

TIME: 2 HOURS

Max. Marks: 40

- 1 (a) A 3-phase SVC is connected to an 11 kV bus. The each phase of the Delta connected 3-phase unit of the thyristor switched capacitor (TSC) comprises of 1000 μF capacitor in series with 1.0 mH inductance. The inductance of the Delta connected TCR unit is 5.0 mH per phase. Compute the reactive power supplied by the SVC if the conduction angle σ of the TCR is 90° . The formula for computing susceptance of the TCR is as follows:

$$B(\sigma) = \frac{\sigma - \sin \sigma}{\pi X_L}, \quad \text{Assume } f = 50 \text{ Hz}$$

where X_L is the TCR reactance/phase for $\sigma = 180^\circ$.
(5)

- (b) A generating plant feeds a load of 1050 MW at 50 Hz. The load varies by 1.5% for a 1% change in frequency. Compute the required value of H so that the initial rate of change of frequency is 0.25 Hz/sec following a sudden drop in load by 50 MW. Also compute the steady state value of new frequency if the speed regulation parameter $R = 2.5 \text{ Hz/pu MW}$. The base MVA = 2000. There is no supplementary controller.
(5)

- 2 (a) What are the main requirements of AGC in a multi-area power system?
(2)

- (b) Draw a transfer function block diagram of a two area power system including supplementary

control action in both the areas. Explain the operation of the system following the tripping of the tie-line connecting the two areas. Assume that there is no change in the setting of interchange schedules.

(5)

- (c) Explain a step-by-step procedure for optimizing the integral gain setting of the supplementary controller for a single area system considering ISE technique.

(2)

- 3 (a) Explain with the help of a neat block diagram the interfacing of HV switchyard (i.e. substation process) with IEDs. How are these IEDs interconnected to the Network control centre.

(5)

- (b) What is the main advantage of IEC 61850 standard for substation automation?

(2)

- (c) In a substation automation system Data integrity is classified as High, Medium and Low. Name the Data which belong to each of the three categories.

(3)

4. (a) What are the main excitation control and protection functions? Explain with the help of a block diagram.

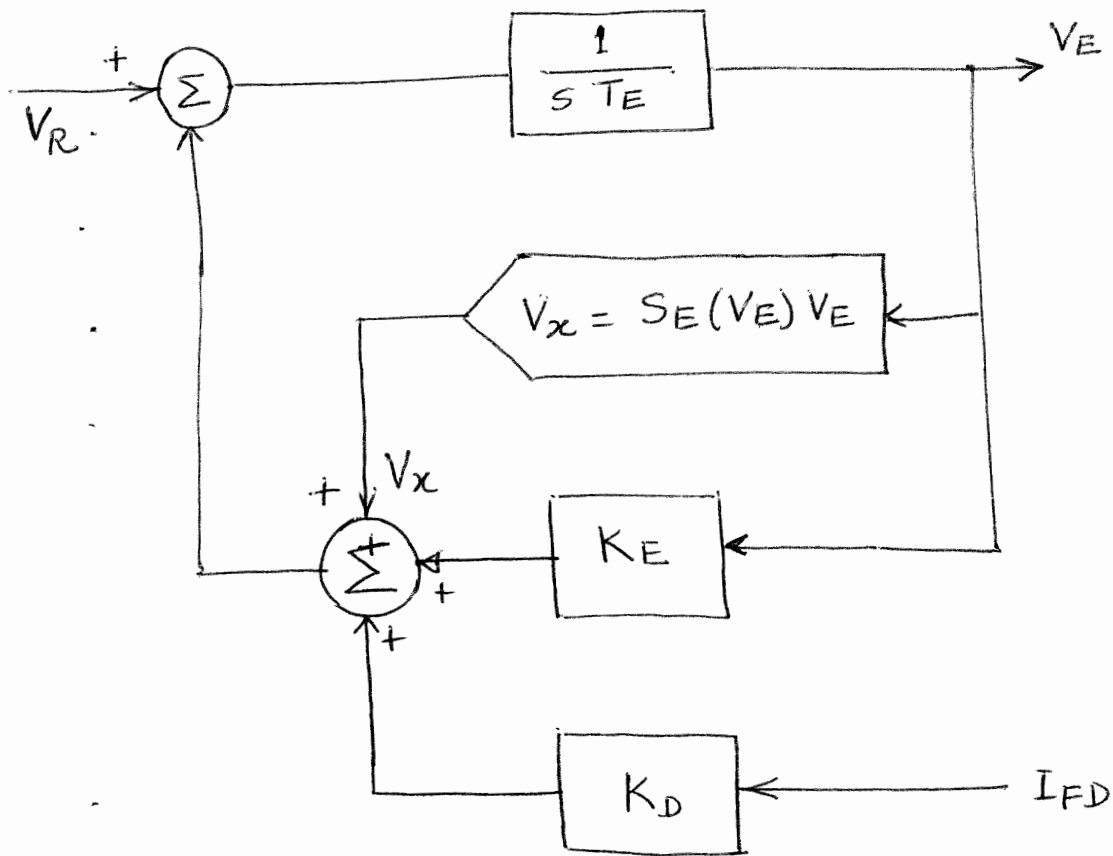
(5)

- (b) A block diagram of an AC excitation system is given below. Explain the procedure for computing the saturation function S_E . What does the negative feedback term $K_D I_{FD}$ stands for?

Does this block diagram includes the voltage

Question 4 (b)

(3)



V_E = No load voltage.
 V_R = Regulator output

Block diagram of an AC Exciter