

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.

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| 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 =25000A/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 ^o phase spread. Assume $B_{av} = 0.55$ Wb/m ² , $a_c = 36000$ A/m, current density= 5 A/mm ² , peripheral speed= 160m/s. The winding should be arranged to eliminate 5 th 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 |
