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Question Paper Code : 86594

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

Sixth Semester

Electrical and Electronics Engineering

EE 1352 — ELECTRICAL MACHINE DESIGN

(Regulations 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the various methods to find the mmf for tapered tooth.
2. Define continuous rating.
3. What is an equalizer connection?
4. What is the effect of interpole on main pole?
5. List the advantages of stepped cores.
6. Write the output equation of a three phase transformer.
7. Why the air gap of an induction motor is made as small as possible?
8. What is skewing? Write its advantages.
9. Define short circuit ratio.
10. Give the output equation of alternator.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss in detail about the various leakage fluxes. (10)
(ii) The field coil of a DC machine is excited with 2.5A at 230V. The weight of copper in the coil is 60 Kg. Estimate the rate at which the temperature will begin to rise when the coil is excited from cold conditions. Specific heat of copper is 390 J/Kg°Cm². (6)

Or

- (b) Explain in detail the various cooling methods of electrical machines. (16)

12. (a) (i) Explain why the specific electric and magnetic loadings cannot be increased beyond certain values. (6)
- (ii) A shunt field coil has to develop an mmf of 9000 AT. The voltage drop in the coil is 40 V and the resistivity of wire is 0.021 ohm.m. The depth of winding is 35 mm and the length of mean turn is 1.4 m. Design a coil so that the power dissipated is 700 w/m² of the total coil surface. Radial thickness insulation of the wire is 0.1 mm. (10)

Or

- (b) (i) Derive the output equation of a d.c. machine. (8)
- (ii) Estimate the main dimensions of a 4 pole 100 kw, 1500 rpm DC generator, assuming specific electrical and magnetic loadings as 19,000 ac/m and 0.4 T respectively. Length of the armature is equal to the pole pitch. (8)
13. (a) (i) Discuss the constructional details of a core and shell type transformers. (10)
- (ii) The ratio of flux to full load mmf in a 400 kVA, 50 Hz, single phase core type power transformer is 2.4×10^{-6} . Calculate the net iron area and the window area of the transformer. Maximum flux density in the core is 1.3 Wb/m², current density 2.7 A/mm² and window space factor 0.26. Also calculate the full load mmf. (6)

Or

- (b) Discuss the no load current calculation of a transformer from design data. (16)
14. (a) (i) Explain the importance of specific electric and specific magnetic loadings in the design of induction machines. (8)
- (ii) Find the values of L and D of a stator core of a 7.5 kw, 250 V, 50 Hz, 4 pole 3 phase induction motor for best power factor. Given $B_{av} = 0.4$ wb/m²; ac/m = 22000; efficiency = 0.87 and power factor = 0.86. (8)

Or

- (b) (i) Explain why the air gap of an induction motor is made as small as possible. (4)
- (ii) Find the current in the bars and end rings of a cage rotor of a 6 pole, 3 phase induction motor having 72 station slots with 15 conductors in each slot, if the stator phase current is 20 amps and rotor slots are 50. Hence find the suitable size of cage bars and end rings. (12)

15. (a) (i) Describe the design of stator of salient pole machine. (6)
- (ii) Find the main dimensions of a 2500 kVA, 187.5 r.p.m, 50 Hz, 3 phase, 3 kV, salient pole synchronous generator. The generator is to be a vertical water wheel type. The specific magnetic loading is 0.6 Wb/m^2 and the specific electric loading is 34000 A/m , use circular poles with ratio of core length to pole pitch = 0.65. Specify the type of pole construction used if the run-away speed is about 2 times the normal speed. (10)

Or

- (b) A 1000 kVA, 3300 V, 50 Hz, 300 rpm, 3 phase alternator has 180 slots with 5 conductors per slot. Single layer winding with full pitch coil is used. The winding is star connected with one circuit per phase. Determine the specific electric and specific magnetic loadings if the stator bore is 2.0 m and the core length is 0.4 m, using the same loadings. Determine the corresponding data for a 1250 kVA, 3300 V, 30 Hz, 250 rpm. 3 phase star connected alternator having 2 circuits per phase. The machines have 60° phase spread. (16)
