

TE sem IV scheme summer 2025

(3 Hours)

[Total Marks: 80]

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

3/6/25

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

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3) Illustrate answers with diagrams wherever necessary.

4) Assumptions made should be clearly stated.

- Q 1. Solve any four**
- Why is rotating field system used in preference to a stationary field? **05**
  - Define voltage regulation. List out different methods to calculate voltage regulation. **05**
  - State the conditions necessary for paralleling alternators. **05**
  - Write a note on Steady-state analysis of synchronous machines. **05**
  - Explain the principle of operation of a 3-phase synchronous motor. **05**
- Q 2.**
- Explain the phenomena of armature reaction when an alternator is delivering a load current at a) purely lagging pf b) unity pf c) purely leading pf. **10**
  - Explain how open circuit and short circuit test are conducted on a synchronous machine. What is an air gap line? **10**
- Q 3.**
- State the applications of synchronous motors. Compare synchronous motor with three phase induction motor. **10**
  - Two station generators A and B operate in parallel. Station capacity of A is 50 MW and that of B is 100 MW. The full-load speed regulation of station A and station B is 4 %. Calculate the load sharing if the connected load is 100 MW. The no-load frequency is 50 Hz. **10**
- Q 4.**
- Explain the effect of varying excitation on armature current and power factor in a synchronous motor. Draw V-curves and state their significance. **10**
  - Draw equivalent circuit and phasor diagrams for different loads of a cylindrical rotor synchronous motor. **10**
- Q 5.**
- Explain Blondel's two-reaction theory of salient-pole synchronous machines. **10**
  - A 1500 KVA, Star connected, 2300 V, 3 phase, Salient pole synchronous generator has reactances  $X_d = 1.95$  Ohms and  $X_q = 1.40$  ohms per phase. All losses may neglected. Find the excitation voltage for operation at rated KVA and power factor of 0.85 lagging. **10**
- Q 6. Solve any two.** **20**
- Derive the basic machine relation in dq0 Variables.
  - Explain two important function served by damper winding in a synchronous machines.
  - What is an infinite bus? State the characteristics of an infinite bus.

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