Reg. No. : | | | | | | | | | | | |

T 3248

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1202 — ELECTRICAL MACHINES — I

(Common to B.E. (Part-Time) Second Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principle of electromechanical energy conversion.

2. Distinguish between statically induced and dynamically induced e.m.fs.

3. What are the conditions to be fulfilled for a D.C. shunt generator to build-up emf?

4. What is meant by armature reaction?

5. Write down the significance of Back emf in a D.C. motor.

6. Mention speed control methods of D.C. shunt motors.

7. Why transformer rating is expressed in terms of kVA?

8. What are the advantages of auto-transformer over two-winding transformer?

9. What are the different losses occurring in a transformer?

10. What are the advantages of Swinburne's test?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Represent pictorially the flow of energy in electromechanical devices for both generating and motoring action. (10)

(ii) 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. (6)

Or

(b) (i) Draw the developed diagram of MMF space wave of a single coil distributed a.c. winding and explain. (8)

(ii) Derive an expression for torque developed in a 2-pole round rotor machine and state the assumptions made. (8)

12. (a) (i) Derive an expression for the emf generated in a D.C. generator. (8)

(ii) A separately excited D.C. generator, when running at 1000 r.p.m., supplied 200 A at 125 V. What will be the load current when the speed drops to 800 r.p.m., if I_f is unchanged?

Given that the armature resistance = 0.04 Ω and brush drop = 2 V. (8)

Or

(b) (i) Draw and explain the important characteristics of separately excited D.C. generator. (8)

(ii) Two shunt generators operating in parallel deliver a total current of 250 A. One of the generators is rated 50 kW and the other 100 kW. The voltage rating of both machine is 500 V and have regulations of 6% (smaller one) and 4%. Assuming linear characteristics, determine (1) the current delivered by each machine and (2) terminal voltage. (8)

13. (a) (i) Derive an expression for the torque developed in the armature of a D.C. motor. (8)

(ii) Determine developed torque and shaft torque of 220 V, 4-pole series motor with 800 conductors wave-connected supplying a load of 8.2 kW by taking 45 A from the mains. The flux per pole is 25 mWb and its armature circuit resistance is 0.6 Ω.

Or

(b) (i) Explain the flux control and armature control methods of speed control of D.C. shunt motor. (8)

(ii) A 220 V shunt motor has an armature resistance of 0.5 Ω and takes an armature current of 40 A on a certain load. By how much must the main flux be reduced to raise the speed by 50% if the developed torque is constant? Neglect saturation and armature reaction. (8)

14. (a) (i) Draw and explain the no load phasor diagram of a single phase transformer. (8)

(ii) A single phase transformer takes 10 A on no-load at 0.2 p.f. lagging. The turns ratio is 4 : 1 (step down). If the load on the secondary is 200 A at a p.f. of 0.85 lagging, find the primary current and power factor. Neglect the voltage drop in the winding. Also draw the phasor diagram. (8)

Or

(b) (i) With the help of circuit diagrams, explain any two types of three-phase transformer connections. (6)

(ii) Obtain the equivalent circuit of a 200/400 V, 50 Hz, 1-phase transformer from the following test data : (10)

O.C. Test : 200 V, 0.7 A, 70 W – on L.V. side

S.C. Test : 15 V, 10 A, 85 W – on H.V. side

15. (a) (i) Derive the condition for maximum efficiency in a transformer. (8)

(ii) A 11000/230 V, 150 kVA, 1-phase, 50 Hz transformer has core loss of 1.4 kW and F.L. cu. loss of 1.6 kW. Determine

(1) the kVA load for maximum efficiency and the value of maximum efficiency at unity p.f.

(2) the efficiency at half F.L. 0.8 p.f. leading. (8)

Or

(b) With the help of neat circuit diagram, explain Swinburne's test and derive the relations for efficiency (both for generator and motor). Also state the merits and demerits of this method. (16)