AMIRAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT : ELECTRICAL
SEMESTER: 7TH
SUBJECT NAME: DESIGN OF AC MACHINE
SUBJECT CODE : 2170909
FACULTY NAME: SUNIL PATEL

QUESTION BANK

1. Derive the equation for relationship between rating and size of the machine in case of three phase induction motor.

2. Determine the main dimensions of 20 kW, 3 phases, 400 V 50 Hz, 1450 rpm squirrel cage induction motor. Assume following:
   Full load efficiency: 85%. Full load power factor: 0.89 lag. Winding factor: 0.955. Specific magnetic loading: 0.45 wb/m2 Specific electrical loading 28000 A/m.
   Rotor peripheral speed 20 m/sec at synchronous speed.

3. Determine the main dimensions, turn per phase, number of slots, conductor section and slot area of a 3-phase, 5 H.P., 400 volts, 50 Hz, 1500 rpm squirrel cage induction motor. The machine is to be started by a star-delta starter. Assume:
   Average flux density in the air gap = 0.5 Wb/m2,ampere conductors per meter = 27000, efficiency = 0.8, power factor = 0.8 lagging at full load, winding factor =0.955, current density = 3.5 A/mm2.Choose main dimensions to give Good overall design.

4. Find the main dimensions, no of stator turns, and number of stator slots of a 30 H.P., 440 Volt, 3 phase, 50 Hz , 960 rpm, sq. cage Induction motor using following data: Specific magnetic loading=0.45wb/m2
   full load efficiency= 0.86, full load p.f. =0.87.Assume that stator winding is delta connected, for normal running. ,Sp.ele.loading=250amp.condctors/cm

5. Determine the main dimensions of 30 kW, 3 phases, 400 V 50 Hz, 1440 rpm squirrel cage induction motor. Assume following:
   Full load efficiency: 87%. Full load power factor: 0.9 lag Winding factor: 0.955. Specific magnetic loading: 0.5 wb/m2. Specific electrical loading 30000 A/m.
   Rotor peripheral speed 20 m/sec at synchronous speed.

6. Determine the main dimensions of 30 kW, 3 phases, 400 V 50 Hz, 1440 rpm squirrel cage induction motor. Assume following:
   Full load efficiency: 87%. Full load power factor: 0.9 lag Winding factor: 0.955. Specific magnetic loading: 0.5 wb/m2. Specific electrical loading 30000 A/m.
   Rotor peripheral speed 20 m/sec at synchronous speed.

QUESTION BANK

7. Explain the factors affecting the selection of Air gap of three phase Induction Motor.

8. Explain the effect of skewing the rotor slots in a squirrel cage induction motor.

9. What is dispersion coefficient? Show its effect on maximum power factor and overload capacity of three phases Induction Motor.

10. Explain methods of Improving starting torque of Induction Motor.

11. Explain the effect of Harmonic Induction Torque and Harmonic synchronous Torque on the performance of three phases Induction Motor.

12. Explain the effect of Harmonic Induction Torque and Harmonic synchronous Torque on the performance of three phases Induction Motor.

13. What is SCR? Discuss its effects on performance of synchronous machine regards
a) Voltage Regulation b) stability of machine c) Parallel operation d) Short circuit current e) Self Excitation .Give its range.

14. Discuss the design of field winding of salient pole synchronous machine.

15. What is the role of damper winding in (i) synchronous generator and
(ii) synchronous motor? Derive the equation of MMF of damper winding.

16. Write the steps and necessary equations for rotor design of an synchronous machine.

17. Explain the factors to be considered while selecting number of armature slots in the design of a synchronous machine.

18. Give the Classification of synchronous machines and their specific applications.

19. Explain the Constructional details of salient pole synchronous machines and smooth cylindrical synchronous machines.

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20. What are the effects of law SCR and high SCR on synchronous Machine?

21. What is Advantages and drawbacks of large air-gap length between stator and rotor of synchronous machine.

22. What are the range of the ratio lg/τ for different types of Synchronous Machine. Justify "More the air-gap length in synchronous machine more the cost of machine."

23. Determine main dimensions and turns per phase of a 3 MVA, 11 kV 50 Hz 32 pole three phase star connected alternator. Assume average gap density of 0.55 wb/m2, ac = 30000, winding factor 0.955. Use L/τ ratio of 1.2.

24. A 2500 kVA 32 pole three phase , 60 Hz, 2400 V, star connected salient pole alternator has the following design data: Stator bore = 2.5 m; core length = 0.44m; turns/phase = 224; winding factor =0.95; length of air gap 10 mm; air gap contraction factor = 1.11; ratio of pole arc to pole pitch = 0.69; ratio of amplitude of fundamental of gap flux density to maximum gap density = 1.068; per unit leakage reactance = 0.14. Determine direct and quadrature axis synchronous reactance.

25. Discuss algorithm and develop flow chart for main dimension design of a low speed alternator.

26. Briefly answer following:
    (1) Why are conductors in the overhang are braced?
    (2) Why the stator winding of all synchronous generators is usually star connected with neutral earthed?
    (3) What are the advantages of circular poles?
    (4) Why does the rotors of turboalternators are slotted for only two third of its periphery?

27. Explain factors affecting specific electric loading and specific magnetic loading of alternator.

QUESTION BANK

28. Find the main dimensions of a 2500 kVA,187.5 r.p.m, 50 Hz ,3 phase ,3 kV, salient pole synchronous generator. The generator is to be a vertical, water wheel type. The specific magnetic loading is 0.6 Wb/$m2$ and the specific electric loading is 34000 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.
29. Design the stator frame of a 500 KVA, 6.6 KV, 50 Hz, 3-phase, 12 pole, star connected salient pole alternator, giving the following information. 1. Internal diameter and gross length of stator. 2. Number of slots and conductor per slot. 3. Number of stator conductors. Assume specific magnetic and electric loading as 0.56T and 26000 AC per metre respectively. Peripheral speed must be less than 40 m/s and slot must be less than 120
30. Explain different methods use to eliminate harmonics from the voltage waveform in synchronous generator.
31. What is the role of damper winding in (i) synchronous generator and (ii) synchronous motor? Derive the equation of MMF of damper winding
32. Explain evaluation of Direct and Quadrature axis reactance of Alternator.