



B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Sixth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

EEE116: Design of Electrical Apparatus

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The MMF required for air gap with slotted armature is _____ times that of smooth armature
 - a) KCS
 - b) KCD
 - c) KG
 - d) KGD
2. Which coolant is used in direct cooling of turbo-alternators
 - a) Hydrogen
 - b) Oxygen
 - c) Carbon di oxide
 - d) Air
3. In Electrical machines laminated core are used with a view to reducing
 - a) copper loss
 - b) hysteresis loss
 - c) eddy current loss
 - d) soft iron
4. The size of the DC machine can be reduced by using_____.
 - a) Lap winding
 - b) High resistance winding material
 - c) Iron commutator
 - d) Magnetic material of high permeability
5. The type of oil which is suitable as transformer oil is _____.
 - a) animal oil
 - b) cooking oil
 - c) mineral oil
 - d) vegetable oil
6. The primary leakage flux links_____
 - a) primary winding only
 - b) secondary winding only
 - c) both primary & secondary windings
 - d) none of the above
7. No load current of 3 phase induction motor is approximately_____ of full load current
 - a) 10-20%
 - b) 5-10%
 - c) 25-45%
 - d) below 5%

8. The stator of a 3 phase induction motor produces ____ magnetic field.
 - a) steady
 - b) rotating
 - c) alternating
 - d) none of the above
9. The synchronous reactance of an alternator is due to _____.
 - a) leakage flux
 - b) d.c field excitation
 - c) armature reaction
 - d) none of the above
10. When the speed of an alternator is reduced by half the generator emf will become _____.
 - a) twice
 - b) $1/4^{\text{th}}$
 - c) $1/2$
 - d) 4 times

PART B (10 x 2 = 20 Marks)

11. What is meant by magnetic circuit calculation?
12. Why hydrogen is used for cooling for large turbo-alternators instead of air?
13. State the factors which limit the armature diameter of a dc machine?
14. What are the factors to be considered in the design of commutator?
15. In transformer which winding is placed near the core? State the reason.
16. What are the advantages and disadvantages of stepped core?
17. What are the advantages of slip ring rotor over cage rotor?
18. What are the factors to be considered for the choice of specific magnetic loading for induction motor?
19. Mention the uses of damper windings in a synchronous machine.
20. Why alternators are rated in Kva?

PART C (5 x 14 = 70 Marks)

21. a) (i) What are the different types of slot leakage fluxes and explain it with necessary diagrams. (4)
- (ii) Calculate the mmf required for air gap of a dc machine with an axial length of 20cm and pole arc of 18cm .The slot pitch is 27 mm ,slot opening is 12mm,air gap is 6mm and useful flux per pole is 25 mweb.Take carter's co-efficient for slot as 0.3. (10)

(OR)

- b) (i) Derive the relation to determine the real and apparent flux densities of slotted armature including fringing effect (4)

- (ii) Determine the air gap length of a dc machine from the following details, gross length of core is 0.12m, number of duct is one with width of 10mm, slot pitch 125mm, slot width is 10 mm. Carter's co-efficient for slots and ducts 10.32. Flux density at pole center is 0.7 Tesla. Feild mmf/pole is 3900 AT and mmf required of iron parts of magnetic circuit is 800 AT (10)

22. a) (i) List the advantages and disadvantages of large number of poles (4)
(ii) Design the suitable commutator for a 350kw,600 rpm,440V,6 pole dc generator having and armature diameter of 0.75m. The number of coil is 288 (10)

(OR)

- b) (i) Write short notes on design of series field winding (4)
(ii) Find the main dimensions and number of poles of a 37 kW, 230V, 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 percent. (10)

23. a) (i) Explain clearly how the no load current of a transformer are determined from the designed data? (4)
(ii) Estimate the main dimension including winding, area of a 3 phase ,delta star core type transformer rated at 300KVA,6600/440V.50Hz. A suitable core with 3 steps having circumscribing circle of 0.25m diameter and leg spacing of 0.4m is available. Emf per turn is 8.5V ,current density is 2.5 A/mm^2 , window space factor is 0.28 and stacking factor is 0.9. (10)

(OR)

- b) (i) Derive the output equation of 3 phase transformer. (4)
(ii) A 3-phase, 50Hz, oil cooled core type transformer has the following dimensions: Distance between the core centers=0.2m, Height of window=0.24m Diameter of circumscribing circle=0.14m, The flux density in the core= 1.25 Wb/m^2 , The current density in the conductor = 2.5 A/mm^2 . Assume a window space factor=0.56. The core is 2-stepped .Estimate kVA rating of the transformer. (10)

24. a) Estimate the stator core dimension, number of stator slots and number of stator conductors per slot for a 100 kW, 3300V, 50Hz, 12 pole, star connected slip ring induction motor. $B=0.4\text{Wb/m}^2$, $a_c=25000$ amp. cond/m, $n=0.9$, $\text{pf}=0.9$. Choose main dimensions to give best power factor. The slot loading should not exceed 500 amp conductors.

(OR)

- b) (i) Derive the output equation of 3-phase induction motor (4)
- (ii) A 3-phase induction motor has 54 stator slots 8 conductors per slot and 72 rotor slots with 4 conductors per slot. Find the number of stator and rotor turns. Find the voltage across the rotor slip rings, when the rotor is open circuited and at rest. Both stator and rotor are star connected and a voltage of 400 volt is applied across the stator terminals (10)
25. a) (i) What is short circuit ratio of synchronous machine? (4)
- (ii) Determine the output coefficient for a 1500 kVA, 2200 volt, 3-phase, 10 pole, 50Hz, star connected alternator with sinusoidal flux distribution. The winding has 60° phase spread and full pitch coils. $a_c=30000$ amp.cond./m, $B_{av}=0.6\text{Wb/m}^2$. If the peripheral speed of the rotor must not exceed 100 m/sec and the ratio pole pitch to core length is to be between 0.6 and 1, find D and L. Assume an air gap length of 6mm. Find also the approximate number of stator conductors (10)

(OR)

- b) Write brief notes on computer aided design of electrical machine with block diagram
