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V 4169

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Seventh Semester

Electrical and Electronics Engineering

EE 1401 — POWER SYSTEM OPERATION AND CONTROL

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the advantages of pool operation with respect to LFC?

2. What is base Load?

3. Why the frequency and voltage to be regulated in a power system?

4. Compare the functions of "Speed Governor" and "Speed Changer" in a speed governing system of a turbine-generator set.

5. What are the various functions of excitation system?

6. What is the need for a compensator in the AVR loop?

7. What is participation factor with respect to economic load dispatch?

8. Mention the assumptions made in the formation of loss formula matrix, B.

9. What are the major functions that are carried out in an operations control center?

10. What do you understand by security constraints?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the following terms :

Installed reserve, Spinning reserve, cold reserve and hot reserve. (8)

(ii) A power station has to meet the following demand

Group A : 200 kW between 8 A.M. and 6 P.M.

Group B : 100 kW between 6 A.M. and 10 A.M.

Group C : 50 kW between 6 A.M. and 10 A.M.

Group D : 100 kW between 10 A.M. and 6 P.M. and then between 6 P.M. and 6 A.M.

Plot the daily Load curve and determine diversity factor, units generated per day and load factor. (8)

Or

(b) (i) Discuss about the recent trends in real time control of power systems. (8)

(ii) Write short note on Load Forecasting. (8)

12. (a) Derive the transfer function model and draw the block diagram for a single control area provided with governor system. From the transfer function derive the expression for steady state frequency error for a step load change. (16)

Or

(b) Two synchronous machines with the following data are operating in parallel to feed a common load of 300 MW.

Machine 1 : Governor speed droop : 4%

Speed changer set to give 75% rated load at rated speed.

Machine 2 : Governor speed droop : 3%

Speed changer set to give 50% rated load at rated speed. The nominal frequency of operation of the set is 50 Hz.

(i) Determine the load taken by each machine and the frequency of operation. (12)

(ii) What adjustment should be made for the machines to share the loads as in (i) but with a frequency of 50 Hz? (4)

13. (a) Draw the circuit diagram for a typical excitation system and derive the transfer function model and draw the block diagram. Discuss the stability aspects of the AVR. (16)

Or

(b) A three-phase overhead line has resistance and reactance of 5 and 20 ohms, respectively. The load at the receiving end is 30 MW, 0.85 power factor lagging at 33 kV. Find the voltage at the sending end. What will be the kVAR rating of the compensating equipment inserted at the receiving end so as to maintain a voltage of 33 kV at each end? Find also the maximum load that can be transmitted. (16)

14. (a) The fuel-cost functions for three thermal plants in \$/h are given by

$$F_1 = 0.004\ P^2_{g1} + 5.3\ P_{g1} + 500$$

$$F_2 = 0.006\ P^2_{g2} + 5.5\ P_{g2} + 400$$

$$F_3 = 0.009\ P^2_{g3} + 5.8\ P_{g3} + 200$$

Where P_{g1}, P_{g2} and P_{g3} are in MW.

Find the optimal dispatch and the total cost when the total load is 975 MW with the following generator limits :

$$100 \text{ MW} \leq P_{g1} \leq 450 \text{ MW}$$

$$100 \text{ MW} \leq P_{g2} \leq 350 \text{ MW}$$

$$100 \text{ MW} \leq P_{g3} \leq 225 \text{ MW}$$ (16)

Or

(b) (i) What is a unit commitment problem? Discuss the constraints that are to be accounted in unit commitment problem. (6)

(ii) Explain priority list method of solving unit commitment problem. State merits and limitations of this method. (10)

15. (a) (i) What is EMS? What are its major functions in power system operation and control? (6)

(ii) Draw a block diagram to show the hardware components of a SCADA system for a power system and explain the application of SCADA in monitoring and control of power system. (10)

Or

(b) Draw a state transition diagram of a power system showing different sets of operating states classified according to security level. Mark on the diagram and explain the state transitions that may occur due to system disturbances and also the different control actions that can be taken to improve the security level of the system. (16)
