

Duration – 3 Hours

Marks – 80

- Note:- (1) Question No.1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Assume suitable data if necessary and justify the same.

- Q 1** Answer the following questions. **20M**
- a)** What are the major considerations in machine design? **5M**
 - b)** Write a short note on Short Circuit Ratio (SCR). What is the effect of SCR on machine performance **5M**
 - c)** Write assumptions made in calculation of leakage reactance present in transformer. **5M**
 - d)** What is a need for CAD (Computer Aided Design)? **5M**
- Q 2 (a)** Derive the output equation for 3 phase Induction motor and specify the various terms used. **10M**
- Q 2 (b)** Find the main dimensions of a 15 Kw, 3 phase, 400 V, 50Hz, 2850 rpm squirrel cage IM having a efficiency of 0.88 and a full load power factor of 0.9. Assume specific magnetic loading = 0.5 Wb/m^2 , specific electric loading = 25000 A/m . Take rotor peripheral speed as approximately 20m/s at synchronous speed. **10M**
- Q 3 (a)** Derive the output equation of 1 phase & 3 phase transformer. **10M**
- Q 3 (b)** Determine the main dimensions for core and yoke for a 5 KVA, 50 Hz, single phase core type transformer. A rectangular core is used with long side twice as long as short side. The window height is 3 times the width. Voltage per turn is 1.8 V, space factor = 0.2, current density = 1.8 A/mm^2 , flux density = 1 Wb/m^2 . **10M**
- Q 4 (a)** Define dispersion coefficient? Explain effect of dispersion coefficient on (i) Maximum power factor ii) Overload capacity **10M**
- Q 4 (b)** Determine the main dimensions for a 1000 KVA, 50Hz, 3 phase alternator to run at 375 rpm. Take average flux density is 0.55 Wb/m^2 and ampere conductors per meter are 28000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which the maximum permissible peripheral speed is 50m/s. The runaway speed is 1.8 times the synchronous speed. **10M**
- Q 5 (a)** Write a short note on design of field winding of synchronous machine. **10M**
- Q 5 (b)** Estimate the diameter, core length, size and no. of conductors, no. of slots for stator of a 15 MVA, 11 KVA, 50 Hz, 2 pole star connected turbo alternator with 60° phase spread. Assume $B_{av} = 0.55 \text{ Wb/m}^2$, $a_c = 36000 \text{ A/m}$, current density = 5 A/mm^2 , peripheral speed = 160m/s. The winding should be arranged to eliminate 5th harmonic. **10M**
- Q 6** Write a short note on following (any two)
- a)** Methods for cooling of transformer **10M**
 - b)** Analysis method of computer aided design. **10M**
 - c)** Design of EV grade Induction motor. **10M**
