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Question Paper Code : X 60508

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Sixth Semester
Electrical and Electronics Engineering
EE 2355/EE 65/10133 EE 605 – DESIGN OF ELECTRICAL MACHINES
(Regulations 20008/2010)
(Common to PTEE 2355 – Design of Electrical Machines for B.E. (Part-Time) Fifth Semester – Electrical and Electronics Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is peripheral speed ? Write the expression for peripheral speed of a rotating machine.

2. What are the factors that affect the size of rotating machine ?

3. Write down the output equation of a d.c. machine.

4. State any two guiding factors for the choice of number of poles.

5. What are the advantages of stepped cores ?

6. Why circular coils are preferred in transformer ?

7. What are the advantages of larger air gap length in an induction motor ?

8. Write down the rules for selecting rotor slots of squirrel cage induction motor.

9. What are the factors that influence the choice of specific magnetic loading in a synchronous machine ?

10. Define short circuit ratio of a synchronous machine.

PART – B **(5×16=80 Marks)**

11. a) What are the main groups of electrical conducting materials ? Describe the properties and applications of those materials. **(16)**

(OR)

b) Describe the methods of measurement of temperature rise in various parts of an electrical machine. **(16)**

12. a) Explain various steps involved in the design of shunt field winding of dc machine. **(16)**

(OR)

b) i) Determine the air gap length of a dc machine from the following particulars : gross length of core = 0.12, number of ducts = one and 10 mm wide, slot pitch = 25 mm, slot width = 10 mm, Carter's coefficient for slots and ducts = 0.32, gap density at pole centre = 0.7 wb/m^2; field mmf/pole = 3900 AT, mmf required for iron parts of magnetic circuit = 800 AT. **(8)**

ii) A 5 kW, 250V, 4 pole, 1500 r.p.m. shunt generator is designed to have a square pole face. The loading are :

Average flux density in the gap = 0.42 Wb/m^2 and ampere conductors per metre = 15,000. Find the main dimensions of the machine. Assume full load efficiency = 0.87 and ratio of pole arc to pole pitch = 0.66. **(8)**

13. a) i) Derive the output equation of a single phase transformer in terms of core and window area. **(8)**

ii) Determine the diameter of core and window for a 5 kVA, 50Hz, 1-phase, core type transformer. A rectangle core is used with long side twice as long as short side. The window height is 3 times the width. Voltage per turn = 1.8V, Space factor = 0.2, δ = 1.8A/mm^2, Bm = 1Wb/mm^2. **(8)**

(OR)

b) A 250 kVA, 6600/400V, 3 phase core type transformer has a total loss of 4800W at full load. The transformer tank is 1.25 m in height and 1m × 0.5 m in plan. Design a suitable for tubes if the average temperature rise is to be limited to 35°C. The diameters of the tubes are 50 mm and are spaced 75 mm from each other. The average height of tubes is 1.05 m.

Specific heat dissipation due to radiation and convection is respectively 6 and 6.5 W/m^2 °C. Assume that the convection is improved by 35 percent due to provision of tubes. **(16)**

14. a) State and explain the factors to be considered when estimating the length of air-gap of a 3-phase induction motor. **(16)**

(OR)

b) Estimate the stator core dimensions and the total number of stator conductors for a 3Φ, 100 kW, 3300 V, 50 Hz, 12 pole star-connected slip ring induction motor. Assume average gap density = 0.4 Wb/m^2, conductors per metre = 25,000 A/m, efficiency = 0.9, power factor = 0.9 and winding factor = 0.96. Choose main dimension to give best power factor. **(16)**

15. a) Find the main dimensions of a 100 MVA, 11 kV, 50 Hz, 150 rpm, 3 phase water wheel generator. The average gap density is 0.65 Wb/m^2 and ampere conductors per metre are 40000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit the runaway peripheral speed. **(16)**

(OR)

b) Explain the armature winding and rotor design of turbo alternator. **(16)**

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