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Question Paper Code : 91206

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

Sixth Semester

Electrical and Electronics Engineering

080280035 – ELECTRICAL MACHINE DESIGN

(Regulations 2008)

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

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is real and apparent flux density ?

2. Define gap contraction factor for slots.

3. What are the main dimension of the rotating machine ?

4. List out the demerits of slip ring induction motor ?

5. What do you understand by circumscribing circle in case of transformer core design ?

6. Compare core type and shell type transformer w.r.t. their design.

7. List some of the methods used for reduction of harmonic torques.

8. What is the effect of variation of power factors in the estimation of length of air gap ?

9. What is the effect of SCR on synchronous machine performance ?

10. What are the types of poles used for salient pole machines ?

PART – B (5 × 16 = 80 Marks)

11. (a) Derive the expression for the total gap contraction factor. Also discuss the effect of saliency in salient pole machines.

OR

(b) A laminated tooth of armature steel in an electrical machine is 30 mm long and has a taper such that maximum width is 1.4 times the minimum. Estimate the mmf required for a mean flux density of 1.9 Wb/m^2 in this tooth use Simpson's rule. The B at curve for the material of tooth is

B Wb/m^2	1.6	1.8	1.9	2.0	2.1	2.2	2.3
At A/m	3700	10,000	17,000	27,000	41,000	70,000	1,09,000

12. (a) Explain the tentative design of field winding of a DC machine from basis and derive all necessary equations.

OR

(b) The following particulars refer to the shunt field coil for a 440 V, 6 pole, d.c. generator :

Mmf per pole = 7000 A; depth of winding = 50 mm; length of inner turn = 1.1 m; length of outer turn = 1.4 m; loss radiated from outer surface excluding ends = 1400 W/m^2; space factor = 0.62; resistivity = 0.02 Q/m and mm^2,

Calculate :

(i) the diameter of wire

(ii) length of coil

(iii) number of turns and

(iv) exciting current

Assuming a voltage drop of 20 percent of terminal voltage across the field regulator.

13. (a) Discuss about the various methods of cooling of power transformer. **(16)**

OR

(b) Derive the output equation of single phase and three phase transformer. **(16)**

14. (a) A 15 kW, 440 V, 4 pole, 50 Hz, 3 phase induction motor is built with a stator bore 0.25 m and core length of 0.16 m. The specific electric loading is 23000 ampere conductor per meter. Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for a 11 kW, 460 V, 6 pole, 50 Hz motor. Assume a full load efficiency of 84% and power factor of 0.8 for each machine. The winding factor is 0.96.

OR

(b) Derive the output equation of 3 phase induction motor from basis and also explain the significance of output co-efficient.

15. (a) (i) Determine the main dimension for 1000 kVA, 50 Hz, three phase, 375 rpm alternator. The average air gap flux density = 0.55 Wb/m^2 and ampere conductors / m = 28000. Use rectangular pole. Assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which machine permissible peripheral speed is 50 m/s. The runway speed is 1.8 times synchronous speed. **(8)**

(ii) Derive the output equation for alternator. **(8)**

OR

(b) The following is the design data available for a 1250 kVA. 3 phase, 50 Hz, 3300 V star connected, 330 rpm alternator of salient pole type, stator bore D = 19 m; stator core length L = 0.335 m; pole arc/pole pitch = 0.66, turns/phase = 150, single layer concentric winding with 5 conductors per slot, short circuit ratio = 1.2. Assume that the distribution of gap flux is rectangular under the pole arc with zero values in the interpolar region.

Calculate :

(i) specific magnetic loading

(ii) armature mmf per pole

(iii) gap density over pole

(iv) air gap length. mmf required for air gap is 0.88 of no load field mmf and the gap contraction factor is 1.15.