Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (EDPS)/SEM-1/EDPM-105(A)/2010-11

2010-11

POWER SYSTEM OPERATION & CONTROL

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. a) What is the objective in economic scheduling ? 2

   b) Explain the various factors to be considered in allocating generation to different power stations for optimal operation. 4

   c) Explain how incremental production cost of a thermal power station can be determined. 8

2. A power system consists of three generator units. Data regarding those generator units are as follows :

   Unit 1 :

   Coal-fired steam unit : Max. output = 600 MW

   Min. output = 150 MW

   Input-Output Curve :

   $$H_1\left(\frac{Rs}{h}\right) = 510 \cdot 0 + 7 \cdot 2\, P_1 + 0 \cdot 00142\, P_1^2$$

   Fuel cost = Rs.1·1/h.

Unit 2 :

Oil-fired steam unit : Max. output = 400 MW

Min. output = 100 MW

Input-Output curve :

$$H_2\left(\frac{Rs}{h}\right) = 310 \cdot 0 + 7 \cdot 85\ P_2 + 0 \cdot 00194\ P_2^2$$

Fuel cost = Re. 1·0/h.

Unit 3 :

Oil-fired steam unit : Max. output = 200 MW

Min. output = 50 MW

Input-Output curve :

$$H_3\left(\frac{Rs}{h}\right) = 78 \cdot 0 + 7 \cdot 97\ P_3 + 0 \cdot 00482\ P_3^2$$

Fuel cost = Re. 1·0/h.

Determine the economic operating point for these three units when delivering a total of 850 MW.

3. a) The incremental fuel cost for the two plants are given by

$$\frac{df_1}{dP_1} = 0 \cdot 2P_1 + 45$$

$$\frac{df_2}{dP_2} = 0 \cdot 25P_2 + 35.,$$

where f is in Rs./h and P is in MW. If both units operate at all times, maximum and minimum loads on each are 100 MW and 20 MW respectively. Determine the economic load schedule of the plants for the loads of 80 MW and 180 MW. Neglect the line losses. 10

b) Write a short note on economic dispatch versus unit commitment. 4

4. Give algorithm for economic allocation of generation among generators of a thermal system taking into account transmission losses. Give steps for implementing this algorithm and also derive necessary equations.

5. a) Give the computational procedure for optimal power flow solution using Linear Programming Method. 9

b) Discuss the lambda-iteration method for economic dispatch problems. 5

6. a) Draw a neat sketch of Speed Governing System for primary ALFC loop to control MW output of the generators and explain the logic of operation. 4

   b) Draw a neat sketch of primary ALFC loop for an isolated system with one number of generator only and derive the expression for the time constant of the power system $G_p(s) = k_p / (1 + sT_p)$, where the notations have their usual meanings. 5

   c) A 300 MW unit with 0·03 p.u. turbine regulation operates in parallel with a 600 MW unit of identical turbine regulation. For a specific amount of power demand increase, find the ratio of sharing of the load by the units. System frequency is 50 Hz. 5

7. a) Draw a neat sketch of complete block diagram of a two-area control system for automatic load frequency control. 8

   b) Deduce static response of ALFC loop for two-area system. 6

8. a) Define the following :

      i) Generator shift factors 2

      ii) Line outage distribution factors. 2

   b) Write an algorithm for contingency analysis using sensitivity factors. 10