

**SUBJECT CODE NO:- P-214**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (EEP/EE/EEE) Examination May/June 2017**  
**Electrical Machine Design**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- i) Q. No. 1 and Q. No.6 are compulsory
- ii) Attempt any two question from remaining question of each section
- iii) Assume suitable data wherever necessary

Section A

- Q.1 Attempt any Five 10
- a) List out the design factor considered in electrical machine design.
  - b) What do you mean by Electrical machine design?
  - c) Enlist the factors affecting air gap length of induction motor
  - d) What do you mean by specification of electrical machines?
  - e) What do you mean by standardization in design of rotating machines?
  - f) Define specific magnetic loading.
  - g) Define magnetic pull in rotating machine.
  - h) State various design limitation.
- Q.2 a) Explain the criterion for selection of No stator slots in 3-ph induction motor 07
- b) Calculate the following design information for 30 kw, 440 v, 3-ph, 6 pole, 50 Hz delta connected sq . cage induction motor 08
- i) main dimension of stator frame
  - ii) No of turns per phase in stator winding
  - iii) no of stator slots
- Q.3 a) Derive the output equation of 3- phase induction motor 07
- b) During the stator design of 3- phase 30kw, 400v, 6 pole, 50 Hz, sq.cage induction motor following information has been obtained 08
- Gross length of stator = 0.17 m  
 Internal dia. of stator = 0.33 m  
 No. of stator slots = 45  
 No. of conductors /slot = 12  
 Based on above data design a suitable cage rotor
- Q.4 a) What do you mean by real and apparent flux density? Derive the relation between them 07
- b) The stator of machine has smooth surface but its rotor has open type of slots with slot width  $w_s$ , = tooth width,  $w_t = 12$  mm and length of air gap  $l_g = 2$ mm Find the effective length of air gap if the Carter's coefficient 08

2017

$$= \frac{1}{1 + 5 \lg / ws} . \quad \text{There are no radial ducts.}$$

- Q.5 Attempt any three 15
- Modern trend in electrical machine design
  - phenomenon of crawling and cogging in induction motor
  - Design of end ring 3- ph induction motor
  - Carter's coefficient and its significance

Section B

- Q.6 Attempt any five 10
- List out the method of cooling of transformer
  - Define heating time constant
  - what is the use of choke coil
  - give the advantages of stepped core of transformer
  - Define window space factor
  - write output equation of 3- phase transformer and write meaning of each parameter
  - define heating cycle of transformer
  - Explain the causes of temp. rise in transformer

- Q.7 a) Explain in detail the steps for determination of main dimension for core ,window and yoke 07
- b) Determine the dimension of core & yoke for 200 KVA, 50Hz, single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times width of core laminations Assume voltage per turn 14 v ,maximum flux density 1.1 wb / m<sup>2</sup> window space factor 0.32, current density 3 Almm<sup>2</sup> and stacking factor = 0.5 .the net iron area is 0.56d<sup>2</sup> in a cruciform core where d is the diameter of circumscribing circle .Also the width of largest stamping is 0.85 d 08

- Q.8 a) Give in detail the design steps for LV & HV winding design of transformer 07
- b) Calculate the core and window area required for 1000 KVA, 6.600/400V, 50Hz single phase core type transformer. Assume max flux density of 1.2 wb / m<sup>2</sup> and current density of 2.5 Almm<sup>2</sup> ,voltage per turn = 30 volts, and window space factor = 0.32 08

- Q.9 a) Explain in detail the various cooling methods of transformer 07
- b) explain why cooling tubes are provided on transformer tank surface. Derive the expression for calculating no. of cooling tubes 08

- Q.10 Attempt any three 15
- Explain the conservator and breather with dia, used in transformer
  - Explain Evolution of leakage reactance & winding of transformer
  - Design of choke coil
  - Explain the various mechanical forces developed under short circuit condition of transformer