

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006

Seventh Semester

Electrical and Electronics Engineering

EE 431 — POWER SYSTEM CONTROL

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

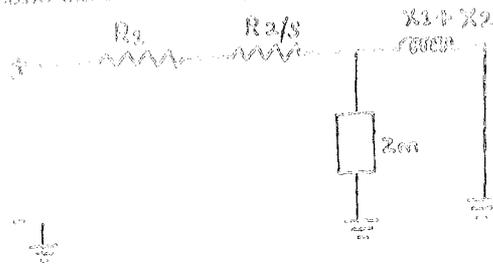
PART A — (10 × 2 = 20 marks)

1. What is the necessity of frequency regulation in power systems?
2. State about real-time control of power systems.
3. Write the tie-line power deviation equation in terms of frequency.
4. Define control area.
5. Name the methods of voltage control in network.
6. Specify the location and nature of tap changing transformers.
7. Mention four types of SCADA systems and its application area.
8. Denote the hierarchical levels used in EMS.
9. Define incremental efficiency.
10. List the various constraints in the modern power systems.

PART B — (5 × 16 = 80 marks)

11. (i) For all the generators and motors in a power system represent a total kinetic energy of 1500 MJ (mw) as measured at rated frequency of 60 HZ. The system experiences a momentary power surplus at 5 MW. At what rate will frequency increase? (8)

- (ii) A 480 V, three phase induction motor power is 10000 W. The motor is assumed speed independent. The motor runs at an initial speed corresponding to a per-unit slip of  $s = 0.03$ . How will the motor load change if the voltage drops by 1%? We shall assume that we operate, as typically the case on the linear portion of the curve. (8)



$$R1 = 0.290 \text{ } \Omega/\text{phase}$$

$$X1 = 0.500 \text{ } \Omega/\text{phase}$$

$$R2 = 0.150 \text{ } \Omega/\text{phase}$$

$$X2 = 0.200 \text{ } \Omega/\text{phase}$$

12. (a) Briefly discuss the LFC control of single area systems. (16)

Or

- (b) (i) Determine the primary ALFC loop parameters for a control area having the following data :

Total rated area capacity,  $P_r = 2000 \text{ mW}$

Normal operating load,  $P_d = 1000 \text{ mW}$

Inertia constant  $H = 5.0$

Regulation  $R = 2.40 \text{ Hz/pu mW}$  (all area generators)

We shall assume that the load frequency dependency is linear meaning that the old load would increase 1% for 1% frequency increase. (8)

- (ii) Explain the dynamic response of two area system. (8)

13. (a) (i) Explain about the static performance of the AVR loop. (8)
- (ii) Discuss about the various methods of voltage control. (8)

Or

- (b) (i) What are Synchronous condenser, Shunt capacitor, Shunt reactors and Series capacitors? (8)
- (ii) Explain about the stability compensation of AVR loop. (8)

14. (a) (i) Explain the different system operating states. (3)  
(ii) Discuss about automatic substation control using SCADA. (3)

Or

- (b) (i) What are the different functions of SCADA system? (3)  
(ii) Explain about SCADA configurations. (3)

15. (a) Draw the flow chart for co-ordination equation with loss and explain. (16)

Or

- (b) A two bus system is shown in figure. If a load of 125 MW is transmitted from plant 1 to the load, a loss of 15.625 MW is incurred. Determine the generation schedule and the load demand if the cost of received power is Rs. 24 M Whr. Solve the problem using co-ordination equation and the penalty factor method approach. The incremental production costs of the plants are (16)

$$dF_1/dP_1 = 0.025P_1 + 15$$

$$dF_2/dP_2 = 0.05P_2 + 20$$

