Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 170902 Date: 05-12-2013

Subject Name: Electrical Machine Design -II

Time: 10:30 TO 01:00 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)** Find out main dimensions and number of armature conductors for 350 KW, 440 Volts, 720 rpm, 6-pole D.C. Generator. Assume square pole face, ratio of pole arc to pole pitch 0.66, efficiency 91%, 4% of rated voltage for brush drop. Use data obtained from the following machine. **10**

250 KW, 500 Volts, 600rpm DC generator with 720 lap connected armature conductors, 0.75m armature diameter and core length of 0.3m.

(b) Answer the following with respect to transformer design : **04**

a. Why cores are stepped?
b. Why yoke is designed for low flux density

Q.2 **(a)** Explain various factors affecting selection of number of poles for D.C. machine. **07**

(b) Explain various factors affecting choice of Average flux density and Ampere conductors per meter for D.C. machine. **07**

OR

(b) Write a Short Note on : Duty Cycle **07**

Q.3 **(a)** Explain various factors affecting selection of Numbers of armature slots for D.C. machine. **07**

(b) A 350 KW, 500 Volts, 450 rpm, 6 pole d.c. generator is built with an armature diameter of 87 cm and core length of 32 cm. The lap wound armature has 660 conductors. Determine specific magnetic and electric loading of the machine. **07**

OR

Q.3 **(a)** What is design optimization? Derive necessary condition for designing a transformer with minimum cost. **07**

(b) Determine the main core & yoke dimensions for a 200 KVA, 50 Hz, 1-phase core type transformer. **07**

Window space factor = 0.32 Current density = 3 A/mm²
Max. flux density = 1.1 Wb/m² Volts per turn = 14 V
Stacking factor = 0.9 Net iron area = 0.56*d2
Cruciform core with distance between adjacent limbs = 1.6 times width of core

Q.4 **(a)** Explain : **07**

a. Significance of mitered joints in transformer.
b. Design difference between power & distribution transformer.

(b) Find out armature demagnetizing & cross magnetizing mmf per pole if brushes are given a lead of 9^0 electrical for a 500 KW, 375 RPM, 8 Pole, D.C. Generator with flux per pole of 88.5 mwb. Assume that the power developed by armature is equal to rating of machine. **07**

OR

Q.4 **(a)** Derive output equation of 3 –Φ Transformer. Write the significance of constant 'K'. **07**

(b) Estimate the leakage reactance of concentric winding in core type transformers clearly stating the assumptions used. **07**

Q.5 **(a)** With the help of neat sketch, explain the effect of armature reaction on air gap flux in case of D.C. machine. **07**

(b) A 4 pole generator supplies a current of 140 A. It has 480 armature conductors (a) wave connected, (b) lap connected. The brushes are given an actual lead of 10°. Calculate the cross and demagnetizing mmf per pole in each case. The field winding is shunt connected and takes a current of 10 A, find the number of extra shunt field turns to neutralize the demagnetization. **07**

OR

Q.5 **(a)** A 40 Hz transformer is to be used on a 50 Hz system. Assuming the Steinmetz's coefficient as 1.6 and losses at lower frequency 1.2%, 0.7% and 0.5% for I^2R, hystersis and eddy current respectively. Find (a) losses on 50 Hz for the same supply voltage and current (b) Output at 50 Hz for the same total losses as on 40 Hz. **07**

(b) What is window space factor? Explain how it varies with (1) KVA rating (2) KV rating **07**

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