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Question Paper Code : 90193

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Third Semester

Electrical and Electronics Engineering

EE 8301 – ELECTRICAL MACHINES – I

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. A conductor 80 cm long moves at right angle to its length at a constant speed of 30 m/s in a uniform magnetic field of flux density 1.2 T. Find the EMF induced when the conductor motion is normal to the field flux.
2. Mention the materials suitable for fabrication of permanent magnets.
3. The full load copper loss in a transformer is 600 W and iron loss is 400 W. What will be the Copper loss and Iron loss at half-load ?
4. Define All day Efficiency.
5. Give examples for single and double excited system.
6. Why fractional pitched winding is preferred over full pitched winding ?
7. Write down the formula for reactance voltage of linear and sinusoidal commutation.
8. Mention the role of interpole in DC machine.
9. Write the significance of back-EMF in DC motor.
10. Why do you need a starter for a DC motor ?

PART – B (5×13=65 Marks)

11. a) i) Define Dynamically induced EMF and derive it. (5)

ii) The total core loss of a specimen of silicon steel is found to be 1500 W at 50Hz. Keeping the flux density constant, the loss becomes 3000 W when the frequency is raised to 75 Hz. Calculate separately the hysteresis and eddy current losses at each of those frequencies. (8)

(OR)

b) i) Explain the AC operation of magnetic circuit. (5)

ii) A flux density of 1.2 wb/m^2 is required in 1 mm air gap of an electromagnet having an iron path of 1.5 m long. Calculate the mmf required. Given the relative permeability of iron = 1600. (8)

12. a) i) Draw neat circuit diagram of Back-back test method. Also, write the formulas to calculate the power and efficiency. (5)

ii) A 50 kVA, 11 kV/400 V transformer has a core loss of 500 W and a full load copper loss of 600 W. Calculate the efficiency on unity power factor at full load. Find the load for maximum efficiency and the iron and copper losses corresponding to this load. (8)

(OR)

b) i) List and explain the conditions for the parallel operation of single phase transformer. (5)

ii) A 33 kVA, 2200/220 V, 50 Hz, single phase transformer has the following parameters :

r_1 = 2.4 ohm , r_2 = 0.03 ohm, x_1 = 6 ohm, x_2 = 0.07 ohm. Calculate

a) Equivalent resistance, leakage reactance and impedance referred to HV side.

b) Equivalent resistance, leakage reactance and impedance referred to LV side.

c) Full load copper loss. (8)

13. a) With neat sketch, explain the multiply excited system of electromechanical energy conversion. (13)

(OR)

b) Derive the torque equation in round rotor machines. Also, clearly state the assumptions made. (13)

14. a) i) Obtain EMF equation of DC Generator. (5)

ii) A 4 pole wave wound DC motor armature has 880 conductors and delivers 120 A. The brushes have been displaced through 3 angular degrees from the geometrical axis. Calculate

a) The demagnetizing ampere-turns/pole,

b) The cross magnetizing ampere turns/pole

c) The additional field current for neutralizing the demagnetization of the field winding has 1100 turns/pole. (8)

(OR)

b) i) Briefly explain any one method to improve the commutation. (5)

ii) A compound generator has armature, series and shunt field resistances of 0.8 ohm, 0.2 ohm and 50 ohm respectively and supplies 5 kW at 230 V. Calculate the EMF generated in the armature, when it is connected as (i) long shunt and (ii) short shunt. (8)

15. a) i) Draw and explain the characteristics of DC Shunt Motor. (5)

ii) A DC shunt motor rated 10 kW connected to 250 V supply is loaded to draw 35A armature current running at a speed of 1250 rpm. Given $R_a = 0.5\Omega$.

a) Determine the load torque if the rotational loss is 500 W.

b) Determine the motor efficiency if the shunt field resistance is 250Ω. (8)

(OR)

b) i) Draw the circuit diagram of Hopkinson's Test and write the merits and demerits of the same. (5)

ii) A 240 V DC series motor takes 40 A when giving its rated output at 1500 rpm. Its armature and field resistance is 0.15 Ω and 0.15 Ω. Calculate the value of resistance which must be added to obtain rated torque at 1000 rpm. (8)

PART – C **(1×15=15 Marks)**

16. a) Draw the equivalent circuit of a single phase 1100/220 V transformer on which the following results were obtained.

1100 V, 0.5 A, 55 W on HV side, LV being open circuited.

10 V, 80 A, 400 W on LV side, HV side being short circuited.

Calculate the voltage regulation and efficiency for the above transformer when supplying 80 A at 0.8 pf lagging. (15)

(OR)

b) A 400 Volts DC Shunt motor has a no load speed of 1450 rpm. The line current being 9 amperes. At full load 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. (15)