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Question Paper Code : 40500

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh Semester

Electrical and Electronics Engineering

EE 8702 – POWER SYSTEM OPERATION AND CONTROL

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out the requirements of a good power system.

2. What is the need for voltage and frequency regulation in power system?

3. What is the function of Load Frequency Control?

4. Define area control error.

5. List the various components in AVR loop.

6. Distinguish between on-load and off-load tap changing.

7. Compare unit commitment and economic dispatch.

8. What is meant by incremental cost curve?

9. Write the principle of operation of PMU.

10. What are the functions of EMS?

PART B — (5 × 13 = 65 marks)

11. (a) What are the components of speed governor system of an alternator? Derive a transfer function and sketch block diagram.

Or

(b) Draw and explain the basic P-f (real power Vs. frequency) and Q-V (reactive power Vs. voltage) control loops.

12. (a) Draw the transfer function block diagram for a two area system provided with governor control and obtain the steady state frequency error following a step road change in both the areas.

Or

(b) The data pertaining to a single area power system with linear load frequency characteristic are as follows. Rated Capacity = 2000 MW. System Load = 1000 MW Inertia Constant = 5 sec, Speed regulation = 0.03 pu, Load damping factor = 1 pu, Normal Frequency = 50Hz. Governor Time constant a sec and Turbine time constant = 0 sec. For a sudden change in load of 20 MW, determine the steady state frequency deviation and the change in generation in MW and reduction in original load in MW.

13. (a) Explain the following methods of voltage control. (i) Tap changing transformers and (ii) Shunt and Series capacitors. (6+7)

Or

(b) (i) Explain why reactive power management and control is critical for overall system stability. Write about the various Reactive power sources and sinks

(ii) Explain the Voltage Collapse phenomenon. (8+5)

14. (a) Formulate the Forward Dynamic Programming method of solving unit commitment problem with neat flaw chart.

Or

(b) The fuel inputs per hour of plants 1 and 2 are given as

$F_1 = 0.2\ P_1^2 - 40P_1 + 120 Rs/hr.$

$F_2 = 0.25\ P_2^2 - 30P_2 + 150 Rs/hr.$

Calculate the economic operating schedule and the corresponding cost of generation. The maximum and the minimum loading on each unit are 100MW and 25MW. Assume the transmission losses are ignored and the total demands 180MW.

15. (a) Draw the block diagram to show the hardware configuration of a SCADA system and explain the application of SCADA in monitoring and control of power system.

Or

(b) Draw and explain the state transition diagram of a power system showing different sets of operating states classified according to security level.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain the Weighted Least Square method of state estimation.

(ii) Discuss the detection and identification of bad measurements in power system state estimation. (8+7)

Or

(b) A power station has to meet the following load demands: Load a : 50kW between 10am to 6pm Load b : 30kW between 6pm to 10pm Load c : 20kW between 4pm to 10am. Plot the daily load curve and load duration curve and evaluate (i) diversity factor, (ii) units generated per day and (iii) load factor. (15)

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