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

IV B.Tech I Semester Regular Examinations, November - 2016

POWER SYSTEMS OPERATION & 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 a penalty factor in economic scheduling? Give its significance. [4]
   b) What are the important methods of hydro – thermal coordination? [4]
   c) What is the need of solution methods for unit commitment problem? [4]
   d) What is meant by tie–line bias control? [4]
   e) What are the considerations in selecting the frequency bias parameters? [3]
   f) What is the need for FACTS controllers? [3]

PART–B *(3x16 = 48 Marks)*

2. a) Explain the following terms with reference to thermal plants
      i) Heat rate curve
      ii) Incremental fuel rate curve
      iii) Incremental production cost curve [8]
   b) Incremental fuel costs in Rs/MWh for 2units in a plant are given by
      $\frac{dc_1}{dp_1}$ =0.15P_1+25, $\frac{dc_2}{dp_2}$ =0.12P_2+15.
      The minimum and maximum loads on each unit are to be 20MW and 125 MW respectively. Determine IFC and allocation of load between units for the minimum cost and load is 150MW. Assume both the units are operating. [8]

3. A two plant system has a steam plant near the load centre and hydro plant at a remote location. The characteristics of both the stations are
   C_1= (0.045P_T+26) P_T Rs/hr
   W_2= (0.004P_H+7) P_H m^3/sec.
   And γ_2=4 x 10^{-4} Rs/m^3 and B_{22}= 0.0025 MW^{-1}.
   Determine the power generation at each station and power received by the load when λ=65 Rs/MWh. [16]

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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 7MW. Also prepare the UC table for the load change s in steps of 1MW starting from the minimum to the maximum load. The minimum and maximum generating capacities and cost-curve parameters of the units listed in a tabular form are as given in below:

Capacities and cost-curve parameters of the units

Unit number	capacity (MW)		Cost-curve parameters		
	Min	Max	a	b	c
1	1.0	15.0	0.68	22.8	823
2	1.0	15.0	1.53	25.9	120
3	1.0	15.0	1.98	29.0	480
4	1.0	15.0	2.23	30.0	500

[16]

5. a) What are the basic requirements needed for control strategy in LFC system. [8]

   b) Obtain the mathematical modeling of the line power in an inter-connected system and its block diagram. [8]

6. Explain how the control scheme results in zero lie-line power deviations and zero frequency deviations under steady state conditions following a step load change in one of the area system with neat block diagram. [16]

7. a) Compare the different types of compensating equipment for transmission system? [8]

   b) Explain the specifications of load compensation? [8]

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

PART–A ***(22 Marks)***

1. a) Define the incremental fuel and production costs. [4]
   b) Obtain the hydro electric plant model. [4]
   c) What is the need for unit commitment? [4]
   d) What is the necessity of keeping frequency constant? [4]
   e) What is the need of integral control in single area LFC system? [3]
   f) What is the need of load compensation? [3]

PART–B ***(3x16 = 48 Marks)***

2. a) What is a penalty factor in economic scheduling? Explain its significance? [8]
   b) The fuel input per hour of plant 1 and 2 are given as
   $C_1=0.2P_1^2+40P_1+120$ Rs/h
   $C_2=0.25P_2^2+30P_2+150$ Rs/h
   Determine the economic operating schedule and the corresponding cost of generation if the max and min loading on each unit is 100MW and 25MW, the demand is 180 MW and transmission losses are neglected. If the load is equally shared by both the units, determine the saving obtained by loading the units as per equal incremental production cost. [8]

3. A two plant system having a steam plant near the load centre and hydro plant at a remote location. The load is 4500MW for 16hrs a day. The characteristics of the units are
   $C_1= 0.075\ P_T^2+45P_T+120$,
   $W_2=0.0028\ P_H^2+0.6P_H$,
   $B_{22}=0.001MW^{-1}$.
   Find the generation schedule, daily water used by the hydro plant and daily operating cost of thermal plant for $\gamma_j=85.5$ Rs/m^3-hr. [16]

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4. a) What are the merits and demerits of DP method over priority list scheme? [8]
   b) Using the dynamic programming approach, how do you find the most economical combination of the units to meet a particular load demand? [8]

5. a) What is meant by the line bias control? [8]
   b) With a neat diagram explain briefly different parts of turbine speed governing system? [8]

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

7. a) What are the merits and demerits of different types of compensating equipment for transmission system? [8]
   b) Explain the uncompensated and compensated transmission lines. [8]

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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
*****

PART–A *(22 Marks)*

1. a) What are coordination equations? Give their physical significance. [4]
   b) What is the need of optimal scheduling of hydrothermal system? [4]
   c) What are the merits of dynamic programming method? [4]
   d) Obtain the modeling of Hydro turbine. [4]
   e) What is meant by area control error in two area system? [3]
   f) What are the specifications of load compensator? [3]

PART–B *(3x16 = 48 Marks)*

2. Derive the transmission loss formula for a system consisting of n-generating plants supplying several loads inter connected through a transmission networks. State any assumptions are made. [16]

3. Describe the hydro thermal economic load scheduling. Derive the necessary equations? [16]

4. a) Explain the priority list method for unit commitment. [8]
   b) 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.
   $C_1=0.8\ P_1^2+22\ P_1$, $C_2=0.85P_2^2+21P_2$ and $C_3=0.8P_3^2+20P_3$.
   The maximum and minimum capacity of each unit is 5 MW and 1 MW respectively. [8]

5. Obtain the block diagram representation of an isolated power system. [16]

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. [8]
   b) Distinguish between load frequency control and economic load dispatch control with neat block diagram. [8]

7. Explain clearly what you mean by compensation of lines and discuss briefly different methods of compensation. [16]

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

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(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
*****

PART–A *(22 Marks)*

1. a) What is the need of economic operation of power systems? [4]
   b) What is the importance of hydro thermal coordination? [4]
   c) What are the constraints in unit commitment? [4]
   d) Obtain the mathematical modeling of speed governing system. [4]
   e) What is the need of integral control in two area LFC system? [3]
   f) What are the advantages and disadvantages of different types of compensation? [3]

PART–B *(3x16 = 48 Marks)*

2. a) Explain the need of economical load dispatch for a given power system. [8]
   b) A system consisting of two plants connected by a tie line and load is located at plant-2. When 100MW is transmitted from plant-1, a loss of 10MW takes place on the tie line. Determine the generation schedule at both the plants and the power received by load when λ of the system is 25Rs/MWh and IFC are given by $\frac{dc_1}{dp_1}$ =0.03P_1+17 Rs/MWh, $\frac{dc_2}{dp_2}$ =0.06P_2+19 Rs/MWh. [8]

3. Obtain the condition for economic generation of steam and hydro plants for short term scheduling. State the any assumptions are considered. [16]

4. Using dynamic programming method to determine the most economical units to be committed to supply a load of 6 MW. There are four units with the following data C_1=0.8 P_1^2 +21 P_1, C_2=0.6P_2^2+22P_2, C_3=0.5P_3^2+21P_3 and C_4=0.6P_4^2+20P_4. The maximum and minimum limits for each unit are 6 MW and 1 MW respectively. [16]

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5. a) With a neat diagram explain briefly different parts of turbine speed governing system? [8]

   b) Two control areas have the following characteristics

   Area 1:R_1=0.011p.u., B_1=0.85p.u., Base MVA=1000

   Area 2: R_2=0.018 p.u., B2=0.95p.u., Base MVA=1000

   A load change of 200MW occurs in area 1. Determine the new steady state frequencies? [8]

6. a) Draw the block diagram of load frequency control and economic load dispatch? Explain its combined operation. [8]

   b) Explain clearly about proportional plus integral load frequency control with a block diagram. [8]

7. a) Discuss the transmission lines compensation? [8]

   b) Explain the specifications of load compensator. [8]