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B.Tech.(EE/Electrical & Electronics) (2011 Onwards E-I) (Sem.–6)

COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Subject Code : BTEE-605A

M.Code : 71152

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1) Answer briefly :

a) Name the various types of enclosures used in electrical machines.

b) What is the significance of specific magnetic loading?

c) Derive the emf equation of a single-phase transformer.

d) What are the requirements of an ideal insulating material?

e) What do you mean by dispersion coefficient in an induction motor?

f) What are the factors to be considered for the choice of specific magnetic loading in a rotating machine?

g) Why air gap of an induction motor is made as small as possible?

h) How will you calculate the transformer weight from its design details?

i) Give a classification of insulating materials.

j) Define distribution factor. Discuss its significance.

SECTION-B

2) A 3-phase squirrel cage induction motor is designed to have copper bars. If, instead of copper, aluminium were used for rotor bars, discuss what would happen to its speed, maximum and starting torques and efficiency under normal operating conditions.

3) Calculate the main dimensions for a 250KVA, 3000/400Volts, 50Hz, 3-Phase, Delta / Star, Core type, oil immersed self-cooled, outdoor type distribution transformer. Assume suitable values for various design constants and specific magnetic loading.

4) Derive the expression of voltage regulation of a single-phase transformer. Also, deduce the conditions for zero and maximum voltage regulation conditions.

5) Show that the specific electric loading of a rotating machine is constant provided the current density, ratio of conductor to slot area, ratio of slot width to slot pitch & the slot depth are constant.

6) A 12.0 HP, 4-pole, 3 phase, 50Hz, 440V delta connected induction motor has the following data.

Effective turns per phase = 214, Diameter of stator = 20cm, Length of stator = 12.5cm,

Radial air-gap on one side = 0.055cm, Gap coefficient = 1.33

Find the air-gap ampere-turns required.

SECTION-C

7) a) Calculate the magnetizing current of a 3-phase, 415V, 4-pole, 50Hz induction motor having the following data :

Stator slots = 36, conductors per slot = 36, stator bore = 0.2m, stator core length = 0.18m, effective gap length = 1.05mm, distribution factor = 0.95, full pitch winding and iron permeability is infinite.

b) Discuss the different types of cross-sections used in the design of power and distribution transformers. Find out the net core area for cruciform core in terms of diameter d.

8) a) Calculate the main dimensions for a 300 kVA, 5500 / 440Volts, 50Hz, 3-Phase, Delta/Star, Core type, oil immersed self-cooled, outdoor type distribution transformer. Assume suitable values for various design constants and specific magnetic loading.

b) A transformer at the design stage is found to have a voltage regulation of 7.5%. What alterations should be made in the transformer design so as to get a voltage regulation of 5%?

9) Deduce for a 3-phase induction motor an expression showing the relationship between HP output, its main dimension, speed, the specific electric and magnetic loadings, efficiency and power factor. Hence, using this expression, obtain suitable values for the main dimensions of the stator of a 3-phase, 60HP, 2000V, 50Hz, induction motor with a wound rotor and to run at about 600*rpm*.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.