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**Question Paper Code : 31407**

**B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013**

**Sixth Semester**

**Electrical and Electronics Engineering**

**EE 2355/EE 65/10133 EE 605 — DESIGN OF ELECTRICAL MACHINES**

**(Regulation 2008/2010)**

**(Common to PTEE 2355 – Design of Electrical Machines for B.E. (Part-Time)  
Fifth Semester – Electrical and Electronics Engineering – Regulation 2009)**

**Time : Three hours**

**Maximum : 100 marks**

**Answer ALL questions.**

**PART A — (10 × 2 = 20 marks)**

1. What is peripheral speed? Write the expression for peripheral speed of a rotating machine.
2. What are the factors that affect the size of rotating machine?
3. What is meant by magnetic circuit calculations?
4. Why square pole is preferred?
5. Distinguish between core and shell type transformers.
6. Why are the cores of large transformers built-up of circular cross section?
7. List the advantages of using open slots.
8. How the induction motor can be designed for best power factor?
9. What is runaway speed?
10. What is the limiting factor for the diameter of synchronous machine?

PART B ← (5 × 16 = 80 marks)

11. (a) (i) Discuss the choice of specific magnetic loading (8)  
(ii) Calculate the specific magnetic loading of 100HP, 300V, 3phase, 50Hz, 8 pole, star connected, flame proof induction motor having stator core length = 0.5m and stator bore = 0.66m, Turns/phase = 286. Assume full load efficiency as 0.938 and power factor as 0.86. (8)

Or

- (b) (i) Discuss the choice of specific electric loading. (8)  
(ii) A 600 rpm, 50Hz, 10000V, 3 phase, synchronous generator has the following design data:  $B_{av} = 0.48 \text{ Wb/m}^2$ , Current density  $\delta = 2.7 \text{ A/mm}^2$ , slot space factor = 0.35, number of slots = 144, slot size =  $120 \times 20 \text{ mm}$ ,  $D = 1.92 \text{ m}$  and  $L = 0.4 \text{ m}$ . Determine the kVA rating of the machine. (8)
12. (a) (i) Explain the various factors that are affected by the selection of poles in a dc machine. (8)  
(ii) Determine the diameter and length of a armature core for 55 KW, 110V, 1000rpm, 4 pole shunt generator assuming specific electric and magnetic loadings of 26000 amp.con/m and  $0.5 \text{ wb/m}^2$  respectively. The pole arc should be about 70% of pole pitch and length of core about 1.1 times the pole arc. Allow 10A for the field current and assume a voltage drop of 4V for the armature circuit. (8)

Or

- (b) (i) Explain various steps involved in the design of shunt field winding of dc machine. (8)  
(ii) Calculate the mmf required for the air gap of machine having core length = 0.32m including 4 ducts of 10mm each, pole arc = 0.19m, slot pitch = 65.4mm, slot opening = 5mm, air gap length = 5mm, flux per pole = 52mwb. Given Carter's coefficient is 0.18 for opening/gap = 1, and is 0.28 for opening/gap = 2. (8)
13. (a) (i) Derive the output equation of a single phase transformer in terms of core and window area. (8)  
(ii) Determine the diameter of core and window for a 5 kVA, 50Hz, 1-phase, core type transformer. A rectangle core is used with long side twice as long as short side. The window height is 3 times the width. Voltage per turn = 1.8V. Space factor = 0.2,  $\delta = 1.8 \text{ A/mm}^2$ .  $B_m = 1 \text{ Wb/mm}^2$ . (8)

Or

- (b) A 250kVA, 6600/400V, 3 phase core type transformer has a total loss of 4800W at full load. The transformer tank is 1.25m in height and  $1\text{m} \times 0.5\text{m}$  in plan. Design a suitable for tubes if the average temperature rise is to be limited to  $35^\circ\text{C}$ . The diameters of the tubes are 50mm and are spaced 75mm from each other. The average height of tubes is 1.05m.

Specific heat dissipation due to radiation and convection is respectively 6 and  $6.5\text{ W/m}^2^\circ\text{C}$ . Assume that the convection is improved by 35 percent due to provision of tubes. (16)

14. (a) (i) Derive the output equation of ac machine in terms of the main dimensions. (8)
- (ii) Describe the procedure for design of rotor bars and end rings of an induction motor. (8)

Or

- (b) Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100kW 3300V, 50Hz, 12 pole star connected slip ring induction motor. Assume: (16)

Average gap density =  $0.4\text{ Wb/m}^2$

Conductors per metre =  $25000\text{ A/m}$

Efficiency = 0.9, power factor = 0.9 and winding factor = 0.96.

Choose main dimension to give best power factor. The slot loading should not be exceed 500 ampere conductors.

15. (a) Find the main dimensions of a 100MVA, 11kV, 50Hz, 150rpm., 3 phase water wheel generator. The average gap density is  $0.65\text{ Wb/m}^2$  and ampere conductors per metre are 40000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit the runaway peripheral speed. (16)

Or

- (b) Explain the armature winding and rotor design of turbo alternator. (16)