Code No: **RT41023** **R13** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

POWER SYSTEM OPERATION AND CONTROL

(Electrical and Electronics Engineering)

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

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) Define the current distribution factor. [3]
   b) States any assumptions are considered for hydro- thermal scheduling. [4]
   c) What is the need of unit commitment problem? [4]
   d) Define the control area concept/ [3]
   e) What is the need of integral controller in LFC system? [4]
   f) What is the need of reactive power compensation in transmission systems? [4]

PART–B *(3x16 = 48 Marks)*

2. a) Explain the various factors to be considered in allocating generation to different power stations for optimum operation. [6]
   b) A system consists of two generating plants with fuel costs of:
   $C_1 = 0.03P_1^2 + 15P_1 + 1.0$
   $C_2 = 0.04P_2^2 + 21P_2 + 1.4$
   The system operates on economic dispatch with 120MW of power generation by each plant. The incremental transmission loss of plant-2 is 0.15. Find he penalty factor of plant-1. [10]

3. a) Explain the need of hydro –thermal coordination. [6]
   b) Explain the short-term hydrothermal scheduling problem and derive co-ordinate equations. [10]

4. A power system network with a thermal power plant is operating by four generating units. Determine the most economical units to be committed to a load demand of 5 MW. Also prepare the unit commitment table for the load changes in steps of 1 MW starting from minimum to maximum load. The minimum and maximum generating capacities and cost curve parameters of the units listed in the following table.

Unit number	Capacity (MW)		Cost curve parameters	
	Minimum	Maximum	a	b
1	1	5	0.65	20.2
2	1	5	1.5	22.6
3	1	5	1.9	25.4
4	1	5	2.2	28.0

[16]

5. a) Explain why it is necessary to maintain the frequency of the system constant. [8]
   b) Two generators of rating 125 and 250MW are operated with a droop characteristics of 4% and 5% respectively from no load to full load. Find the load sharing by each generator if a load of 300MW is connected across the parallel combination of those generators. [8]

6. a) Describe the load frequency control and economic dispatch control with necessary diagram. [8]
   b) Show that steady state frequency deviation in a single area LFC is reduced to zero if the PI controller is reduced. [8]

7. a) Explain the need of FACTS controllers in transmission systems. [8]
   b) Describe the performance of uncompensated transmission lines. [8]

Code No: **RT41023** **R13** **Set No. 2**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

POWER SYSTEM OPERATION AND CONTROL

(Electrical and Electronics Engineering)

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

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B

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PART–A *(22 Marks)*

1. a) What is your analysis by considering the optimization problem with and without transmission loss consideration? [4]
   b) What is meant by hydro –thermal coordination? [3]
   c) What is the need of Unit Commitment solution methods? List the methods. [4]
   d) How can you show that real power depends on frequency and independent of reactive power? [4]
   e) What is the function of PI controller in LFC system? [3]
   f) What are advantages of different types of compensating equipment for transmission systems? [4]

PART–B *(3x16 = 48 Marks)*

2. 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. [9]

3. a) Explain the hydroelectric power plant model with a neat diagram. [8]
   b) Explain the hydrothermal scheduling problem. [8]

4. a) Explain the various constraints in unit commitment problem. [10]
   b) Explain the dynamic programming approach for the solution of unit commitment problem. [6]

5. a) Derive the expression for change in tie line power and draw its block diagram? [8]
   b) A 250MVA synchronous generator is operating at 1500 rpm, 50Hz. A load of 60MW is suddenly applied to the machine and the station valve to the turbine opens only after 0.3 sec 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 valve of H of the generator is 3.2 kW-sec per kVA of the generator energy. [8]

6. Explain clearly about proportional plus integral LFC with a block diagram and prove that its change in frequency is zero. [16]

7. a) Compare the different types of compensating equipment for transmission systems. [8]
   b) Discuss the specification of load compensation. [8]

Code No: **RT41023** **R13** **Set No. 3**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

POWER SYSTEM OPERATION AND CONTROL

(Electrical and Electronics Engineering)

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

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B

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PART–A *(22 Marks)*

1. a) State the equality and inequality constraints on the optimization of product cost of a power station. [4]
   b) What is meant by short-term hydro-thermal coordination? [4]
   c) What are the advantages of Unit Commitment solution method? [4]
   d) Define tie line bias control. [3]
   e) What is economic load dispatch control? [3]
   f) What are disadvantages of different types of compensating equipment for transmission systems? [4]

PART–B *(3x16 = 48 Marks)*

2. a) Derive the transmission loss formula and state the assumptions made in it. [8]
   b) Obtain the condition for optimum operation of a power system with 'n' plants including the effect of transmission losses. [8]

3. a) Obtain the hydro- thermal scheduling problem. State if any assumptions are considered. [8]
   b) A load is feeded by two plants, one is thermal and other is a hydro plant. The load is located near the thermal plant. The characteristics of the plants are
   $F_T = 0.04P_T^2 + 25P_T + 20$ Rs/hr, $w_H = 0.0012P_H^2 + 7.5P_H$ m^3/Sec
   $\gamma_H = 2.5\times10^{-3}$ Rs/m^3 and $B_{22} = 0.0015$ $(MW)^{-1}$
   Determine the power generation of both plants and load connected, when λ = 20 Rs./ MWh [8]

4. Using dynamic programming method to determine the most economical units to be committed to supply a load of 6 MW. There are three units with the following data.
   $C_1=0.6\ P_1^2+20\ P_1$, $C_2=0.85P_2^2+19P_2$ and $C_3=0.7P_3^2+25P_3$.
   The maximum and minimum capacities of each unit are 5 MW and 1 MW respectively. [16]

5. a) Obtain the modeling of hydro turbine and draw its block diagram. [10]
   b) What is the necessity of keeping frequency constant? [6]

6. For a single area system, show that the static error in frequency can be reduced to zero using frequency controller with neat block diagram. [16]

7. a) Explain the objectives of load compensator. [6]
   b) A 35 kW induction motor has power factor 0.85 and efficiency 0.9 at full load, power factor 0.6 and efficiency 0.7 at half-load. At no-load, the current is 25% of the full-load current and power factor 0.1. Capacitors are supplied to make the line power factor 0.8 at half-load. With these capacitors in circuit, find the line power factor at (i) full load and (ii) no-load. [10]

Code No: **RT41023** **R13** **Set No. 4**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

POWER SYSTEM OPERATION AND CONTROL

(Electrical and Electronics Engineering)

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

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B

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PART–A *(22 Marks)*

1. a) How is the inequality constraints considered in the determination of optimum allocation? [4]
   b) What are the advantages of operation of hydro thermal combinations? [3]
   c) What are the constraints for Unit Commitment solution method? [4]
   d) Define the ACE's for two area system and write its expression. [4]
   e) What is the effect of integral control action in LFC? [3]
   f) What are the specifications of load compensator? [4]

PART–B *(3x16 = 48 Marks)*

2. a) Obtain the condition for optimum operation of a power system with 'n' plants when losses are neglected. [7]
   b) A system consists of three generating plants with fuel costs of:
   $C_1 = 0.04P_1^2 + 20P_1 + 230$ Rs./h
   $C_2 = 0.06P_2^2 + 18P_2 + 200$ Rs./h
   $C_3 = 0.15P_3^2 + 15P_3 + 180$ Rs/h
   Determine the optimum sharing of a total load of 180MW for which each plant would take up for minimum input cost of received power in Rs/MWh. [9]

3. Explain in detail about the short term hydro thermal scheduling. [16]

4. a) Describe the need for unit commitment. [8]
   b) Explain the priority ordering method for unit commitment. [8]

5. a) Obtain the mathematical modeling of speed governing system. [8]
   b) The two control areas of capacity 1,000 and 5,000 MW 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 150 MW, determine the static frequency drop and the tie-line power. [8]

6. Explain the steady state analysis of two area LFC system with controlled case and draw its block diagram. [16]

7. a) Explain the effects on uncompensated line under no load and load conditions. [10]
   b) What are the merits and demerits of different types of compensation? [6]