[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2125)

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B. Tech 7th Semester Examination

Electrical Machine Design (OS)

EE-7001

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any FIVE questions in all, selecting at least one question from each section A, B, C, and D. Section E is compulsory.

SECTION - A

1. (a) Classify insulating materials based on their temperature rise. Give example of each classification. (10)

   (b) Write detailed notes on radial and axial ventilation systems. (10)

2. (a) Compare copper and aluminium when used in electrical machine windings. Also write a short note on cooling of transformers. (10)

   (b) Discuss the advantages of 'hydrogen cooling' in electrical machines. Write a detailed note on induced self ventilation of machines. (10)

SECTION - B

3. (a) Derive an expression for the leakage reactance of transformer with primary and secondary cylindrical coils of equal lengths. State clearly the assumptions made. (10)

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   (b) What types of mechanical forces developed in transformer winding? (10)

4. (a) Discuss the magnetic circuits of 'three phase induction motor'. Also discuss the effect of changing supply voltage frequency on magnetic losses of transformer. (10)

   (b) Show that leakage reactance is directly proportional to specific slot leakage permeance. What is the effect of saturation and load on leakage coefficient? (10)

SECTION - C

5. (a) What do mean by output equation in electrical machine design ? Derive the output equation of both single and three phase transformer. (10)

   (b) Estimate the main dimensions including winding conductor areas of a 3-phase delta/star core type transformer rated at 300 kVA, 6600/440 V, 50 Hz. A suitable core with three steps having a circumscribing circle of 0.25 m diameter and a leg spacing of 0.4 m is available. The emf per turn is 8.5 V. Assume a current density of 2.5 A/mm^2, a window space factor of 0.28 and a stacking factor of 0.9. (10)

6. (a) Discuss with the help of neat sketches about the 3-phase core type and shell type transformer. (10)

   (b) Calculate no-load current and magnetizing volt amp for a single-phase transformer. (10)

SECTION - D

7. (a) Discuss the factors to be considered in estimating the length of air gap of an Induction Motor. (10)

   (b) Find the value of stator core dimensions of a 8 kW, 220 V, 50 Hz, 6 pole, 3-phase induction motor for best power factor. Assume: specific magnetic loading = 0.5 Wb/m^2; specific electrical loading = 23000 A/m; efficiency = 0.88 and power factor = 0.87. Core length to pole pitch ratio is unity. (10)

8. (a) Discuss the step by step procedure to design the rotor of a squirrel cage Induction Motor. (10)

   (b) A 415 V, 3-phase, 50 Hz, 6 pole delta connected induction motor has a specific magnetic loading of 0.5 Tesla and specific electric loading of 24000 A/m. The stator core diameter and length are 0.275 m and 0.15 m respectively. Find the output of the machine if full load efficiency and power factor are 0.88 and 0.89 respectively. Also determine the number of stator slots, conductors per slot and length of air gap. (10)

SECTION - E

9. Attempt all questions

   (a) What is window space vector?

   (b) Define total magnetic loading and specific magnetic loading.

   (c) Define dispersion coefficient of an induction motor.

   (d) Give the relationship between emf per turn and kVA rating in a transformer.

   (e) What are the factors that decide the choice of specific magnetic loading?

   (f) Define specific permeance of a slot.

   (g) Define unbalance magnetic pull.

   (h) Write down the output equation for the 1-phase and 3-phase transformer.

   (i) List the methods used for estimating the mmf for teeth.

   (j) What is the significance of guard terminals resistance in high resistances? (2×10=20)