Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2160912 **Date: 27/04/2017**

Subject Name: Design of DC Machines and Transformer

Time: 10:30 AM to 01:30 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 Multi step core is used in transformer to
(a) Increase the output (b) Decrease the cost of copper

2 In transformer the cylindrical winding is generally not used beyond
(a) 33 kV (b) 66 kV

3 Tapping's are usually provided on
(a) H V winding (b) L V winding
(c) Both H V and L V winding (d) None of the above

4 Distribution transformer should be designed to have maximum η at
(a) 100 % load (b) 75 % load

5 In transformers, with increase in supply frequency, the iron losses
(a) Increase (b) Decrease
(c) Decrease or Increase (d) Remain unaffected

6 Suggest cooling method for 300 kVA distribution transformer
(a) AN (b) AB
(c) OFAF (d) ON

7 Most suitable value of ratio of window height to window width
(a) 3 (b) 4
(c) 2 (d) 5

8 D C machine Yoke is made of
(a) Aluminium (b) Phosphor Bronze
(c) Cast Steel (d) Brass

9 Which loss is independent of load current & flux density
(a) Copper loss (b) Eddy current loss
(c) Windage loss (d) Hysteresis loss

10 Function of dummy coil in D C generator is
(a) To increase flux density (b) To improve commutation
(c) To provide mechanical balance (d) To reduce eddy current

11 Compared to induction motor the air gap in D C machine is
(a) Large (b) Small
(c) Very small (d) Equal

12 Inter pole in D C machine are provided to reduce
(a) Hunting (b) Iron loss
(c) Temperature rise (d) Sparking

13 Poles of D C machines are often laminated to
(a) Reduce pulsation loss (b) Reduce armature reaction
(c) Reduce iron weight (d) Dissipate more heat

14 The dimensions of D C machines depends upon
(a) Number of poles (b) Work done per revolution

Q.2 **(a)** Classify different insulating materials according to temperature withstanding capacity. **03**

(b) Differentiate between power transformer and distribution transformer according to design point of view. **04**

(c) Derive equation $Et = k\sqrt{Q}$ where Q = kVA rating of a transformer. Explain how service condition of transformer affect the value of K. **07**

OR

(c) What is design optimization? Derive necessary condition for designing a transformer with minimum cost. **07**

Q.3 **(a)** Define following words related to transformer design: **03**
(I) Window space factor
(II) Staking factor
(III) Circumscribing Circle

(b) Why tapping's are generally provided on HV winding? **04**

(c) Determine the main dimensions of the core for a 5 kVA , 11000/400 V, 50 Hz, single phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross section of iron in the core. Assume a square cross-section for the core, a flux density 1 Wb/m2 , a current density 1.4 A/mm2,and a window space factor 0.2. The height of window is 3 times its width. **07**

OR

Q.3 **(a)** Differentiate between Radial Forces and Axial Forces in transformer windings. **03**

(b) From the design data discuss how no load current can be estimated in 3-phase core type transformer. **04**

(c) A 250 kVA, 6600/400 V, 3 phase core type transformer has a total loss of 4800 W at full load. The transformer tanks is 1.25 m in height and 1 m x 0.5 m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35^0 C. The diameter of tubes is 50 mm and are spaced 75 mm from each other. The average height of tubes is 1.05 m. Specific heat dissipation due to radiation and convection is respectively 6 and 6.5 W/m^2 -^{0}C. Assume that convection is improved by 35 % due to provision of tubes. **07**

Q.4 **(a)** Discuss necessity of inter pole in D C machine design. **03**

(b) The length of the air-gap is not uniform under the entire pole face. Why it is so? **04**

(c) Explain various factor affecting selection of number of poles for D.C. machine **07**

OR

Q.4 **(a)** State factor to be consider for selection of specific loading. **03**

(b) Write a short note on heating of electric machine. **04**

(c) Explain various factors affecting selection of airgap length in D.C. machine. **07**

Q.5 **(a)** How to reduce the demagnetizing effects and cross-magnetizing effect? **03**

(b) Derive the output equation of a D C machine. **04**

	(c)	Calculate the diameter and length of armature for a 7.5kW, 4 pole, 1000 r.p.m 220 V shunt motor. Given: full load efficiency= 0.83; maximum gap flux density=0.9 Wb/m2: specific electric loading=30,000 ampere conductors per meter; field form factor = 0.7. Assume that the maximum efficiency occurs at full load and field current is 2.5% of rated current. The pole face is square.	**07**

OR

Q.5	**(a)**	State different methods used to improve armature reaction effect in D.C. machine.	**03**
	(b)	Explain steps to design shunt field winding of a D.C. machine.	**04**
	(c)	A 500 kW, 375 r.p.m. 8 pole, D C generator has a flux per pole of 0.0885 Wb. Determine the armature demagnetizing and cross magnetizing mmf per pole if the brushes are given a lead of 5 % of pole pitch. Assume power developed by armature to be equal to rating of machine.	**07**

****