7E 4177

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B.Tech. VII Semester(Main/Back) Examination - 2014

Electrical Engineering

7EE6.2 Computer Aided Design of Electrical Machines

EE, EX

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from each **unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Enumerate the main and performance specifications of Electrical machines? **(5)**

   b) Write short note on insulating materials as used in electrical machines **(5)**

   c) Write and explain the Ohm's Law for magnetic circuit **(6)**

OR

1. a) Define and explain the terms specific electric loading and specific Magnetic loading as applied to an electromagnetic machine **(10)**

   b) Explain What is meant by real and apparent flux density. Derive the equation for the relation between real and apparent flux density. **(6)**

Unit - II

2. a) Explain the terms "Continous rating" inter mittent rating and short time rating How are these ratings important in the design of electrical machines. **(6)**

   b) A motor has a heating time constant of 100 minutes a cooling time. Constant (When stationery) of 2000 minutes and a final steady temperature rise on full load of 60^0C .Estimate the maximum temperature attained if the motor runs on full load for 30 minutes followed by a stationary period of 45 minutes. the cycle being repeated indefinitely. **(10)**

OR

2. a) Write short note on hydrogen cooling of turbo alternates (6)

b) Derive the equation for mmf required for air gap of a rotating machine having slotted armature. What is the meaning of affective length of air gap. (10)

Unit - III

3. a) Advantages and disadvantages of using silicon steel for transformer stampings (6)

b) Essential difference between a power and distribution transformer specially from the design consideration. (5)

c) Derive the output equation for a three phase transformer. (5)

OR

3. a) Explain with neat sketches the following types of windings used in these phase core type transformer.

i) Cylindrical

ii) Cross Over

iii) Helical and

iv) Disc (6)

b) Find the main dimensions of core for a 50 Hz 200KVA, 6600/500 Volts, Star/delta core type transformer. Use the following data:

Core limb section to be 4 - stepped

Window space factor =0.27

(Height of window) / (width of window)=2

Current density = 2.8 A/mm^2

Voltage per turn = 8.5

Maximum flux density = 1.25 web/m^2 (10)

Unit - IV

4. a) Explain the term "Short circuit ratio" and - its effects on the performance of synchronous machines. Show that the short circuit ratio (SCR) of synchronous machines is inversely proportional to its synchronous reactance.

b) Design the main dimensions of a 75 MVA, 11KV, 50Hz, 3000rpm 3-phase, star connected alternates Also determine the value of flux per pole, turns per phase, and size of armature conductors.

Given that

Average flux density = 0.6 web/m^2

Specific electric loading = 50000 ac/meter

Peripheral speed = 180 m/sec

Winding factor = 0.95

Current density = 6A/mm^2 **(16)**

OR

4. a) Give reasons why a turbo alternates has smaller diameter and langer length where as a water wheel generates has large diameter and smaller length **(6)**

   b) Determine the main dimensions of a 3000 KVA, 6.6 KV, 50 HZ, 187.5 rpm. 3 phase, star connected alternates. Also find the turns per phase. Given that Average flux density =0.58 web/m^2, Specific electric loading = 3500 ac/meter. Pole-arc to pole-pitch ratio = 0.7 **(10)**

Unit - V

5. a) Deduce the output equation of a 3 phase induction motor in terms of its specific loadings. Why the length of air gap in induction motor is kept as minimum as possible? **(6)**

   b) Calculate diameter and length of states core, and number of turns per phase of a 3-ϕ, 120 KW, 2200 volts, 750 rpm (Synchronous speed), 50Hz, star connected slip ring induction motor. Given that Average flux density in air gap=0.48 web/m^2 Specific electric loading = 26000 ac/meter Efficiency = 92%, power factor = 0.88 Winding factor = 0.955, Current density=5 A/mm^2. Pole arc to pole pitch ratio is 1.25. **(10)**

OR

5. a) Explain the phenomenon of crawling and coagging in case of squirrel cage induction motor. Why is an induction motor, the number of starter slots should never be equal to the number of roter slots. **(10)**

   b) Estimate the stator core dimensions and stator turns per phase for a 100 KW, 3300V, 50Hz, 12 pole star connected slip ring induction motor, Given that :

   Average gas density = 0.4 web/m^2, Specific electric loading = 25000 ac/meter Efficiency = 90%, power factor = 0.9 Winding factor = 0.96

   Design the machine for the bes power factor. **(6)**
