

**Time: 3 Hours**

**Total Marks: 80**

**N.B. 1) Question No. 1 is compulsory**

**2) Attempt any three from the remaining Questions No. 2 to No. 6.**

**3) Illustrate answers with diagrams wherever necessary.**

**4) Assumption made should be clearly stated.**

- Q 1. Solve any four**
- a) Why is a rotating field system used in preference to a stationary field? **05**
  - b) Explain the term unsaturated synchronous reactance. **05**
  - c) Explain the condition for parallel operation of alternator. **05**
  - d) Explain the working principle of synchronous motor. **05**
  - e) Write note on: Steady state analysis of synchronous machine. **05**
- Q 2.**
- a) What is armature reaction? Explain the effect of armature reaction on the terminal voltage of alternator at unity, lagging and leading power factor. **10**
  - b) A 3-phase star connected alternator is rated at 1600 KVA, 13500 V. The armature effective resistance and synchronous reactance are 1.5 ohms and 30 Ohms respectively per phase. Calculate the percentage voltage regulation for a load of 1280 KW at a power factor of (a) 0.8 leading (b) 0.8 lagging. **10**
- Q 3.**
- a) Explain the effect of varying excitation on armature current and power factor in a synchronous motor. **10**
  - b) Two station generators A and B operates in parallel. Station capacity of A is 50 MW and that of B is 100 MW. Full-load speed regulation of both station is 4%. Calculate the load sharing if the connected load is 100 MW. No-load frequency is 50 Hz. **10**
- Q 4.**
- a) Draw equivalent circuit and phasor diagram of a cylindrical rotor synchronous motor. **10**
  - b) Explain the significance of synchronising power and derive the equation of synchronising power and synchronising torque. **10**
- Q 5.**
- a) Explain Blondel's two reaction theory. **10**
  - b) Explain the application of synchronous motor. Compare synchronous motor and induction motor. **10**
- Q 6.** Solve any two. **20**
- a) Explain the functions of damper winding in a synchronous motor.
  - b) Explain the characteristics of infinite bus bar.
  - c) Derive the basic machine relation in dq0 Variables.