



12. a) i) Derive the output equation of DC machine. (8)
- ii) A 5KW, 250V, 4Pole, 1500 rpm DC shunt generator is designed to have a square pole face. The specific magnetic loading and specific electric loading are 0.42wb/m^2 and 15000 ac/m respectively. Find the main dimensions of the machines. Assume full load efficiency 87% and poles arc to pole pitch ratio is 0.66. (8)

(OR)

- b) Calculate the MMF required for the air gap of a salient pole synchronous machines having core length of 0.2 m including 4 ducts of 10 mm each; pole arc = 0.19m. Slot Pitch = 65.4mm; slot opening = 5mm. Air gap length = 5mm. Flux per pole = 52m Wb; Carter's Coefficient is 0.18 for opening/gap = 1; Carter's coefficient is 0.28 for opening/gap = 2. (16)

13. a) Explain the different methods of cooling of Transformers. (16)

(OR)

- b) A single phase, 400V, 50Hz, transformer is built from stampings having a relative Permeability of 1000. The length of the flux path is 2.5 m, the area of cross section of the core is $2.5 \times 10^{-3}\text{m}^2$ and the primary winding has 800 Turns. Estimate the maximum flux and no load current of the transformer. The iron loss at the working flux density is 2.6W/kg . Iron weight $7.8 \times 10^3\text{ kg/m}^3$, stacking factor is 0.9. (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) A 15KW, 440V, 50Hz, 3 phase induction motor is built with a stator bore 0.25 m and a Core Length of 0.16. The specific electric loading is 23000 ampere conductors per meter. Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for a 11KW, 460V, 6 Pole, 50 Hz motor. Assume: a full load efficiency of 84% and power factor of 0.82 for each machine. The winding factor is 0.955. (16)

15. a) Find the main dimensions of 100MVA, 11KV, 50Hz, 150rpm, 3 phase water wheel generator. The average gap density is 0.6Wb/m^2 and the ampere conductors per meter are 40,000. The Peripheral speed should not exceed 65 m/s at normal running speed in order to limit the Run-away peripheral speed. (16)

(OR)

- b) Determine the output coefficient for a 1500KVA, 2200Volts, 3 phase, 10pole, 50Hz, star connected alternator with sinusoidal flux distribution. The winding has 60° phase spread and full pitch coils. $\text{ac} = 30000\text{amps.conductor/m}$, $B_{\text{av}} = 0.6\text{Wb/m}^2$. If the peripheral speed of the rotor must not exceed 100 m/sec and the ratio of 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)