GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2130904   **Date: 09/06/2017**
Subject Name: DC Machines and Transformer
Time: 10:30 AM to 01:00 PM   **Total Marks: 70**

Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

Q.1   **Short Questions**   **14**

1   Which of the following is not a part of the DC machine
  (A) End rings   (B) Brushes
  (C) Commutator   (D) Pole shoe

2   The induced emf of a DC generator running at its rated speed on no load is 240 Volt. If the flux is increased by 20% and simultaneously the speed is reduced by 10%, What will be the induced emf?
  (A) 274 Volt   (B) 259 Volt   (C) 220 Volt   (D) 216 Volt

3   'Critical resistance' of a DC generator is associated with
  (A) Self excitation of a DC generator
  (B) Resistance of the field circuit
  (C) Slope of the linear part of the OCC
  (D) All of the above

4   Which of the following is not a method of speed control for DC motors?
  (A) Armature control method
  (B) Field control method
  (C) Frequency control method
  (D) Tapped field control method

5   If the efficiency of a transformer with very light load is represented by 'n1' and efficiency of the same transformer with nearly full load is represented by 'n2'. Which of the following is generally true?
  (A) n1 < n2   (B) n1 > n2   (C) n1 = n2
  (D) None of these

6   Voltage regulation of a transformer is positive and less than 100%. That means,
  (A) Output terminal voltage increases with load
  (B) Output terminal voltage decreases with load
  (C) Output terminal voltage is not affected by the load
  (D) Output terminal voltage is zero

7   The back emf of a 240 V, DC shunt motor is 220 V. If the armature resistance is 2 Ohm, the armature current of motor for this condition will be:
  (A) 20 A   (B) 100 A   (C) 10 A   (D) 0.1 A

8   No load voltage on the secondary of a single phase transformer is 120 Volt and the secondary voltage with some load is 125 Volt. The voltage regulation corresponding to this load is:
  (A) – 16%   (B) – 8%   (C) 4%   (D) – 4%

9   Transformer core is generally tightly clamped in order to:
  (A) Reduce the noise in the transformer
  (B) Reduce the copper loss
  (C) Reduce iron loss

1

(D) Increase the rating of the transformer

10 A single phase transformer is operating with no load. Winding resistances and leakage reactances are negligible. Keeping the supply voltage constant, if the frequency of the supply is increased, the iron losses of the transformer will:

(A) Increase   (B) Decrease

(C) Remain the same   (D) Increase or decrease

11 By mistake, 230 Volt DC is applied on HV (High Voltage) winding of a 230/115 Volt, 50 Hz, single phase transformer for a long time period. Which of the following is incorrect?

(A) Transformer HV winding will burn out

(B) There will be a very high voltage on LV winding

(C) There will be zero voltage on LV winding

(D) All of the above

12 Iron core of a single phase transformer is replaced with a wooden core of same dimensions and rated voltage at rated frequency is applied on the primary winding. Which of the following is correct?

(A) There will be very high voltage on secondary winding

(B) There will be rated voltage on the secondary winding

(C) There will be almost zero voltage on the secondary winding

(D) None of these

13 Efficiency of transformers is higher than that of electric motors of similar rating because:

(A) Friction and windage losses are only 10%

(B) Friction and windage losses of motors are very large

(C) Friction and windage losses are only 5%

(D) Friction and windage losses are almost zero

14 Efficiency of a transformer on no load is expected to be:

(A) 100%   (B) 96%   (C) 0%   (D) 99%

Q.2	**(a)**	Mention the parts of a DC machine. Explain the use of any one of them.	**03**
	(b)	Derive the emf equation of a transformer from first principles.	**04**
	(c)	A 440/110 Volt transformer has a HV resistance of 0.03 Ohm and LV resistance of 0.02 Ohm. Its iron loss at rated output is 150 Watt. Determine the secondary current at which maximum efficiency will occur. Also find out the value of maximum efficiency with unity power factor load.	**07**

OR

	(c)	An 8-pole DC generator has 500 armature conductors and has a useful flux per pole of 0.065 Wb. What will be the emf generated if it is lap connected and runs at a speed of 1000 rpm? What must be the speed at which it must be driven to produce the same emf if it is wave wound?	**07**
Q.3	**(a)**	List the conditions for satisfactory parallel operation of two three phase transformers.	**03**
	(b)	Write a brief note on open circuit test of a single phase transformer.	**04**
	(c)	Draw the vector diagrams and winding connections for the following transformer connections. (1) Dz6 (2)Yd11	**07**

OR

Q.3	**(a)**	Briefly describe the principle of operation of a transformer.	**03**
	(b)	Give a comparison of an auto transformer with a two winding transformer.	**04**
	(c)	Draw the vector diagrams and winding connections for the following transformer connections. (1) Dy1 (2)Yz11	**07**
Q.4	**(a)**	Explain the terms (1) Pole pitch (2) Full pitch coil (3) Pitch factor	**03**
	(b)	With suitable examples briefly explain the singly excited and doubly excited magnetic systems.	**04**

2

	(c)	Briefly explain the working of ON Load and OFF Load tap changing transformers.	**07**

OR

Q.4	**(a)**	Describe various losses in a DC machine and derive the equation of efficiency of DC machine as a motor and as a generator.	**03**
	(b)	Draw the vector diagram and winding connections for Scott connection.	**04**
	(c)	Discuss the physical concept of torque production. Compare the electromagnetic torque with reluctance torque.	**07**
Q.5	**(a)**	Derive the emf equation of a DC generator.	**03**
	(b)	What is the necessity of starter in a DC motor? Name the starters for DC motors.	**04**
	(c)	Enlist the methods of speed control of DC motors. Explain any one of them in detail.	**07**

OR

Q.5	**(a)**	Derive the torque equation of a DC motor from first principles.	**03**
	(b)	What is armature reaction? Discuss any one method to counterbalance armature reaction.	**04**
	(c)	Draw the circuit diagram and explain the Hopkinson's test for DC shunt machines in detail.	**07**

****