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Question Paper Code : 80506

B.E/B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Sixth Semester

Electrical and Electronics Engineering

EE 2355/EE 65/ 10133 EE 605 – DESIGN OF ELECTRICAL MACHINES

(Regulations 2008/2010)

(Common to PTEE 2355/10133 EE 605 -Design of Electrical Machines for B.E. (Part-Time) Fifth Semester - Electrical and Electronics Engineering - Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the major considerations in electrical machine design?

2. Define space factor.

3. What is mean by magnetic circuit calculations?

4. Why square pole is preferred?

5. What are the cooling methods used for dry type transformers?

6. Define Window Space Factor.

7. Write down the equation for output coefficient in an Induction Motor.

8. What is meant by an Ideal short circuit current?

9. Define short circuit ratio of a synchronous machine.

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

PART B — (5 × 16 = 80 marks)

11. (a) Discuss about the factors that influence the choice of specific electric and magnetic loadings in the design of rotating machines. (16)

Or

(b) Describe any two methods used for determination of motor rating for variable load drives. (16)

12. (a) (i) Explain the various factors that are affected by the selection of poles in a dc machine. (8)

(ii) Determine the diameter and length of a armature core for 55 KW, 110V, 1000rpm, 4 pole shunt generator assuming specific electric and magnetic loadings of 26000amp.con/m and 0.5 wb/m^2 respectively. The pole arc should be about 70% of pole pitch and length of core about 1.1 times the pole arc. Allow 10A for the field current and assume a voltage drop of 4V for the armature circuit (8)

Or

(b) (i) Explain various steps involved in the design of shunt field winding of dc machine. (8)

(ii) Calculate the mmf required for the air gap of machine having core length = 0.32m including 4 ducts of 10mm each, pole arc = 0.19m, slot pitch = 65.4mm, slot opening = 5mm, air gap length = 5mm, flux per pole = 52mwb. Given Carter's coefficient is 0.18 for opening/gap = 1, and is 0.28 for opening/gap = 2, (8)

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

(ii) A 3 phase, 50Hz, oil cooled core type transformer has the following dimensions Distance between core centers = 0.2m, Height of window = 0.24m. Diameter of circumscribing circle = 0.14m. The flux density in the core = 1.25Wb/m^2, the current density in the conductor = 2.5A/mm^2. Assume a window space factor of 0.2 and the core area factor = 0.56. The core is 2 stepped. Estimate kVA rating of the transformer. (8)

Or

(b) A 250kVA, 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 1 × 5 m^2 in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35°C. The diameter of tubes is 50mm and are spaced 75mm from each other. The average height of tubes is 1.05m. Specific heat dissipation due to radiation and convection is respectively 6 and 6.5 W/m^2-°C, Assume that convection is improved by 35 percent due to provision of tubes. (16)

14. (a) Describe the effect of dispersion co-efficient due to the following factors in an induction motor.

(i) Overload capacity (4)

(ii) Air gap length, (4)

(iii) Number of poles and (4)

(iv) Frequency. (4)

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) (i) Describe the construction of turbo alternator with neat sketch. (8)

(ii) For a 250kVA, 1100V, 12 pole, 500rpm, 3 phase alternator, determine core diameter and core length. Assuming average gap density as 0.6wb/m^2 and specific electric loading of 30,000 amp. cond/m, $L/\tau = 1.5$. (8)

Or

(b) Determine the output coefficient for a 1500kVA, 2200Volts, 3 phase, 10 pole, 50Hz, star connected alternator with sinusoidal flux distribution. The winding has 60° phase spread and full pitch coils. ac=30,000 amp. cond/m, Bay = 0.6 Wb/m^2. If the peripheral speed of the rotor must not exceed 100 m/sec and the ratio pole pitch to core length is to be between 0.6 and 1, find D and L. Assume an air gap length of 6 mm.

Find also the approximate number of stator conductors. (16)

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