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Question Paper Code : 57328

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Sixth Semester

Electrical and Electronics Engineering

EE 6604 – DESIGN OF ELECTRICAL MACHINES

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Define specific magnetic loading.
2. Mention the various duty cycles of a motor.
3. What is real and apparent flux density ?
4. Define field form factor.
5. Why the area of yoke of a transformer is usually kept 15-20% more than that of core ?
6. Why the efficiency of transformer is so high ?
7. What are the factors to be considered for the choice of specific electric loading ?
8. How the induction motor can be designed for best power factor ?
9. Define short circuit ratio (SCR).
10. Mention the factors that govern the design of field in an alternator.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) State and explain the advantages of hydrogen cooling as applied to turbo alternator. **(8)**

(ii) Explain the methods by which mmf for teeth are calculated. **(8)**

OR

(b) (i) Calculate the apparent flux density at a section of the teeth of an armature of a D.C. machine from the following data at that section. Slot pitch = 24 mm, slot width = tooth width = 12 mm, length of armature core including five ducts of 10 mm each = 0.38 m, iron stacking factor = 0.92. True flux density in the teeth at that section is 2.2 T for which the mmf is 70000AT/m. **(8)**

(ii) Determine the air gap length of a D.C machine from the following data. Gross core length = 0.12 m, No. of ducts = one of 10 mm width, slot pitch = 25 mm, Carters coefficient for slots and ducts = 0.32, gap density at pole center = 0.7 T. Field mmf per pole = 3900AT, mmf require for iron parts of magnetic circuit = 800AT. **(8)**

12. (a) Find the main dimensions and the number of poles of a 37 kW, 230 V, 1400 rpm shunt motor, so that a square pole face is obtained. The average gap density is 0.5 wb/m^2 and the ampere conductors per meter are 22000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90%. **(16)**

OR

(b) (i) Derive the output equation of a dc machine and point out the salient features. **(8)**

(ii) State and explain the factors which govern the choice of specific magnetic loading in a DC machine. **(8)**

13. (a) (i) Derive the output equation of three phase transformer. **(8)**

(ii) State and explain the different methods of cooling the transformer. **(8)**

OR

(b) A 250 kVA, 6600/400 V, 3 phase core type transformer has a total loss of 4800 Watts on full load. The transformer tank is 1.25 m in height and 1 m × 0.5 m in plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35 degree C. The diameter of the tube is 50 mm and are spaced 75 mm from each other. The average height of the tube is 1.05 m. **(16)**

14. (a) Determine the approximate diameter and length of stator core, the number of stator slots and the number of stator conductors for a 11 kW, 400 V, 3 phase, 4-pole, 1425 rpm, delta connected induction motor. Bav = 0.45 wb/sq.m, ac = 23000 amp.cond/m, full load efficiency = 0.85, pf = 0.88, pole arc to pole pitch is 1 . The stator employs a double layer winding. **(16)**

OR

(b) Design a cage rotor for a 40 HP, 3 - phase, 400V, 50 Hz, 6 pole delta connected induction motor having a full load efficiency of 87% and a full load pf of 0.85. Take D = 33 cm and L = 17 cm. Stator slots = 54, Conductors per slot = 14. Assume suitably the missing data if any. **(16)**

15. (a) (i) State and explain the main factors which influence the choice of specific magnetic loading and specific electric loading in a synchronous machine. **(8)**

(ii) Derive output equation of synchronous machine. **(8)**

OR

(b) For a 250 kVA, 1100 V, 12 pole 500 rpm 3 – phase 3 alternator. Determine the 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/sq.m and specific electric loading of 30000 amp.cond/m. pole arc to pole pitch is 1.5. **(16)**