Exam.Code:0938
Sub. Code: 6999

2062

B.E. (Electrical and Electronics Engineering)
Eighth Semester
Elective – II
EE-808: Electrical Machine Design

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Missing data (if any) can be appropriately assumed.*

x-x-x

1. Explain in brief.

A) Write the equation representing the Newton's law of cooling and state the operating conditions under which the law is strictly applicable. **(02)**

B) What are the factors to determine the rotor slots in induction motor? **(02)**

C) Why riser is provided on the commutator? **(02)**

D) Why the length of air gap in induction motor is kept minimum possible whereas in a d.c. machine it is larger? **(02)**

E) State merits of computer aided design of an electrical machine. **(02)**

Part A

2. A) Define "specific magnetic loading" and "specific electric loading". What are advantages and disadvantages of using higher specific loading? **(05)**

B) A 5 KW, 250V, 4 pole 1500rpm shunt generator is designed to have a square pole face. The loadings are: average flux density B_{av}=0.42Wb/m^2 and ampere conductors per metre ac=15000A/m. Find the main dimensions of the machine. Assume full load efficiency = 0.87 and ratio of pole arc to pole picth=0.66 **(05)**

3. A) When a motor runs at its continuous rating, its final temperature rise is 75°C. It has heat time constant of 0.75 hours. **(05)**

(i) Calculate the temperature rise after 1 hour of the start of the motor and running continuously on the load.

(ii) Calculate the maximum steady temperature if the temperature rise in one hour rating is 75°C.

(iii) How much time the motor will take to a temperature rise from 50°C to 75°C if it is working at its one hour rating?

B) Explain briefly various types of cooling systems used for rotating electrical machines. **(05)**

4.A) Calculate approximate overall dimensions for a 200 KVA, 6600/440 V, 50 Hz, 3 -ϕ core type transformer. The following data may be assumed: flux density B_m=1.3 Wb/m^2, Current density δ=2.5 A/mm^2, window space factor K_w=0.3, Overall height is equal to Overall width, Iron factor K_i= 0.9, EMF/turn=10V, Use 3 stepped core. For a 3 stepped core: W_d= 0.9d; A_i= 0.6 d^2. Verify overall height is same as that of overall width of the transformer. **(07)**

B) Why are distributed transformers designed to have maximum efficiency at loads quite lower than the full loads? **(03)**

Part B

5. A) Explain crawling and cogging of induction motor. **(05)**

B) Estimate the main dimensions, number of stator slots and number of stator conductors per slot for a 140 H.P., 3300 volt, 50 c/sec., 12 poles, star-connected slipring induction motor. Assume **(05)**

Average gap density = 0.4 Wb/m^2

Ampere-conductor per metre = 25,000

Efficiency, η = 90%

Power factor = 0.9

Winding factor = 0.96

P.T.O.

6. A) Derive the output equation of a synchronous machine in terms of its main dimensions and specific loadings. **(05)**

B) Estimate suitable air gap diameter and length of a 10 MVA, 11 kV, 8-pole 3-phase, 50 Hz star-connected synchronous generator. Maximum air-gap flux density is 0.92 tesla. The ampere per conductor per metre length of periphery is varying from 20,000 to 40,000 A/m. The peripheral velocity should not be more than 80 m/sec. Suggest the type of pole to be constructed. Pole arc to pole pitch ratio is 0.66. **(05)**

7. Write a short notes on **(10)**

A) Draw the flow chart for overall design of three phase Induction motor.

B) Why the field structure is usually made a rotating part in a 3-phase synchronous alternator?

x-x-x