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SUBJECT CODE NO:- P-267

FACULTY OF ENGINEERING AND TECHNOLOGY

T.E. (EEP/EE/EEE) Examination MAY/JUNE-2016

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 questions from Q.No.2 to Q.No.5.
iii) Attempt any two questions from Q.No.7 to Q.No.10.
iv) Assume suitable data, if necessary.

Section A

Q.1 Attempt the following. (Any five) 10

a) Enlist the limitations in design.
b) Define specific electric loading.
c) Enlist the different design circuits.
d) What do you mean by magnetic leakage and fringing?
e) What is yoke section of distribution transformer?
f) What are the advantages of stepped core of transformer?
g) What do you mean by magnetic circuit calculation?
h) What do you mean by heating and cooling cycle in transformer?

Q.2 a) Derive the output equation of single phase transformer. 07

b) Determine the dimensions of core and yoke for 200KVA, 50HZ single phase transformer. A cruciform core is used with distance between adjacent limb is equal to 1.6tones width of core lamination. Assume voltage per turn 14 V_7 B_{max} = 1.1 Wb/m^2, window space factor = 0.32; current density 3A/mm^2. The net iron area in core is 0.56 **dz** in cruciform core and width of largest stamping is 0.85d. 08

Q.3 a) Explain various cooling methods of transformer. 07

b) Determine the main dimensions of core and window for 1250 KVA, 30 33/6.6KV, 50Hz core type power transformer based on following information of parameters. 08
B_{max} = 1.5 Wb/m^2 , δ = 2.5 A/mm^2 , KW = 0.21 , Ai = 0.6dz , window proportion 3:1 ,
Full load magnetic loading to mmf ratio is1.687×10^{-6}.

Q.4 a) What do you mean by real and apparent flux density in iron path, derive the relation between them? 07

b) Calculate the mmf required for air gap of machine having core length = 0.32m, including 4 ducts of 10mm wide, pole area = 0.19 m , slot pitch = 65.4mm , slot opening = 5mm , air gap length = 5mm flux per pole 52 mwb, given carter's coefficient for slot = 1 and carters coefficient for duct = 2. 08

Q.5 Attempt any three. 15

i. Modern trend in electrical machine design.
ii. Calculation of AT in tapered tooth.
iii. Specification and standardization
iv. Estimation of losses in transformer.
v. Heating time constant in transformer.

Section B

Q.6 Attempt <u>any five</u>. 10

a) What are the main dimensions and 3-ph induction motor?
b) Write the output equation of 3-ph induction motor and expression of output coefficient.
c) What are the factors to be considered for choosing the specific magnetic loading of induction motor?
d) What are the different types of stator winding in induction motor?
e) What are the advantages of lower air gap length in induction motor?
f) Discuss the relative merits and demerits of open and closed slots of induction motor.
g) What is the range of specific magnetic loading in induction motor?
h) What is the range of specific electrical loading in induction motor?

Q.7 a) Explain the various guideline factors of which gives the choice of stator slots of 3-ph induction motor. 07

b) Calculate the following design information for 30KW, 440V, 3-phase 6 pole 50Hz, and delta connected squirrel cage induction motor. 08

i. Main dimensions of stator frame
ii. No of turns per phase
iii. No of stator slots

Assume BaV = 0.48wb/m^2 , ac = 26000A/m , η = 0.88 , pf = 0.86, kw = 0.955

Q.8 a) Explain the factors affecting length of air gap in 3 phase induction motor. 07

b) During the stator design of 3-phase 30KW, 400V, 6 pole, 50Hz, squirrel cage induction motor following information has been obtained. 08

Gross length of stator = 0.17m
Internal dia. of stator = 0.33m
Number of stator slots = 45
Number of conductors per slot = 12
Based on above data design a suitable cage rotor for above motor.

Q.9 a) Explain the steps for designing a wound rotor. 07

b) Explain in detail unbalance magnetic pull and its estimation in Induction motor. 08

Q.10 Attempt <u>any three</u>. 15

a) Design of heating coil
b) Phenomenon of crawling and caging in Induction motor
c) Output equation of 3-ph induction motor
d) Design of choke coil
e) Types of a.c. winding