ANNA UNIVERSITY COIMBATORE

B.E / B.Tech DEGREE EXAMINATION – DEC 2008

BE (ECE) - THIRD SEMESTER

EC 302 – ELECTROMECHANICAL ENERGY CONVERSION

Time: Three hours **Maximum: 100 marks**

PART A – (20 x 2 = 40 marks)

Answer ALL questions

1. The core of the armature is laminated in DC machines. Justify.
2. What are the reasons due to which a DC shunt generator fails to build up?
3. What are the conditions to be satisfied before connecting two DC generators in parallel?
4. Why is the starting current high in a DC motor?
5. What is the function of Bucholz relay in a transformer?
6. Draw the no load phasor diagram of a transformer?
7. What is the effect of load power factor on the voltage regulation of a transformer?
8. What is the condition for maximum efficiency in a transformer?
9. A 3 phase induction motor is operating at 400V, 50 Hz supply. If the slip is 4% find the frequency of its rotor induced emf.
10. How can the direction of rotation of a three phase Induction motor be reversed?
11. What are the various methods of speed control of 3 phase induction motor?
12. Why a single phase induction motor is not self starting?
13. Differentiate salient pole and smooth cylindrical type of synchronous machines.
14. What is meant by load angle of an alternator?
15. List any two methods of starting a synchronous motor.
16. What is a synchronous condenser?

17. Write down few applications of Universal motor.
18. Define step angle referred to stepper motor.
19. What are the salient features of Hystersis motor?
20. What are the advantages of brushless DC motor over brushed DC motor?

PART – B (5 x 12= 60 MARKS)

Answer Any FIVE Questions

21.a) Derive from first principles an expression for the emf generated in the armature winding of a DC machine. **(6)**

b) Draw and explain the load characteristics of a DC shunt generator. **(6)**

22.a) A 6 pole DC motor has 936 wave connected armature conductors. The useful flux per pole is 0.02Wb and the armature circuit resistance is 0.5Ω. Calculate (i) the speed and (ii) the torque developed when its armature takes 35A at 400V. **(6)**

b) Show the speed Vs torque characteristics of different type of DC motors in one diagram. State the reasons for their deviation. **(6)**

23. Explain how the equivalent circuit parameters of 1 phase transformers are determined from open circuit and short circuit test readings. **(12)**

24.a) Short circuit test is conducted on a 5 KVA, 400 V/100 V 1 – phase transformer with 100 V winding is shorted. The input voltage at full load current is 40 V. The wattmeter at the input side reads 250 W. Find the power factor at which the regulation is zero. **(6)**

b) Draw and explain the torque slip curves of a three phase slip ring Induction motor for different values of its rotor resistance. **(6)**

25.a) The power input to the rotor of a 440 V, 50 Hz, 3 – phase, 6 pole induction motor is 60 KW. It is observed that the rotor emf makes 90 complete cycles / minute. Calculate

(i) Slip

(ii) rotor speed

(iii) rotor copper loss

(iv) mechanical power developed. **(8)**

b) Brief the starting of three phase Induction motor with the help of a stator resistance starter. **(4)**

26.a) A 3 – phase star connected alternator is rated at 1600 KVA, 13500 V. The armature resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage voltage regulation for a load of 1280 KW at 0.8 power factor leading. **(6)**

b) Explain briefly the variation of armature current and power factor of synchronous motor with respect to field excitation when the mechanical output is constant. **(6)**

27.a)Explain the principle of operation of a synchronous motor **(6)**

b) Explain the construction and working of a universal motor. **(6)**

28.a)Explain the working of a Hystersis motor **(6)**

b) Explain how the torque is produced in a Brushless dc motors **(6)**

*******THE END*******