**R13**

**Code No: 117GQ**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech IV Year I Semester Examinations, January/February - 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 do you understand by optimal power flow? | [2] |
| b) | Explain in detail about different costs involved in the operation of plants. | [3] |
| c) | What do you mean by Hydro thermal scheduling? | [2] |
| d) | What are the constraints considered for the problem on scheduling of hydrothermal power plants? | [3] |
| e) | Explain the need for regulating the steam of a turbo generators and water for the hydro generators. | [2] |
| f) | Explain the need of Excitation controller in a Generator | [3] |
| g) | Explain how the steady state error of frequency in a typical load frequency control of a power system is reduced to zero. | [2] |
| h) | Explain the need for maintaining a constant frequency in power system operation | [3] |
| i) | Explain the term Power factor | [2] |
| j) | Explain the necessity for reactive power compensation in a transmission line | [3] |

## PART – B

**(50 Marks)**

2.a) Explain how the problem of Economic Dispatch can be solved when transmission lines are neglected.

b) What are the methods of scheduling power generation of steam plants? Explain their merits and demerits? [5+5]

**OR**

3.a) Derive the loss formula coefficients for a two-plant system stating clearly the assumptions made.

b) The incremental cost of generation of two generating units are given as: $IC_1 = 0.5P_1 + 20$ and $IC_2 = 0.4P_2 + 15$. The optimal allocation of total plant load yields the generation of two units as $P_1 = P_2 = 150$MW. If the penalty factor of Unit-1 is 1.3, find the penalty factor of Unit-2. [6+4]

4.a) Explain in detail about the short term Hydro Thermal Scheduling

b) Distinguish between Peak load and Base load stations. [6+4]

**OR**

5. A power system consists of one thermal and one hydro plant. The load is constant at 150 MW for a period of 50 days. The fuel cost curve of the thermal plant is represented by:

$$F(P_{Th}) = 0.018\,P_{Th}^{2} + 10\,P_{Th} + 80 \text{ Rs / hr}.$$

If the total energy produced by the hydel plant in the period is 100,000 MWH, calculate the optimal time for which the thermal plant should be kept in service and optimal thermal generation. [10]

6.a) Explain the mathematical model of the Speed governing system with a neat diagram along with proper labelling.

b) Explain the Exciter load saturation curve along with its significance. [6+4]

**OR**

7.a) Explain the Generator load model with a neat block diagram representation.

b) Explain why turbine transfer function is characterized by two-time constants. [6+4]

8. Obtain the dynamic response of load frequency controller with and without integral control action. [10]

**OR**

9.a) Derive an expression for steady state change of frequency and tie-line power transfer of a two-area power system.

b) A control area had a total rated capacity of 1500 MW. The speed regulation 'R' for all the units in the area is 2.5 Hz/p.u MW. A one percent change in frequency causes a one percent change in load. If the system is operating at half of the rated capacity and the load increase by 3 percent, (i) find the static frequency drop. (ii) if the speed governor loops were open what would be the frequency drop. [6+4]

10. Explain in detail about the reactive power compensating equipment for transmission systems. [10]

**OR**

11.a) A 5 KV single-phase circuit, which feeds a load of 550 kW and operates at a lagging power factor of 0.72. If it is desired to improve the power factor, determine i) The reactive power consumption. ii) The new corrected power factor after installing a shunt capacitor bank with a rating of 450 KVAR.

b) Give the specifications of load compensator. [5+5]

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