

N.B. : (1) All questions carry equal marks.

(2) Question No. 1 is compulsory.

(3) Attempt any four out of the remaining questions.

Question 1.

- Handwritten: 4/12/22*
- Handwritten: Use old principles of Eret. Design*
- Explain with the help of a neat diagram the current distribution in the bars and end rings of a squirrel cage Induction Motor.
 - Explain in detail the construction of a core of transformer using CRGO steel.

Question 2

- Derive an expression for reluctance offered by a parallel sided slot with single conductor in a induction motor stator.
- In case of a 3 phase IM show that
 - Maximum power factor = $1 - \sigma$

$$\frac{1 - \sigma}{1 + \sigma}$$

$$\text{Maximum power factor} = \frac{\text{full load output} * (1 + \sigma)}{2 \sqrt{\sigma}}$$

$$2 \sqrt{\sigma}$$

Question 3

- Explain in detail the effects of choice of specific magnetic and specific electric loading while designing a 3 phase Induction Motor.
- Explain the significance of B_{60}° in estimating the magnetizing current in a 3 phase Induction Motor.

Question 4

- Describe briefly various types of coils used in transformer windings. Further explain where each type of coil is used
- For a 3 phase transformer derive the relation between the rating and the main dimensions.

Question 5

- In case of a transformer, write a detailed note on the different accessories and their functions
- Write a detailed note on the different methods of cooling of a transformer.

Question 6

- Derive an expression for the total leakage reactance referred to primary side
- Prove the exponential law between time and temperature rise of an electrical equipment on constant load.

Question 7

- Determine the dimensions of the core, the number of turns and the cross sectional area of conductors in the primary and secondary windings of a 100 kVA, 2200/480 V, single phase core type transformer to operate at a frequency of 50 Hz.; assuming the following data: approximate voltage per turn = 7.5 V, maximum flux density 1.2 Wb/m^2 , ratio of effective cross sectional area of core to square of diameter of circumscribing circle 0.6, ratio of height to width of window 2, window space factor 0.28, current density 2.5 A/mm^2 .
- Calculate the equivalent resistance of rotor per phase referred to stator, from the following data of a 400 V, 3 phase 4 pole 50 Hz cage motor. Stator slots = 48 with 30 conductors per slot; Rotor slots = 53 with one bar on each slot. The length of each rotor bar is 0.12 m and area 60 sq. mm. The end rings have a mean diameter of 0.18 m and an area of cross section of 150 sq. mm. Full pitched winding with 60 degree phase spread is used for the stator. The material used for bars and end rings has a resistivity of 0.021 ohm/m-sq.mm.