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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 121301 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. III) THEORY EXAMINATION, 2015-16

ELECTRO-MECHANICAL ENERGY CONVERSION-I

[Time:3 hours] **[Total Marks:100]**

Note : Attempt all 3 Section.

SECTION-A

1. Attempt **all** parts of this section. (2×10=20)

   (a) Why is the wave winding useful for high voltage low current DC machines?

   (b) How the back EMF does make the DC machine self-regulatory?

   (c) How the direction of rotation of the DC shunt motor can be changed?

   (d) Based on the principle of conservation of energy, write an energy balance equation of the motor.

(e) State the phenomenon useful for the electromechanical energy conversion in rotating machines?

(f) Give two applications of the DC shunt motor and DC compound generator.

(g) How are the transformer losses affected by the power factor of the connected load?

(h) An autotransformer has primary voltage V_1 and secondary voltage V_2, where $V_1 > V_2$. Calculate the fraction of power transferred inductively.

(i) If P_i and P_o represents iron loss and full load ohmic loss, then find the fractional load at which the maximum power shall be transferred.

(j) A 1000 KVA, 50kV/40kV single phase auto transformer is fully loaded. Find the current in the common section of the winding.

SECTION-B

Attempt **any five** questions from the following. (10×5=50)

2. (i) Show that the torque in a doubly excited magnetic system is equal to the rate of increase of the field energy with respect to the displacement at constant currents.

(ii) Show that in a linear magnetic system the energy and co-energy are represented by the same expression.

3. (i) Explain the commutator action in DC machines. Also describe the ways for achieving good commutation.

(ii) A 4-pole d.c. shunt generator with wave connected armature has field and armature resistance of 90Ω and 0.15Ω. It supplies power to 25 lamps rated at 100V, 60W each, calculate the armature current and emf generated neglecting brush drop.

4. Discuss the internal and external characteristics of the DC shunt generator. Also explain why the load characteristics of DC shunt generator have drooping more than that of separately excited generator.

5. Compare the speed torque characteristics of DC shunt, series and compound motor. Which machine is most suitable for traction purpose?

What are the advantages of the field flux control over armature circuit resistance control method employed for the speed control of DC motors?

6. Show that the VA rating of the auto transformer is more than the corresponding two winding transformer.

Show that in case of an auto transformer

$$\frac{\text{inductively transferred power}}{\text{total power}} = \frac{\text{high voltage} - \text{low voltage}}{\text{high voltage}}$$

7. A 2300/220 V 500 kVA, 50 Hz distribution transformer has the core losses of 1600 W at rated voltage and copper loss 7.5 kW at full load. During the day, it is loaded as follows:

% Load	0%	20%	50%	80%	100%	125%
Power Factor		0.7 lag	0.8 lag	0.9 lag	1	0.85 lag
Hours	2	4	4	5	7	2

8. Explain the back to test for testing of the single phase transformers. Also explain how the reading of the wattmeter recording the core losses remain unaffected when the low voltage is injected in the secondary series circuit.

9. An electrical machine has cylindrical stator and salient pole rotor. Justify the correctness of the following statement :

(i) Reluctance torque is producted when exciting winding is on rotor.

(ii) When stator and rotor both carry exciting winding, electromagnetic as well as reluctance torque are produced.

SECTION-C

Attempt **any two** questions of the following. **(15×2=30)**

10. Explain the conditions to be satisfied for the successful parallel operation of the single phase transformers.

Two single phase transformers rated 1000 kVA and 500 kVA respectively are connected in parallel on both HV and LV sides. They have equal voltage rating of 11kV/400 V and their per unit impedances are (0.02+j 0.07)Ω and (0.0025+j 0.0875) Ω respectively. What is the largest value of the unity power factor load that can be delivered by the parallel combination at the rated voltage?

11. Explain the Hopkinson test for determining the efficiency of the DC shunt machine.

A 50kW, 250 V compound motor takes a current of 9 A running at no load at rated voltage and rated speed. The shunt field current is 5A. The resistance of the windings is as armature winding 0.1Ω, series field 0.07Ω, interpolar windings 0.03Ω. The brush drop is 2V. Determine the motor output and the efficiency of the motor when the intake is 155 A.

12. Write short notes on:

(i) Magnetization characteristics for DC shunt generator.

(ii) Three phase to two phase connection.

(iii) In-Rush Current in transformers.

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