**R16**

**Code No: 137FX**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech IV Year I Semester Examinations, July/August - 2023**

**POWER SYSTEM OPERATION AND CONTROL**

**(Electrical and Electronics Engineering)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

## PART – A

**(25 Marks)**

1.a) What is area control error? [2]

b) Explain how governor drooping is related to load sharing between two parallel operating generators? [3]

c) List out all the power system elements which can either generate or absorb reactive power. [2]

d) Distinguish between line and load compensation. [3]

e) Explain the physical concept of penalty factor. [2]

f) What is Incremental fuel cost? Explain with a neat graph. [3]

g) What is Spinning Reserve? [2]

h) Distinguish between cold and hot startup cost. [3]

i) List the important routines of EMS. [2]

j) What is Load Forecasting? [3]

## PART – B

**(50 Marks)**

2.a) Develop the block diagram of the LFC of a single-area system.

b) A 250-MVA synchronous generator is operating at 1,500 rpm, 50 Hz. A load of 50 MW is suddenly applied to the machine and the station valve to the turbine opens only after 0.35 s due to the time lag in the generator action. Calculate the frequency at which the generated voltage drops before the steam flow commences to increase to meet the new load. Given that the valve of $H$ of the generator is 3.5 kW-s per kVA of the generator energy. [5+5]

**OR**

3.a) What do you mean by LFC? Why it is necessary to maintain the frequency of the system constant?

b) For two-area load frequency control with integral controller blocks, derive an expression for steady values of change in frequency and tie line power for simultaneously applied unit step load disturbance inputs in the two areas. [4+6]

4.a) Explain the concepts of generator voltage control through excitation with the help of neat diagram.

b) Briefly discuss about various types of excitation system used for generators. Mention their characteristics features, advantages and disadvantages. [5+5]

**OR**

5. Explain different methods of voltage control in power systems. [10]

6. The cost curves of the three plants are given as follows:

$$C_1 = 0.04\,P^2_{G1} + 20\,P_{G1} + 230 \text{ Rs./hr}$$
$$C_2 = 0.06\,P^2_{G2} + 18\,P_{G2} + 200 \text{ Rs./hr}$$
$$C_3 = 0.05\,P^2_{G3} + 15\,P_{G3} + 180 \text{ Rs./hr}$$

Determine the optimum sharing of a total load of 280 MW. The limits on minimum and maximum loading on each generator are [10]

| | Minimum Loading | Maximum Loading |
|---|---|---|
| $P_{G1}$ | 30MW | 150MW |
| $P_{G2}$ | 50MW | 125MW |
| $P_{G3}$ | 40MW | 175MW |

**OR**

7.a) Derive the necessary and sufficient conditions for economic load scheduling considering transmission losses.

b) Explain the λ iterative algorithm. [4+6]

8.a) Explain difference between economic load schedule and Unit Commitment problem.

b) Explain the various constraints in Unit Commitment problem. [5+5]

**OR**

9. Explain Forward Dynamic Programming method to solve UC problem. Give the flow chart. [10]

10.a) Explain the need for computer control of Power System.

b) Explain the objectives and functions of load dispatch centers. [4+6]

**OR**

11. What is SCADA system? Briefly discuss about the system architecture. [10]

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