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Question Paper Code : 77131

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Electrical and Electronics Engineering

EE 6401 — ELECTRICAL MACHINES – I

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by statically induced EMF?

2. Mention the materials suitable for fabrication of Permanent Magnets.

3. Specify the applications of autotransformer?

4. Mention the role of tertiary winding in Transformer.

5. Why do all practical energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field?

6. Write the equation, which relates rotor speed in electrical and mechanical radian/second.

7. Specify the role of Interpoles in DC Machine?

8. What is meant by residual emf in DC generator?

9. Specify the techniques used to control the speed of DC shunt motor for below and above the rated speed?

10. Why DC series motor is suited for traction applications?

PART B — (5 × 16 = 80 marks)

11. (a) Explain the methods of energy conversion via Electric Field, with examples of Electrical Machines. (16)

Or

(b) (i) Specify the causes for Hysteresis and Eddy current losses in Electrical Machines. Also suggest the methods in construction to minimize the above losses. (8)

(ii) State properties of magnetic material suitable for fabrication Permanent Magnet and Electromagnet. (8)

12. (a) (i) What is meant by Inrush Current in Transformer? Specify the nature of Inrush currents and its problem during Transformer Charging. (6)

(ii) A 500 KVA Transformer has a core loss of 2200 watts and a full load copper loss of 7500 watts. If the power factor of the load is 0.90 lagging, calculate the full load efficiency and the KVA load at which maximum efficiency occurs. (10)

Or

(b) (i) Specify the conditions for parallel operation of Transformer. Also explain the effect of load sharing due to impedance variation between transformers during parallel operation. (6)

(ii) A 100 KVA, 3300 V/240 V, 50 Hz, Single phase transformer has 990 turns on the primary. Calculate the number of turns on secondary and the approximate value of primary & secondary full load currents. (10)

13. (a) With neat sketch explain the multiple excited magnetic field system in electromechanical energy conversion systems. Also obtain the expression for filed energy in the system. (16)

Or

(b) Derive the torque equation of a round rotor machine. Also clearly state the assumptions made. (16)

14. (a) (i) Draw and explain the load characteristics of Differentially and Cumulatively compound DC generator. (6)

(ii) A 4 pole DC shunt generator with lap connected armature supplies 5 kilowatt at 230 Volts. The armature and filed copper losses are 360 Watts and 200 Watts respectively. Calculate the armature current and generated EMF? (10)

Or

(b) (i) Derive the EMF equation of DC generator. (6)

(ii) In a 400 volts, DC compound generator, the resistance of the armature, series and shunt windings are 0.10 ohm, 0.05 ohm and 100 ohms respectively. The machines supplies power to 20 Nos. resistive heaters, each rated 500 watts, 400 Volts. Calculate the induced emf and armature currents when the generator is connected in (1) Short Shunt (2) Long Shunt. Allow brush contact drop of 2 volts per brush. (10)

15. (a) (i) Why starting current is high at the moment of starting a DC Motor? Explain the method of limiting the starting current in DC motors. (6)

(ii) A 400 Volts DC Shunt motor has a no load speed of 1450 RPM, the line current being 9 Amperes. At full loaded condition, the Line current is 75 Amperes. If the shunt field resistance is 200 Ohms and armature resistance is 0.5 Ohm. Calculate the full load speed. (10)

Or

(b) (i) Draw the speed Torque characteristics of DC Shunt and Series motor. Also from the characteristics specify the applications for each motor. (6)

(ii) A 230 Volts DC Shunt motor on no-load runs at a speed of 1200 RPM and draws a current of 4.5 Amperes. The armature and shunt field resistances are 0.3 ohm and 230 ohms respectively. Calculate the back EMF induced and speed, when loaded and drawing a current of 36 Amperes. (10)