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Question Paper Code : 10588

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

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 — ($10 \times 2 = 20$ marks)

1. What are the major control loops used in large generators?
2. Define load factor.
3. Distinguish between primary and secondary feedback loops in frequency control.
4. Define a control error.
5. State the advantages of switched capacitors in voltage control.
6. Define uncompensated transmission lines.
7. State the condition for the optimal power dispatch in a lossless system.
8. List the few constraints that are accounted in unit commitment problem.
9. What are the advantages of computer control?
10. What is meant by PMU?

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Explain the operations of the components of a speed governor system of an alternator. (7)
(ii) Derive the mathematical model of a speed governor system with aid of block diagram. (6)
- Or
- (b) Draw the load curve and load duration curve and also explain the importance of these curves in connection with economic operation of a power system.

12. (a) Explain with the transfer function block diagram for a single area system provided with static analysis of uncontrolled case and controlled case.

Or

- (b) Estimate the primary ALFC loop parameters for a control area : Total rated capacity $P_r = 2000$ MW.

Normal operating load $P_d = 1000$ MW

Inertia constant $H = 5.0$

Regulation $R = 2.40$ Hz/pu MW (all area generators)

We shall assume that the load frequency dependency as linear meaning that the old load would increase 1% for 1% frequency increase. Having the following data.

13. (a) Examine the circuit for a typical excitation system and derive the transfer function model and draw the block diagram.

Or

- (b) Explain in detail, the stability compensation and effects of generator loading with necessary diagrams and expressions.

14. (a) The fuel inputs per hour of plants 1 and 2 are given as

$$F_1 = 0.2P_1^2 + 40P_1 + 120 \text{ Rs/hr}$$

$$F_2 = 0.25P_2^2 + 30P_2 + 150 \text{ Rs/hr}$$

- (i) Calculate the economic operating schedule and the corresponding cost of generation. The maximum and the minimum loading on each unit are 100 MW and 25 MW. (8)
- (ii) Assume the transmission losses are ignored and the total demand is 180MW, determine the saving obtained if the load is equally shared by both the units. (5)

Or

- (b) The input output curve characteristics of three units are

$$F_1 = 750 + 6.49 P_{g1} + 0.0035 P_{g1}^2$$

$$F_2 = 870 + 5.75 P_{g2} + 0.0015 P_{g2}^2$$

$$F_3 = 620 + 8.56 P_{g3} + 0.001 P_{g3}^2$$

The fuel cost of unit 1 is 1.0 Rs/MBtu, 1.0 Rs/MBtu for unit 2 and 1.0 Rs/MBtu for unit 3 of total load is 800 MW. Use the participation factor method to estimate the dispatch for a load being increased to 880 MW.

15. (a) What is EMS? Explain in detail major functions of EMS in power system operation and control with illustrations. (13)

Or

- (b) (i) Discuss various functions of SCADA with neat diagram. (9)
(ii) List some of the common features and applications. (4)

PART C — ($1 \times 15 = 15$ marks)

16. (a) A generating station has the following daily loads

0-6 hrs = 5000 kw; 6-8 hrs = 4500 kw;

8-12 hrs = 9000 kw; 12-14 hrs = 2500 kw;

14-18 hrs = 8500 kw; 18-20 hrs = 3000 kw;

20-24 hrs = 5500 kw;

Sketch load duration curve and formulate load factor and plant capacity factor, if the capacity of plant is 15 MW.

Or

- (b) Find the rating of synchronous compensator connected to the tertiary winding of 60 kV star connected, 33kV star connected, 11 kv delta connected three winding transformer to supply a load of 60 MW at 0.8 pf lagging at 33 kV across the secondary. Equivalent primary and tertiary winding reactances are 18Ω and 0.12Ω respectively. While the secondary winding reactance is negligible. Assume that V1 is 66 kV and maximum off nominal setting between transformer primary and secondary is 1:1:1.
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