B.TECH. SEM -V ELECTRICAL 2014 COURSE (CBCS) :
SUMMER - 2018
SUBJECT : ELECTRICAL MACHINE DESIGN

Day : **Wednesday** **S-2018-2344** Time : **10.00 AM TO 01.00 PM**
Date : **23/05/2018** Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of nonprogrammable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

Q.1 **a)** From the fundamentals derive equation for final steady temperature rise of an electrical machine. **[06]**

b) What are the limitations in design of electrical machines? **[04]**

OR

a) How the temperatures of core and low voltage winding measured in power transformer? **04]**

b) A copper bar 12mm in diameter is insulated with micanite tube which fits tightly around the bar and into the rotor slot of an induction motor. The micanite tube is 1.5 mm thick and its thermal resistivity is 8Ω-m. Calculate the loss that will pass from copper bar to iron if a temperature difference of 25^0 C is maintained between them. The length of the bar is 0.2 m. **[06]**

Q.2 **a)** Write down the steps and formulae to design low voltage winding of three phase distribution transformer. **[05]**

b) A 300 KVA, 6600 V / 440 V, three phase, delta/star core type transformer has a maximum flux density of 1.35 wb/m^2 and the total weight of core is 650 kg. The magnetizing VA/kg and the iron loss/kg corresponding to 1.35 wb/m^2 are 30 and 2.5 W respectively. Calculate the no load current if the mmf required for joints is 2.5% of that of iron. **[05]**

OR

a) Classify transformers on the basis of methods of cooling methods. State reaons for placing L.V. winding near the core and H.V. winding away from the core. **[05]**

b) What are different types of transformer windings? With neat diagram explain any one of the winding used for low voltage side of power transformer. **[05]**

Q.3 **a)** How will you estimate no load current of three phase induction motor? **[06]**

b) What is dispersion co-efficient? Where is it used in design of induction motor? **[04]**

OR

P.T.O.

a) What is mush winding? For which type of induction motor is it used? **[02]**

b) Determine the main dimensions, turns per phase, number of slots of a three phase, 250 H.P., 50 Hz 415V, 1450 rpm slip ring induction motor. Assume B_{av} = 0.5 wb/m^2; ac = 30000 A/m, efficiency = 0.9 and power factor = 0.9 lagging, winding factor = 0.955, current density 3.5 A/mm^2. The ratio of core length to pole pitch is 1. The machine is delta connected. **[08]**

Q.4 a) Discuss the operating characteristics of single phase induction motor. **[05]**

b) Show that the output for a single phase induction motor is 2/3rd of that for a three phase equivalent induction motor for the same D^2L values. **[05]**

OR

How do you select the no. of rotor slots, area of rotor bars, area of end ring, rotor resistance, rotor teeth of single phase induction motor? **[10]**

Q.5 a) Design a suitable 5 section starter for a 20hp, 250V, 1000 rpm dc shunt motor from the following data: **[05]**
Maximum torque = full load torque; armature resistance = 0.4Ω;
efficiency = 0.85.

b) Discuss the factors that govern the choice of average gap density for synchronous machine. **[05]**

OR

a) The following data for a 1250 kVA, 0.8pf, 50Hz, 3300 V, 300 rpm star connected alternator is available: **[04]**

Stator turns per phase	= 150
Field turns per pole	= 60
Effective area per pole	= 0.09 m^2
Air gap length at pole centre	= 5mm
Field current for full load short circuit current	= 80A
ATs per pole for iron portion	= 20% of air gap

Assuming sinusoidal flux distribution, estimate the values of short circuit ratio and synchronous reactance.

b) Explain the procedure for tentative design of the field winding of a 3-phase hydro-generator and show that the height of the field winding is given by **[06]**

$$h_f = \frac{AT_{fe} \times 10^{-4}}{\sqrt{q_f s_f d_f}}$$

Q.6 a) Discuss the objective of Design optimization of Electrical Machines. **[05]**

b) Describe the work flow of FEA based Electrical Machine Design optimization. **[05]**

OR

a) Draw the machine design optimization flow chart and explain it. **[06]**

b) What are the different FEA based machine design packages. Discuss any one in brief. **[04]**

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