Roll No. | | | | | | | | | | 1

10/5/19

B.E. (Full Time) END SEMESTER EXAMINATIONS, APRIL/MAY 2019

ELECTRICAL AND ELECTRONICS ENGINEERING

Semester : VII

EE 8701 : DESIGN OF ELECTRICAL APPARATUS

(Regulation 2012)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1 What are the materials used for brushes in dc machines?
2 How is heat produced in a rotating electrical machine?
3 State the difference between armature winding of dc machine and stator winding of ac machine.
4 What factor decides the minimum number of armature coils?
5 Define windows space factor
6 What are the factors to be considered for choosing the method of cooling?
7 How the induction motor can be designed for best power factor?
8 What happens if the air gap length is doubled?
9 Determine the total number of slots in the stator of an alternator having 4 poles, 3 phase, 6 slots per pole per phase.
10 Mention the factors that govern the design of field system of alternator

PART – B (5 x 16 = 80 Marks)

11 a (i) What is the fundamental requirement of a good insulating material? What is the importance of temperature as a factor in the life of insulating materials? (8)

(ii) Derive an expression for a thermal model of motor for heating and cooling also draw the heating and cooling curve (8)

12 a (i) What are the important considerations in choosing number of poles in a D.C.machine? (8)

(ii) Calculate the main dimensions of 20 KW, 1000 rpm, dc motor. Given that β = 0.37 Tesla and ac = 16000 amp.cond/m. Make the necessary assumptions. (8)

OR

b (i) Determine the total commutator losses for a 1000kW, 500V,8000rpm, 10 pole generator. commutator diameter=1.0m, current density at brush contact = $75*10^{-3}$ A/mm^2, brush pressure = 14.7kN/m^2. coefficient of friction = 0.28, brush contact drop = 2.2V. (16)

13 a (i) Derive the output equation of a 3-phase transformer (6)

(ii) Estimate the main dimensions including winding conductor area of a 3-phase, Δ-Y core type transformer rated at 300kVA, 6600/440V, 50Hz. A suitable core with 3-steps having a circumscribing circle of 0.25m diameter and a leg spacing of 0.4m is available. Emf per turn = 8.5V, $\delta = 2.5 A/mm^2$, $K_w = 0.28$, $S_f = 0.9$ (10)

OR

b (i) The tank of 1250kVA, natural oil cooled transformer has the dimensions length, width and height as 0.65*1.55*1.85 m respectively. The full load loss = 13.1kW, loss dissipations due to radiations = 6 W/m^2 degree centigrade, loss dissipations due to radiations = 6.5 W/m^2 degree centigrade, improvement in convection due to provision of tubes = 40%, temperature rise = 40 degree Centigrade, length of each tube = 1m, diameter of tube = 50mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling. (16)

14 a (i) What are the factors to be considered for estimating the length of air-gap in induction motor? (6)

(ii) Estimate the main dimensions, air-gap length, stator slots, stator turns per phase and cross sectional area of stator and rotor conductors for a 3-phase, 15HP, 400V, 6 pole, 50Hz, 975rpm, induction motor. The motor is suitable for star delta starting. $B_{av} = 0.45 Wb/m^2$, ac = 20000 amp.cond./m, $L/\tau = 0.85$, $\eta = 0.9$, pf = 0.85 (10)

OR

b (i) Bring out the main difference in the design procedure of a three-phase cage induction motor with three-phase slip ring induction motor (6)

(ii) A 90kW, 500V, 50Hz, 3-phase, 8-pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is not to exceed 400 volt, find a suitable rotor winding by estimating number of slots, number of conductors per slot, coil span, slip-ring voltage on open circuit, approximate full load current per phase in rotor. Assume η = 0.9 and pf = 0.86. (10)

15 a (i) For a 250kVA, 1100V, 12pole, 500rpm, 3-phase alternator. Determine air gap diameter, core length, Number of stator conductors, Number of stator slots and cross-section of stator conductors. Assuming average gap density as 0.6 Wb/m^2 and specific electric loading of 30,000 amp.cond./m. $L/\tau = 1.5$. (16)

OR

b (i) Define: SCR. Discuss the effect of SCR on the performance of a synchronous machine. (8)

(ii) What are the factors to be considered for selection of number of slots (8)