explain the production of rotating magnetic field in the induction motor air gap. **(06 Marks)**

b. Explain the two types of induction motors based on rotor construction. What are their applications? **(06 Marks)**

c. A three phase induction motor stator has 6 poles. If the line frequency is 60 Hz calculate the rotor frequency at the instant of starting and at the full speed of 1140 rpm. **(08 Marks)**

6 a. Draw complete torque – slip characteristics of an induction machine: show starting torque, breakdown torque and rated torque. Mark the stable and unstable regions. **(06 Marks)**

b. Draw approximate circle diagram of an induction motor and mark all the important features. **(06 Marks)**

c. A 400 V, 6 pole, three phase, 50 Hz star connected induction motor gives following results:

BR test: 150V, 35 A, 4000 W; stator resistance, $R_1 = 0.55\Omega$/phase. When the motor is operating at a slip of 4% calculate gross mechanical power and torque. **(08 Marks)**

7 a. What is the need of starter for a three phase induction motor? List different types of starters. **(06 Marks)**

b. Draw the torque speed curves of an induction motor when its speed is controlled by

i) Voltage control

ii) rotor resistance control

iii) Voltage frequency (V/f) control.

c. A squirrel cage induction motor has a full load slip of 0.05. The motor starting current at rated voltage is six times its full load. Find the tapping on the auto – transformer starter, which should give full load torque at start. Also find the line current at starting. **(08 Marks)**

8 Briefly explain the following:

a. Cogging and crawling **(06 Marks)**

b. Induction generator **(06 Marks)**

c. Types of single phase induction motors and their applications **(08 Marks)**

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