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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Sixth Semester

Electrical and Electronics Engineering

EE 6603 — POWER SYSTEM OPERATION AND CONTROL

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the need for frequency regulation in power system?

2. Define load duration curve.

3. Define control area.

4. Specify the use of static and dynamic response of the ALFC.

5. What are the various functions of an excitation system?

6. Mention the purposes of series compensation.

7. Write the coordination equation taking the effect of transmission losses.

8. Write about the term incremental operating cost of a power system.

9. What are the functions of SCADA?

10. What are the major functions that are carried out in an operational control centre?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A generating station has the following daily loads :

            0-6 hrs 4500 kW; 6-8 hrs 3500 kW; 8-12 hrs 7500 kW; 12-14 hrs 2000 kW;

            14-18 hrs 8000 kW; 18-20 hrs 2500 kW; 20-24 hrs 5000 kW
            Sketch the load duration curve and determine the load factor and plant capacity factor, if the capacity of the plant is 12 MW.   (8)

        (ii) Discuss the importance of load forecasting with a suitable example. (8)

Or

    (b) (i) Peak demand of a generating station is 90 MW. The load factor and the plant capacity factor are 0.6 and 0.5 respectively. Determine

            (1) daily energy produced

            (2) installed capacity

            (3) reserve capacity and

            (4) utilization factor.   (10)

        (ii) What is the significance of load factor and diversity factor?   (6)

12. (a) (i) Derive the block diagram of state variable model for ALFC. (8)
       (ii) A power system has a total load of 1250 MW at 50 Hz. The load varies 1.5% for every 1% change in frequency. Find the steady-state frequency deviation when a 50 MW load is suddenly tripped, if
           (1) There is no speed control;
           (2) The system has 250 MW of spinning reserve evenly spread among 500 MW of generating capacity with 5% regulation based on this capacity. Assume that the effect of governor dead bands is such that only 80% of the governor respond to the reduction in system Load. (8)

Or

   (b) 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 change.(16)

13. (a) The load at the receiving end of a three-phase overhead line is 25 MW at 0.8 power factor lagging at a line voltage of 33 kV. The line has a resistance 5 ohm per phase and an inductive reactance at 20 ohm per phase. Calculate the sending end voltage. A synchronous compensator is connected at the receiving end and the voltage at both end of the line is maintained at 33 kV. Calculate
       (i) the MVAR of the compensator
       (ii) transmission losses and efficiency with and without compensator and
       (iii) the maximum load that can be transmitted with the compensator. (16)

Or

   (b) Derive the complete block diagram representation of AVR. Perform the static and dynamic analysis of the AVR. (16)

14. (a) A two bus systems shown in Fig. 14 (a). If 100 MW is transmitted from plant 1 to the load, a transmission loss of 10 MW is incurred. Find the required generation for each plant and power received by load when the system incremental cost is Rs. 25 MW-hr. The cost equations of the two plants are given below. (16)
       $F_1 = 0.01 P_1^2 + 16P_1 + 180$ Rs/hr $F_2 = 0.02P_2^2 + 20P_2 + 160$ Rs/hr.

Fig. 14 (a) Two Unit.system

Or

   (b) (i) Explain with a neat flow chart the lambda iteration method for solving the economic dispatch problem without loss. (8)
       (ii) What are the constraints in solving the unit commitment problem? (8)

15. (a) Explain with state transition diagram, the different state of the power system and the various control actions taken under every state to maintain or bring back the system to normal operating mode. (16)

Or

   (b) Explain briefly the typical functions of the ECC. What are the main functions common to all SCADA system and the main tasks of control centre at different levels? (16)