

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEMESTER– VII EXAMINATION – WINTER 2014

Subject Code:170902**Date: 02/12/2014****Subject Name: Electrical Machine Design- I****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.

- Q.1** (a) Define Field Form Factor. Explain Carter's Fringe Curve. **07**
 (b) Explain how temperature rise affects the life of electrical machine ? Also explain Intermittent with starting duty cycle. **07**
- Q.2** (a) Calculate approximate overall dimensions for a 500 KVA, 6600 / 440 V, 50Hz, 3-phase core type transformer. The following data may be assumed ; emf / turn= 10 V, max. flux density = 1.3 wb/m² , current density = 2.5 A/mm², window space factor = 0.3 , overall height = overall width, stacking factor=0.9, Use 3 stepped core. **07**
 For core, width of largest stamping = 0.9 d and net iron area= 0.6 d, where d= dia. of circumscribing circle.
 (b) Explain effect of change in frequency on losses, voltage & leakage impedance of transformer. **07**
- OR**
- (b) List out diff. types of winding used in 3- phase transformer with its voltage rating. Also explain continuous disc type winding for 3- phase transformer. **07**
- Q.3** (a) Explain various factors affecting selection of air gap length in dc machine. **07**
 (b) Calculate main dimensions of 50 KW, 4-pole, 600 rpm, dc shunt generator with full load terminal voltage 220 V. The max. gap flux density is 0.83 wb/m² and the specific electric loading is 30,000. **07**
 Assume that the full load armature voltage drop is 3 % of rated terminal voltage and field current is 1 % of rated full load current. Ratio of pole arc to pole pitch is 0.67& pole face is square.
- OR**
- Q.3** (a) Explain diff. methods used to improve armature reaction effect in dc machine. **07**
 (b) Explain guiding factors for choice of no of armature slots. Also show the slot view with insulations. **07**
- Q.4** (a) Define Design Optimisation of Transformer. Derive necessary conditions for maximum efficiency of transformer. **07**
 (b) The armature of 12 pole ,500KW, 550 V, generator has a simplex lap winding consisting of 2484 conductors. There are 621 commutator segments & ratio of pole arc to pole pitch is 0.7. **07**
 (a) Calculate the demagnetizing & cross magnetizing mmf / pole at rated full load current if brushes are shifted through 3 segments from G.N.A.
 (b) Calculate no. of conductors that must be provided in each pole face if a compensating winding is used.
- OR**
- Q.4** (a) Explain Commutation in dc machine. Explain how interpole improves it ? **07**
 (b) The following particulars refer to the shunt field coil for 440 V, 6 pole, dc generator. **07**

MMF / pole = 7000 A, depth of winding = 50 mm, length of inner turn = 1.1 m, length of outer turn = 1.4 m, loss radiated from outer surface excluding ends = 1400 W/m^2 , space factor = 0.62, resistivity = $0.02 \text{ ohm/m} \cdot \text{mm}^2$
 calculate (1) dia of wire, (b) length of coil (3) no of turns (4) exciting current
 Assume a voltage drop of 20 % of terminal voltage across the field regulator.

- Q.5** (a) Explain design aspects of C.T. **07**
 (b) Explain **1.** **07**
 Bracing in tr. Winding 2. Choice of current density in transformer

OR

- Q.5** (a) Define Window Space Factor. Explain role of it to improve transformer regulation . **07**
 (b) Explain diff. cooling methods used for oil immersed transformer **07**
