Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30546

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Sixth Semester

Electrical and Electronics Engineering

EE8002 – DESIGN OF ELECTRICAL APPARATUS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define flux linkage.
2. How magnetization curve is used in the design of electrical apparatus?
3. In the design of transformers, how the effect of rise in temperature is considered.
4. The voltage per turn of a 500 KVA, 11 KV, Δ/Y three phase transformer is 8.7 V. Calculate the number of turns per phase of LV and HV windings.
5. Define specific magnetic loading in the design of DC machines.
6. What is the relationship between coils and commutator bars in a DC generator?
7. Write the output equation for the design of main dimensions of an induction motor and define each term in it.
8. What are the various information that are needed to draw the circle diagram of Induction motor?
9. Define short circuit ratio in synchronous machines
10. What are the effects of large air gap length on the performance of synchronous machines?

PART B — (5 × 13 = 65 marks)

11. (a) Explain in detail about the major considerations to evolve a good design of electrical machines.

Or

(b) Discuss in detail the design of lap winding and wave winding.

12. (a) Explain the different methods of cooling the transformer.

Or

(b) Explain the step by step procedure for the design of yoke, core and winding for a shell type transformer.

13. (a) Draw the flowchart and write a program to design the armature main dimensions of DC machines.

Or

(b) Explain the procedure and factors affecting the selection of number of poles in a DC machine. Also explain the advantages and disadvantages of large number of poles in a DC machine.

14. (a) Find the main dimension of a 15 KW, three phase, 400v, 50 Hz, 2810 rpm, squirrel cage IM having an efficiency of 0.88 and full load power factor of 0.9. Take the rotor peripheral speed as 20 m/sec at synchronous speed. Assume specific electric loading 25000 ac/m and specific magnetic loading 0.5 Wb/m^2. What is the effect if p-f reduces to 0.7?

Or

(b) A 20 HP, 3 phase, 400 V, 50 Hz, 4 pole star connected induction motor has 3 slots/pole phase with short pitched coils of 160 span. Flux per pole is 0.009 Wb, gap area is 180 cm^2, effective air gap is 0.55 m. Estimate the magnetizing current component of the air gap.

15. (a) Discuss the various aspects involved in the design of turbo alternators.

Or

(b) Illustrate the steps involved in the design of damper winding of synchronous machines.

PART C — (1 × 15 = 15 marks)

16. (a) A 350 kW, 500 V, 450 rpm, 6 pole DC generator is built with an armature diameter of – 0.87m and core length of 0.32 m, the lap wound armature has 660 conductors. Calculate the specific electric and magnetic loading.

Or

(b) A 500 kVA, 33 kV, 50 Hz, 600 rpm, 3 phase salient pole alternator has per phase. Estimate the air gap length if the average flux density is 0.54 Wb/m^2. The ratio of pole arc to pole pitch is 0.65, the short circuit ratio is 1.2, the gap contraction factor is 1.15 and the winding factor is 0.955. The mmf required for gap is 80% of no load field mmf.
