

Duration – 3 Hours

Total Marks – 80

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

- Q 1.** Answer the following questions. **20**
- a) Define the term total magnetic loading, total electric loading, specific magnetic loading and specific electric loading.
 - b) Explain effect of short circuit ration on performance of synchronous machine.
 - c) What are the desired properties of conducting materials and insulating materials used in electric machines?
 - d) Explain the need for CAD analysis
- Q 2 a)** Derive output equation of single-phase transformer and specify the various terms used. **10**
- Q 2 b)** Calculate approximate overall dimensions for a 200 kVA, 6600/440V, 50Hz, three phase core type transformer. The following data may be assumed: Emf per turn = 10V, maximum flux density = 1.3 Wb/m^2 , current density = 2.5 A/mm^2 , window space factor = 0.3, overall height = overall width, stacking factor = 0.9. Use a 3 stepped core. For 3 stepped core width of largest stamping = $0.9d$, and net iron area = $0.6d^2$ where d is diameter of circumscribing circle. **10**
- Q 3 a)** Derive the output equation for a three-phase induction motor and specify the various terms used. **10**
- Q 3 b)** Determine the main dimensions and number of turns per phase of a 3.7 kW, 400V, three phase 50Hz, squirrel cage induction motor to be started by star delta starter. Assume following data: Average flux density in the gap = 0.45 Wb/m^2 , ampere conductors per meter = 23000, efficiency = 85%, power factor = 0.84, winding factor = 0.955, stacking factor = 0.9, ratio of core length to pole pitch is 1.5. **10**
- Q 4 a)** Define dispersion coefficient? Explain effect of dispersion coefficient on i) Maximum power factor ii) Overload capacity **10**
- Q 4 b)** Explain different cooling methods of transformer. **10**
- Q 5 a)** Write a short note on design of field winding of synchronous machines. **10**
- Q 5 b)** Determine the main dimensions, flux per pole and turns per phase of a 75000 KVA, 13.8 KV, 50 Hz, 62.5 rpm, 3 phase, star connected alternator. The peripheral speed should be about 40 m/s. Assume average gap density= 0.65 Wb/m^2 , ampere conductors per meter= 40000 and current density= 4 A/mm^2 **10**
- Q 6 a)** Write a short note on design of EV grade induction motor. **10**
- Q 6 b)** With a flowchart explain synthesis method of computer aided machine design. **10**
