

Duration: 3 Hours

Total Marks: 80

- Note: 1. **Q. 1** is **compulsory**.
 2. Solve any **3** questions out of remaining questions.
 3. Assume suitable data if necessary.

Q1) Solve any four [20]

- Explain mathematical representation of terminal voltage transducer and load component in excitation system.
- Explain basic assumption made for synchronous machine modeling
- Explain the need for modeling of power system.
- Draw and explain SVC control characteristics.
- In transformer modeling what is initial off nominal turn ratio

Q2) [20]

- A 555MVA, 24KV, 0.9pf, 60HZ, 3 phase, 2 pole synchronous generator has the following inductances associated with stator and field windings

$$l_{aa} = 3.2758 + 0.0458 \cos(2\theta) \text{ mH}$$

$$l_{ab} = -1.6379 - 0.0458 \cos(2\theta + \pi/3) \text{ mH}$$

$$l_{afd} = 40 \cos\theta \text{ mH}$$

$$l_{ffd} = 576.92 \text{ mH}$$

$$R_a = 0.0031 \Omega$$

$$R_{fd} = 0.0715 \Omega$$

Determine L_d and L_q in henrys.

If the stator leakage inductance L_l is 0.4129 mH, determine L_{ad} and L_{aq} in henrys

Using the machine rated values as the base values for stator quantities, determine the per unit values of the following in the L_{ad} base reciprocal per unit system

$$L_l, L_{ad}, L_{aq}, L_d, L_q, L_{afd}, L_{ffd}, L_{fd}, R_a, R_{fd}.$$

- Draw and Explain functional block diagram of a synchronous generator excitation control and explain each of them.

Q3) [20]

- Explain the tandem compound single reheat and cross component single reheat steam turbine system with its model.
- State the basic assumptions made in transmission line modeling. Explain phase variable transformation to D-Q component in transmission line.

[TURN OVER]

Q4) [20]

- a. Analyze the transient phenomena with the help of 3 phase current waveforms when a bolted 3-phase short circuit fault is suddenly applied at the terminals of a synchronous machine.
- b. Explain representation of equivalent circuit of phase shift transformer and develop matrix relating the phase-shifter terminal voltage and currents.

Q5) [20]

- a. Explain modeling of separately excited dc exciter also represents it in block diagram of dc exciter.
- b. Explain dq0 transformation in synchronous machine also state physical interpretation of dq0 transformation.

Q6) [20]

- a. Explain static load modeling by considering polynomial and exponential representation
- b. Explain types of SVC and controllers and explain variable impedance type and variable source type SVCs.
