ANNA UNIVERSITY COIMBATORE

B.E. / B.Tech. DEGREE EXAMINATIONS – DECEMBER 2008

THIRD SEMESTER – ELECTRICAL & ELECTRONICS ENGINEERING

EE302 - DC MACHINES AND TRANSFORMERS

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

PART A – (20 x 2 = 40 Marks)

Answer ALL Questions

1. Write the emf equation of a DC generator for (i) lap and (ii)wave winding
2. What is meant by coenergy?
3. Compare lap and wave windings used for DC machine armature.
4. Draw the block diagram of flow of energy in electro mechanical energy conversion via a coupling field.
5. What are the reasons due to which a DC shunt generator fails to build up?
6. Define the term 'critical speed in DC shunt generator.
7. What is meant by armature reaction in DC machines?
8. Why should an equalizer bus bar be provided for the stable operation pf two DC series generators in parallel?
9. What is meant by back emf in DC motors?
10. Why starters are used for DC motors?
11. What are the methods of speed control of DC shunt motors?
12. At what load, the efficiency is maximum in DC shunt machines?
13. What are the different ways of connecting three phase transformers?
14. Define transformation ratio.
15. What is an auto transformer?
16. List the conditions to be satisfied for operating two transformers in parallel.
17. Why brake test is not suitable for large size machines?
18. Hopkinson's test is also called as regenerative test. Justify.
19. What is sumpner's test?
20. Why the short circuit test is performed on HV side?

PART B – (5 x 12 = 60 Marks)

Answer Any FIVE Questions

21. a) Derive an expression for the field energy in a multiply excited magnetic field systems. (9)

b) The magnetic flux density on the surface of an iron face is 1.6 T which is a typical saturation level value for ferromagnetic material. Find the force density on the iron face. (3)

22. a)A 4 pole, lap wound dc machine has 278 armature conductors. Its field winding is excited from a dc source to create an air gap flux of 32 mWb/pole. The machine (generator) is run from a prime mover at 1600 rpm. It supplies a current of 100 A to an electric load. (6)

(i) Calculate the electromagnetic power developed.

(ii) What is the mechanical power that is fed from the prime mover to the generator?

(iii) What is the torque produced by the prime mover?

b) Explain the purpose and arrangement of compensating windings in DC machines (6)

23. (a)Explain the essential requirements for the operation of two shunt generators in parallel and how they share the load (6)

(b)Discuss clearly the load characteristics of DC shunt generator. (6)

24. a) A 4 pole DC series motor has 944 wave connected armature conductors. At a particular load, the flux per pole is 0.04 Wb and the total torque developed is 260 Nm. Calculate the line current taken by the motor and the speed at which it will run with an applied voltage of 500V. The total motor resistance is 2Ω. (6)

b) Show the speed torque characteristics of different motors in one diagram. State the reasons for their deviation. Indicate with reasons the most suitable characteristics for traction purposes (6)

25. a) Draw a neat diagram of the 4 point starter and explain how they are used to start a DC shunt motor. (6)

b) Derive an expression for voltage regulation of a transformer using its approximate equivalent circuit. (6)

26. a)Brief the operation of an auto transformer and its advantages over a two winding transformer. (6)

b) Explain briefly the action of a transformer on no load with the help of a phasor diagram. (6)

27.a) Explain how the efficiency of a transformer may be found from the open circuit and short circuit tests (6)

b) In a 50 kVA transformer the iron loss is 400W and full load copper loss is 600W. Estimate its efficiency at (i) full load, upf and (ii)half full load, 0.8 pf (6)

28.a) Describe the back to back test for determining the efficiency of two similar DC shunt machines and explain the method of calculating the efficiency. (8)

b) What are the advantages and disadvantages of the Swinburne's method of determining the efficiency of a shunt machine (4)

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