ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : MAY / JUNE 2010

REGULATIONS : 2007

FIFTH SEMESTER : EEE

070280032 - ELECTRICAL MACHINE DESIGN

TIME : 3 Hours Max.Marks : 100

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. State "Total magnetic Loading"
2. Define "Specific Electric Loading"
3. What is total gap contraction factor ?
4. Define "field form factor".
5. How can we avoid the flash over between the adjacent brush arms in DC machines.?
6. What are the guiding factors for the choice of number of poles in DC machines?
7. What are the design modifications done in DC machines to reduce the effects of armature reaction?
8. What is the role of interpoles in DC machines.?
9. Define "window space factor"
10. What are the usual values of maximum flux density in the core of power and distribution transformers?
11. What do you mean by air blast cooling?
12. What are the factors to be considered while designing the insulation of transformers?
13. Compare squirrel cage and wound rotors.
14. What are the factors to be considered for the choice of ampere conductors per metre in Induction motors?

15. What is tooth pulsation loss in Induction motors?
16. What is crawling?
17. Define "SCR" in synchronous machines.
18. What are the different methods available for the elimination of harmonics in synchronous machines?
19. What is hot spot temperatures in synchronous machines?
20. What are the factors to be considered for the selection of number of armature slots in synchronous machines?

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. a What are the main dimensions of a rotating machine? Explain in detail about the total loadings and specific loadings of a rotating machine. 6

    b Explain the factors affecting the size of rotating machines 6

22. a Explain the factors which influence the relative values of D and L for a DC machine 6

    b A 500 KW, 375 RPM DC generator is designed with B_{av} = 0.6 Wb/m^2 and ac = 35000 ampere conductors per metre and ratio pole arc to pitch = 0.66. The armature is lap connected and single turn coils are used. Find suitable values for diameter and length of armature if the maximum value of voltage between adjacent segments is not to exceed 30 V at full load and the peripheral speed is not to exceed 30 m/s. Assume the maximum value of gap density at full load to be 1.3 times the maximum value of flux density at no load. Efficiency at full load = 0.91 6

23. a Derive the output equation of a DC machine and explain all the dimensions in detail 6

b Explain the choice of ampere conductors per metre of a DC machine 6

24. a Explain the factors to be considered for the design of length of air gap for a DC machine 6

b A design is required for a 50 KW, 4 pole, 600 RPM DC shunt generator, the full load terminal voltage being 220 V. If the maximum gap density is 0.83 wb/m^2 and the armature ampere conductors per metre are 30000, calculate suitable dimensions of armature core to give a square pole face. 6

Assume that the full load armature voltage drop is 3% of the rated terminal voltage and that the field current is 1% of rated full load current. Ratio of pole arc to pole pitch is 0.67.

25. a Derive the output equation of transformer for both single phase and three phase. 8

b Write short notes on overall dimensions of transformers 4

26. a Explain the design of oil tank and tubes for a transformer 6

b Calculate the KVA output of a single phase transformer from the following data : Core height / distance between core centres = 2.8; diameter of circumscribing circle / distance between core centres= 0.56; net iron area/area of circumscribing circle = 0.7. current density = 2.3 A /mm^2. Window space factor = 0.27. Frequency = 50 Hz. Flux density of core = 1.2 wb/m^2. 6

27. a Explain the design of stator slot for an Induction Motor 8

b Determine the main dimensions of a 250 h.p, 3 phase 50 Hz, 400 V, 1410 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, winding factor = 0.955, current density = 3.5 A/mm^2. 4

28. a Explain the choice of specific magnetic and electric loading of a synchronous machine. 6

b Find the main dimensions of a 2500 KVA, 187.5 rpm, 50Hz, 3 phase, 3KV, salient pole synchronous generator. The generator is to be a vertical water wheel type. The specific magnetic loading is 0.6 wb/m^2 and the specific electric loading is 24000 A/m.Use circular poles with ratio of core length to pole pitch = 0.65. Specify the type of pole construction used if the run away speed is about 2 times the normal speed. 6

*****THE END*****