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Question Paper Code: 53032

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Third Semester

Electrical and Electronics Engineering

15UEE302 - DC MACHINES AND TRANSFORMERS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The principle of dynamically induced emf is utilized in

   (a) transformer (b) choke
   (c) generator (d) thermocouple

2. On Which of the following factors does hysteresis loss depend

   (1) flux density (2) Frequency (3) thickness of lamination (4) time

   (a) 2 and 3 (b) 1 and 2
   (c) 3 and 4 (d) 1 and 4

3. The basic function of a transformer is to change

   (a) the level of voltage (b) the power level
   (c) the power factor (d) the frequency

4. A transformer steps up the voltage by a factor 100. The ratio of current in the primary to that in the secondary

   (a) 1 (b) 100 (c) 0.01 (d) 0.1

5. In an electromechanical energy conversion device, the developed torque depends upon

   (a) stator field strength and torque angle
   (b) stator field and rotor field strengths
   (c) stator field and rotor field strengths and the toque angle
   (d) stator field strength only

6. The armature MMF waveform of a dc machine is

   (a) pulsating (b) rectangular
   (c) triangular (d) sinusoidal

7. In a lap wound dc generator, the equalizer rings are provided to

   (a) avoid short circuiting
   (b) avoid unequal distribution of currents at brushes
   (c) avoid harmonics generated in the emf
   (d) provide mechanical balancing

8. In dc generators, the residual magnetism is the order of

   (a) 2.5% (b) 10% (c) 15% (d) 20%

9. With the increase in speed of a dc motor

   (a) both back emf as well as line current increase
   (b) both back emf as well as line current fall
   (c) back emf increases, but line current falls
   (d) back emf falls, but line current increases

10. If the applied voltage to a dc machine is 230 V, then the back emf for maximum power developed is

    (a) 115 V (b) 200 V (c) 230 V (d) 400 V

PART - B (5 x 2 = 10 Marks)

11. What is eddy current loss?

12. The efficiency of a transformer is always higher than that of rotating electrical machines. Why?

13. State the assumptions made for analyzing singly excited system.

14. Why is the yoke of a dc machine not laminated whereas the armature core is laminated?

15. Why should a dc series motor not be run without load and it is ideally suited for traction purposes?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Difference between static and dynamic induced emf. (4)

(ii) Explain the determination of B-H curve of Hysteresis loop for magnetic circuits. (12)

Or

(b) (i) Explain in detail about hysteresis loss and eddy current loss. (10)

(ii) Briefly explain transformer as a magnetically coupled circuit. (6)

17. (a) (i) Why transformer rated in kVA? (4)

(ii) Derive the equation of EMF equation of single phase transformer. (12)

Or

(b) (i) A 40 kVA, 3300 / 240 V, 50 Hz supply single-phase transformer has 660 turns on the primary. Determine (i) the no. of turns on secondary (ii) the maximum value of flux in the core (iii) the approximate value of primary and secondary full load currents. (8)

(ii) Explain the Parallel operation of single phase transformer. (8)

18. (a) Explain the concept of a doubly excited magnetic system with a neat diagram. Also derive the expression for the magnetic torque developed. (16)

Or

(b) (i) Two coupled coils have self and mutual inductances of

$$L_{11} = 3 + \frac{1}{3x},\ L_{22} = 1 + \frac{1}{3x},\ L_{12} = L_{21} = \frac{1}{3x}$$

Over a certain range of linear displacement x, the first coil is excited by a constant current of 10 A and the second by a constant current of – 5 A. Find the mechanical work done if x changes from 0.5 m to 1 m and energy supplied by each electrical source for the above case. (6)

(ii) For a single excited system formulate the expression for field energy and mechanical force developed. (10)

19. (a) Draw a detailed sketch of a dc machine and identify the different parts. Briefly describe the function of each major part. Explain in detail the working of that part which changes ac armature voltage to dc voltage. (16)

Or

(b) (i) With neat diagrams explain armature reaction and its effect in a dc machine. (8)

(ii) A four pole, lap wound long shunt compound generator has 1200 armature conductors. The armature, series field and shunt field resistance are 0.1 Ω, 0.15 Ω, 250 Ω, respectively. If flux per pole is 0.075 Wb. Calculate the speed at which the machine should be driven so that it can deliver the load of 50 kW at 500 V. Take overall voltage drop due to brush contact as 2V. (8)

20. (a) (i) Draw and explain the mechanical and electrical characteristics of DC shunt motor and hence deduce its applications. (8)

(ii) Draw a neat diagram for a four-point starter. Explain the protective devices used and their working. (8)

Or

(b) (i) A 4-pole, dc shunt motor has flux of 0.04 Wb and armature is lap wound with 720 conductors. The shunt field resistance is 240 Ω and the armature resistance is 0.2 Ω. Total brush drop is 2 V. Determine speed of the machine when running (a) as a motor taking 60 A and (b) as a generator supplying 120 A. The terminal voltage in each case is 480 V. (8)

(ii) The torque on the armature with a smaller diameter will be larger than the torque on a large diameter in the case of dc machine for the same current and flux in the air gap. State whether the above statement is correct or wrong and state the reasons by deriving the necessary equation. (8)

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