Code No: **R204102I** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

POWER SYSTEM OPERATION AND CONTROL

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions

ONE Question from Each unit

All Questions Carry Equal Marks

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UNIT - I

1 a) Derive the transmission loss formula and state the assumptions made in it. [7]

b) Two units each of 200MW in a thermal power plant are operating all the time throughout the year. The max and minimum load on each unit is 200 and 50MW respectively. The incremental fuel characteristics for the two units are given as

$$\frac{dC_1}{dPG_1} = 15 + 0.08PG_1 Rs / \text{MWH}$$

$$\frac{dC_2}{dPG_2} = 13 + 0.1PG_2 Rs / \text{MWH}$$

If total load varies between 100 and 400MW, find the IFC and allocation load between two units for minimum fuel cost for various total loads. [7]

(OR)

2 a) Explain the various factors to be considered in allocating generation to different power stations for optimum operation. [7]

b) Draw the flow chart for obtaining optimal scheduling of generating units by neglecting the transmission losses. [7]

UNIT - II

3 a) A two plant system having a steam plant near the load centre and a hydro plant at remote location. The load is 500MW for 16 hr a day and 350MW, for 8 hr a day. The characteristics of the units are

$C_1 = 120 + 45P_{GT} + 0.075P^2_{GT}$

$w_2 = 0.6P_{GH} + 0.00283P^2_{GH}$ m^3/s

Loss coefficient, $B_{22} = 0.001MW^{-1}$

Find the generation schedule, daily water used by hydro plant and daily operating cost of the thermal plant for $\gamma_j = 85.5$ Rs./m^3-hr [7]

b) Explain the problems and constraints found in unit commitment. [7]

(OR)

4 a) Derive the mathematical formulation for short-term Hydro-thermal scheduling. [7]

b) Explain the solution technology for unit commitment by priority list method. [7]

Code No: **R204102I** **R20** **Set No. 1**

UNIT - III

5 a) Explain the mathematical modeling of speed governing system and derive the transfer function of speed governor model. State the assumptions made. [7]

b) A 200MVA synchronous generator is operating at 3000rpm, 50Hz. A load of 40MW is suddenly applied to the machine and the steam valve of the turbine opens only after 0.4sec due to the time lag in the generator action. Calculate the frequency to which the generated voltage drops before the steam flow commences to increase to meet the new load. Given that the value of H of the generator is 5.5kW-sec/KVA of the generator capacity. [7]

(OR)

6 a) Explain proportional plus integral load frequency control of a single area system with a neat block diagram. [7]

b) What is meant by control area and ACE? [7]

UNIT - IV

7 a) What are the differences between controlled, uncontrolled and tie line bias of a two area system. [7]

b) Describe the combined operation of a load frequency control and economical dispatch control, with the help of block diagram. [7]

(OR)

8 a) Obtain the block diagram of LFC two area system. [7]

b) Explain clearly about proportional plus integral load frequency control with a block diagram. [7]

UNIT - V

9 a) Discuss the transmission lines compensation? [7]

b) Explain the specifications of load compensator. [7]

(OR)

10 a) What are the merits and demerits of shunt and series compensation? [7]

b) A short transmission line having an impedance of (2+j3) ohms interconnects two power stations A and B both operating at 11kV; equal in magnitude and phase. To transfer 25MW at 0.8 p.f. lagging from A to B determine the voltage boost required at plant A. [7]

Code No: **R204102I** **R20** **Set No. 2**

IV B.Tech I Semester Regular Examinations, January – 2024

POWER SYSTEM OPERATION AND CONTROL

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Derive necessary condition for economic operation of N-plant system considering transmission losses. [7]

b) A power system consists of two 200MW units whose input cost data are represented by the equations: $C_1 = 0.03P_1^2 + 21P_1 + 750$ Rs/hour, $C_2 = 0.5P_2^2 + 18P_2 + 980$ Rs/hour. If the total received power $P_R = 350$MW, determine the load division between the units for the most economic operation. [7]

(OR)

2 a) Explain in detail about heat rate curve and cost curve. [7]

b) The incremental cost characteristics of the two units in a plant are $IC_1 = 0.4P_1 + 25$ Rs/MWh $IC_2 = 0.2P_2 + 35$ Rs/MWh. If the total load is 200MW, estimate the optimum load schedule. [7]

UNIT - II

3 a) Explain problem formation and solution procedure of optimal scheduling for hydro thermal plants. [7]

b) A two plant system having a steam plant near the load centre and a hydro plant at remote location. The load is 400MW for 18 hr a day and 250MW, for 6 hr a day. The characteristics of the units are

$C_1 = 130+35P_{GT}+0.065P^2_{GT}$

$w_2 = 0.8P_{GH}+0.00185P^2_{GH}$ m^3/s

Loss coefficient, $B_{22} = 0.002MW^{-1}$

Find the generation schedule, daily water used by hydro plant and daily operating cost of the thermal plant for $\gamma_j = 75.5$ Rs./m^3-hr [7]

(OR)

4 a) Explain the need of an Optimal unit commitment problem. [7]

b) With the help of a flow chart, explain the dynamic programming method in unit commitment. [7]

Code No: **R204102I** **R20** **Set No. 2**

UNIT - III

5 a) What are the components of speed governor system of an alternator and Derive its transfer function with an aid of a block diagram? [7]

b) Derive the transfer function model and draw the block diagram for single control area provided with governor system [7]

(OR)

6 a) For a single area system, show that the static error in frequency can be reduced to zero for single area load frequency control with integral control. [7]

b) Discuss the adverse effects of change in the voltage and the frequency of a power system. Mention the acceptable ranges of these changes. [7]

UNIT - IV

7 a) Explain the steady state analysis of two area LFC system with controlled case. [7]

b) Obtain the mathematical modelling the line power in an interconnected system and its block diagram. [7]

(OR)

8 a) Draw the diagram of Economic Dispatch Control and explain each component. [7]

b) Explain in detail about the tie – line bias control and give its significance. [7]

UNIT - V

9 a) Explain the Static shunt capacitor Compensator and Static series capacitor Compensator for System Control. [7]

b) Mention various loads, Which require compensation? [7]

(OR)

10 a) Explain the need of FACTS controllers in transmission systems. [7]

b) Describe the performance of uncompensated transmission lines. [7]

Code No: **R204102I** **R20** **Set No. 3**

IV B.Tech I Semester Regular Examinations, January – 2024

POWER SYSTEM OPERATION AND CONTROL

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
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UNIT - I

1 a) Explain how the incremental production cost of a thermal power station can be determined? [7]

b) The incremental cost characteristics of the two units in a plant are $IC_1 = 0.1P_1 + 8$ Rs/MWh $IC_2 = 0.15P_2 + 3$ Rs/MWh. If the total load is 100MW, estimate the optimum load schedule. [7]

(OR)

2 a) Explain the need of economical load dispatch for a given power system. [7]

b) What is meant by optimal generation allocation? Derive the conditions for optimal allocation of generation among the generators in a thermal plant including transmission losses. [7]

UNIT - II

3 a) Why hydrothermal coordination is required? What are the advantages this coordination? [7]

b) Discuss about the thermal and hydro constraints in hydrothermal coordination. [7]

(OR)

4 a) What is spinning reserve? Describe the reliability consideration in a unit commitment problem. [7]

b) Write an Algorithm and explain the solution of unit commitment problem using dynamic programming. [7]

UNIT - III

5 a) Derive the transfer for function of Automatic Generation and Control system components. [7]

b) The two control areas of capacity 1,000 and 5,000MW are interconnected through a tie line. The parameters of each area based on its own capacity base are R = 1 Hz/p.u. MW and B = 0.01 p.u. MW/Hz. If the Control area-2 experiences an increment in load of 150MW, determine the static frequency drop and the tie-line power. [7]

(OR)

Code No: **R204102I** **R20** **Set No. 3**

6 a) What are the basic requirements needed for control strategy in LFC system. [7]
b) Explain the dynamic response of an isolated area for load frequency control with first order approximation. [7]

UNIT - IV

7 a) Distinguish between load frequency control and economic dispatch control. [7]
b) Obtain an expression for steady state response of a load frequency controller with integral control of two area system. [7]

(OR)

8 a) Draw the block diagram of load frequency control and economic load dispatch? [7]
b) Derive the expression for incremental tie line power of an area in an uncontrolled two area system under dynamic state for a step load change in either area. [7]

UNIT - V

9 a) Explain the reactive power generation by synchronous generators. [7]
b) Discuss different FACTS controllers used in transmission system. [7]

(OR)

10 a) Briefly explain advantages and disadvantages of different types of compensating equipment for transmission system. [7]
b) Describe the features of load compensator and its specifications. [7]

Code No: **R204102I** **R20** **Set No. 4**

IV B.Tech I Semester Regular Examinations, January – 2024

POWER SYSTEM OPERATION AND CONTROL

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions

ONE Question from Each unit

All Questions Carry Equal Marks

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UNIT - I

1 a) Explain the significance of equality and inequality constraints in the economic allocation of generation among different plants in a system. [7]

b) What are B-coefficients? Derive them. [7]

(OR)

2 a) Explain the following terms with reference to thermal power plants:

i) Incremental fuel cost curve

ii) Incremental production cost curve [7]

b) The incremental costs in Rs./MWH for two units in a plant are given by

$$\frac{dF_1}{dP_1} = 200 + 0.5P_1 \; Rs / \text{MWH}$$

$$\frac{dF_2}{dP_2} = 160 + 2.4P_2 Rs / \text{MWH}$$

The minimum and maximum generation and each unit are to be 50MW and 150MW. Determined the economic allocation between the units for a total load of 200MW. [7]

UNIT - II

3 a) Mention the merits of operating hydro-thermal combinations. [7]

b) Derive the coordination equation for the optimal scheduling of hydrothermal interconnected power plants. [7]

(OR)

4 a) Compare an optimal constraints considered in solving a unit commitment problem. [7]

b) What is priority list method of unit commitment? Explain it with an example. [7]

Code No: **R204102I** **R20** **Set No. 4**

UNIT – III

5 a) Obtain the block diagram of single area LFC system. [7]

b) A 80MVA synchronous generator operates on full load at a frequency of 50Hz. The load is suddenly reduced to 40MW. Due to time lag in the governor system, the steam valve begins to close after 0.3secs. Determine the change in frequency that occurs in this time. H=4 KW-s/KVA of generator capacity. [7]

(OR)

6 a) Obtain the modeling of hydro turbine and draw its block diagram. [7]

b) What is the necessity of keeping frequency constant? Explain. [7]

UNIT - IV

7 a) Explain about economic dispatch control with an example. [7]

b) With the help of block diagram explain clearly about proportional and integral load frequency control and show that frequency change in steady state is zero. [7]

(OR)

8 a) Draw the block diagram of uncontrolled two area load frequency control system and explain the salient features under static condition. [7]

b) Discuss the importance of combined load frequency control and economic dispatch control with a neat block diagram. [7]

UNIT - V

9 a) What do mean by compensation of a line? Discuss briefly different methods of compensation. [7]

b) Define fundamentals of FACTS devices and write the need for FACTS controllers. [7]

(OR)

10 a) Compare series, shunt compensations with their advantages and disadvantages. [7]

b) What is the importance of load compensation? What are the specifications of load compensation equipment? [7]