

2014  
B.E. (Electrical and Electronics Engineering)  
Sixth Semester  
PE-EE-605: Electric Machine Design

Time allowed: 3 Hours

Max. Marks: 50

*NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.*

x-x-x

**Que.1**

- (a) What are the major considerations to evolve a good design of electrical machine?
- (b) Define specific electric loading. What are the factors that decide the choice of specific electric loading?
- (c) Why the stepped core is generally preferred in transformer core design? Explain briefly
- (d) Write the expression for the output equation and out coefficient of induction motor. Clearly mention all the symbols used.
- (e) What are the factors that govern the design of field system of the alternator? Explain.

(5\*2=10)

**PART -A**

**Que. 2** (a) Prove that for a rotating machine output equation in volt amperes =  $C_o D^2 L n$ . Show that how and why the output coefficient changes with size and type of machine. (5)

(b) Find the main dimensions of a 200 kW, 250 volts, 6 poles, 1000, rpm DC generator. The maximum value of flux density in the air gap is  $0.87 \text{ wb/m}^2$  and the ampere conductors per meter length of armature periphery are 31000. The ratio of pole arc to pole pitch is 0.67 and the efficiency is 91 percent. Assume that the ratio of length of core to pole pitch = 0.75. (5)

**Que.3** (a) Explain the various cooling methods used in electrical machines. (5)

(b) Discuss the various duties and ratings of rotating machines and give their temperature time curves. (5)

**Que.4** Calculate the approximate overall dimensions for a 200 KVA, 6600/440V, 50HZ, 3- $\Phi$  core type transformer. The following data may be assumed; emf per turn = 10V, Max. Flux density= $1.3 \text{ wb/m}^2$ , current density = $2.5 \text{ A/mm}^2$ , window space factor= $0.3$ , overall height = overall width, stacking factor =  $0.9$ . For a three stepped core, width of largest stamping =  $0.9 d$  and net iron area =  $0.6 d^2$  where  $d$  is the diameter of circumscribing circle. (10)

P.T.O.

(2)

PART -B

Que. 5 (a) What types of slots are preferred for the induction motor? Define slot space factor. What are the factors to be considered for selecting number of slots in induction machine stator? (5)

(b) Derive expression for the design of rotor and end rings of squirrel cage induction motor. (5)

Que.6 Determine for a 250 kVA, 1100 V, 12 pole, 500 rpm, 3-phase alternator

- Air gap diameter
- Core length
- Number of stator conductors
- Number of stator slots
- Cross section of stator conductors

Assuming average gap density as  $0.6 \text{ wb/m}^2$ , and specific electric loading of 3000 ampere conductors /m,  $L/\tau = 1.5$ . (10)

Que.7 Write short notes on:

- i) Advantages and Disadvantages of Synthesis Method of Electrical Machine design
- ii) Compare squirrel cage induction motor with wound rotor motors.

(2\*5=10)

x-x-x