Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

14EE2009 Electrical Machine Design

Set B

Time : 3 hrs
Total Marks: 100

1. a.What are the factors influencing the choice of specific magnetic loading in electrical machines?

   b. A 350 kW, 500 V, 450 rpm, 6 pole dc generator is built with an armature diameter of 0.87 m, and Core length of 0.32m, the lap wound armature has 660 conductors. Calculate specific electric and magnetic loading.

OR

2. a. Obtain the relationship between real and apparent flux density in the slots of rotating machine.

   b. Determine the air-gap length of a dc machine from the following particulars: gross length of core =0.12m, number of ducts =1 and is 10 mm wide, slot pitch = 25mm, slot width =10mm. Take Carter's coefficient for slot and ducts = 0.32, gap density at pole centre = 0.7wb/m^2; field mmf/pole = 3900AT, mmf required for iron parts of magnetic circuit = 800AT.

3. a. What are the advantages of having more no. of poles in a DC machine?

   b. Determine suitable values for the number of poles, Diameter, core length of a dc shunt generator with following data. Voltage rating 500V, 1000kW, speed 300rpm, specific magnetic loading 1 Tesla and specific electric loading 400 ac/cm, assume square pole face.

OR

4. Design a suitable commutator for a 350KW, 600 rpm, 440V, 6 pole, dc generator having an armature diameter of 0.75m. The numbers of coils are 288. Assume suitable value wherever necessary.

5. a. Derive the expression for the number of cooling tubes required for the transformer.
   b. Derive the output equation of single phase Transformer and three phase transformer.

OR

6. Determine the dimension of the core, the number of turns, the cross section area of conductors in primary and secondary windings of a 100 kVA, 2200/480V, single phase, core type transformer to operate at a frequency of 50 Hz, by assuming the following data. Approximate Volt/turn = 7.5 Volts. Maximum flux density=1.2 Wb/m^2. Ratio of effective cross sectional area of core to square of diameter of circumscribing circle is 0.6. Ratio of height to width of window is 2. Window space factor = 0.28, current density =2.5 A/mm^2.

7. Determine the main dimensions, number of radial ventilating ducts, number of stator slots and turns per phase of a 3.7 kW, three phase, 400 V, 4 Pole, 50 Hz squirrel cage Induction Motor to be started by a Star-Delta starter. Given that the average flux density in the air gap = 0.45 Wb/m^2; Ampere Conductor per meter of armature periphery = 23000, full load efficiency = 0.85, full load power factor = 0.84 and k_w = 0.955. Take $L/\tau = 1.5$.

OR

8. A 90 kW, 500 V, 50 Hz, 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 V, find a suitable rotor winding by estimating the number of slots, number of conductors per slot, coil span, approximate full load current per phase in rotor. Assume η =0.9 and power factor = 0.86

9. Calculate the output co-efficient for a 1500 kVA, 2200 V, 3 phase, 10 pole, 50 Hz, star connected alternator with sinusoidal flux distribution. The winding has 60º phase spread, full pitch coils, ac = 30000 ac/m and B_{av} = 0.6 Wb/m^2. If the peripheral speed of the rotor must not exceed 100 m/s and the ratio of pole pitch to core length is to be between 0.6 and 1, find D and L. Assume an air gap length of 6 mm.

Find also the approximate number of stator conductors.

Wishing you All the Best
