Unit 5 – SYNCHRONOUS MACHINES

PART - A

1. What are the merits of computer aided design?
2. What is run away speed?
3. What are the constructional differences between salient pole alternator and cylindrical rotor type alternator?
4. How the computer is aided design different from conventional design in the case of electrical apparatus.
5. How Cylindrical pole different from salient pole in asynchronous machine?
6. Define short circuit ratio (SCR) of a synchronous generator.
7. What are the prime movers used for a) salient pole b) Non salient pole alternator?
8. What is critical speed of Alternator?
9. Mention the uses of damper winding in a synchronous machine.
10. List the factors to be considered for separation of D and L for salient pole machines.
11. State the factors for separation of D and L in cylindrical rotor machine.
12. Why alternators are rated in KVA?
13. What are the factors to be considered for the choice of specific magnetic loading in synchronous machine?
14. List the factors to be considered for the choice of specific magnetic loading in synchronous machine?
15. List the factors to be considered for the choice of number of slots in synchronous machine
16. Determine the total number of slots in the stator ofan alternator having 4 poles, 3 phase 6 slots per pole for each phase.
17. Mention the factors that govern the design of field system of alternator.

PART - B

1. 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 L /τ 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.
2. Describe the construction of turbo alternators with neat sketch.
3. Explain the design of field winding if alternator.
4. The field coils of a salient pole alternator are wound with a single layer winding of bare copper strip 30mm deep, with separating insulation 0.15 m thick. Compute thickness of the conductor, number of turns and height of the winding to develop an mmf of 12000 ampere turns with a potential difference of 5 volts per coil and a loss of 1200 watts/ m2 of coil surface area. Mean length of turn is 1.2 metre. Resistivity of copper is 0.021Ω/m/mm^2.

5. Compute the main dimensions of a 2500 KVA, 187.5rpm, 50 Hz, three phase, 3KV salient pole synchronous generator. The specific magnetic loading is 0.6wb/m^2 and the specific electric loading is 34000 ac/m. The ratio of core length to pole pitch = 0.65.
6. State and explain the main factors which influence he choice of specific electric and magnetic loading in a synchronous machine.
7. Explain the role of digital computers in the design of electrical machines.
8. Derive the output equation of a synchronous machine.
9. Determine the main dimensions of a 75000 KVA, 13.8 KV, 50Hz, 62.5 rpm, three phase star connected alternator. The peripheral speed of rotor should be about 40m/sec. Assume average gap density equal to 0.65wb/m^2 , ampere conductors per metre equal to 40,000 and current density = 4 A/mm^2 . Assume K_w = 0.955.
10. A 1000 kVA, 3300V, 50Hz, 300 rpm, three phase alternator has 180 slots with 5 conductors / slot single layer winding with full pitch coil is used. The winding is star connected with one circuit / phase. Determine specific electric loading and magnetic loading, if stator core is 0.2 m and core length = 0.4 m. Using same loading determine the data for 1250 kVA, 3300V, 50 Hz, 250 rpm, three phase star connected alternator having 2 Circuits / phase.
11. Discuss the factors leading to the choice of length of air gap in alternator design.
12. A 1250 kVA 3 phase 6600 V salient pole alternator has the following data: Air gap diameter=1.55m, Length of the core=45cm, No. of poles = 20, Armature ac= 30000, Pole arc/pole pitch = 0.7, Stator slot pitch = 28 mm, Current density in damper bar = 3 A/mm^2. Design suitable damper winding for the machine.
13. A 3000 rpm, 50 Hz, 3 phase turbo alternator has a core length of 94 cm. The average gap density is 0.40 wb/m2 ampere conductors / metre are 23000. Peripheral speed of rotor is 100 m/s and length of air gap is 2 cm. Find the kVA output of the machine when the coil is full pitched.

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