Code No: R05410204 **Set No. 1**

IV B.Tech I Semester Regular Examinations, November 2008
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. The fuel cost functions in Rs./hr. for three thermal plants are given by
   $C_1 = 400+8.4P_1+0.006{P_1}^2, \quad 100 \leq P_1 \leq 600$
   $C_2 = 650+6.78P_2+0.004{P_2}^2, \quad 300 \leq P_3 \leq 650$
   Where P_1, P_2, are in MW. Neglecting line losses and including generator limits, determine the optimal generation scheduling where $P_D = 1550$MW. [16]

2. 150 MW, 220 MW and 220 MW are the ratings of three units located in a thermal power station. Their respective incremental costs are given by the following equations:
   dc1/dp1 = Rs(0.11p1 + 12);
   dc3/dp3 = Rs(0.1p3 + 13)
   dc2/dp2 = Rs(0.095p2 + 14)
   Where P_1, P_2 and P_3 are the loads in MW. Determine the economical load allocation between the three units, when the total load on the station is
   (a) 350 MW
   (b) 500 MW. [16]

3. From the fundamentals discuss about hydro thermal scheduling. [16]

4. Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600 MW be shared between them? If the load reduces to 400MW how it will be shared among the generators and what will be the system frequency. Assume free governor operation the speed changes of a governor are reset so that the load of 400MW is shared among the generators at 50Hz in the ratio of their ratings. What are the no load frequencies of the generators. [16]

5. Two generating stations A and B have full load capacities of 200 MW and 75 MW respectively. The inter connector connecting the two stations has an induction motor/synchronous generator (plant C) of full load capacity of 25 MW. Percentage changes in speeds of A, B and C are 5, 4 and 3 respectively. The loads on the bus bars of A and B are 75 MW and 30 MW respectively. Determine the load taken by the set C and indicate the direction in which the energy is flowing. [16]

6. Two interconnected areas 1 and 2 have the capacity of 200MW and 500MW respectively. The incremental regulation and damping torque co-efficient for each area on its own base are 0.2 pu and 0.08 pu respectively. Find the steady state change

in system frequency from a nominal frequency of 50 Hz and the change in steady state tie-line power following a 750MW change in load of area 1. [16]

7. Explain the effect of integral gain on the performance of load frequency control in two area load frequency control. [16]

8. Explain clearly what do mean by compensation of a line and discuss briefly different methods of compensation. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05410204 **Set No. 2**

IV B.Tech I Semester Regular Examinations, November 2008
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. A simple two-plant system have the Incremental cost curves are
   dC1 / dP_{G1} = 0.01 P_{G1} + 2.0
   dC2 / dP_{G2} = 0.01 P_{G2} + 1.5 determine P_{G1} and P_{G2} when the load on the system is 1000MW. [16]

2. Write algorithm for economic allocation of generation among generators of a thermal system taking into account transmission losses with derive necessary equations. [16]

3. Derive Mathematical Formulation for Hydro thermal scheduling. [16]

4. Two generating stations A and B have full load capacities of 500MW and 210MW respectively. The inter connector connecting the two stations has an induction motor / synchronous generator (plant C) of full load capacity 50 MW near station A percentage changes of speeds of A, B and C are 5,4 and 2.5 respectively. The loads on bus bars A and B are 250MW and 100MW respectively. Determine the load taken by the set C and indicate the direction of power flow. [16]

5. A power system has load of 1250 MW at 50 Hz. If 50 MW load is tripped, find the steady state frequency deviation when

   (a) there is no speed control

   (b) the system has a reserve of 200 MW spread over 500 MW of generation capacity with 5 % regulation on this capacity.

   All the generators are operating with valves wide open. Due to dead band only 80 % of governors respond to load change. Assume load damping constant B=1.5. [16]

6. Two control areas of 1000MW and 2000MW capacities are interconnected by a tie line. The speed regulations of the two areas respectively are 4 Hz / Pu MW and 2.5 Hz / Pu MW. Consider 2% change in load occurs for 2% change in frequency in each area. Find steady state change in frequency and tie-line power of 10MW change in load occurs in both areas. [16]

7. Explain how modern control theory can be applied to load frequency control problem. [16]

8. Explain the operations of synchronous condenser and mention its applications in power systems and derive the expression for capacity of synchronous condenser. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05410204 **Set No. 3**

IV B.Tech I Semester Regular Examinations, November 2008
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain how the incremental production cost of a thermal power station can be determined.
   (b) Explain the various factors that effect optimum operation to be considered in allocating generation of different power stations neglect line losses. [8+8]

2. A power system consists of two 100 MW units whose input cost data are represented by equations below:
   $C_1 = 0.04\ P_1^2 + 22\ P_1 + 800$ Rupees/hour
   $C_2 = 0.045\ P_2^2 + 15\ P_2 + 1000$ Rupees/hour
   If total received power $P_R = 150$ Mw. Determine the load sharing between units for most economic operation. [16]

3. Explain different constraints to be considered for mathematical modeling of hydro thermal scheduling. [16]

4. Two generating stations A and B of capacities 20MW and 10MW and speed regulation of 2% and 3% respectively. Two stations are connected through are inter connector and motor generator set. The set is connected to bus bar of A and has a capacity of 3 MW and full load slip of 4%. Determine the load of the inter connector when there is load of 8MW on bus bar B due to its own consumers but A has no external load. [16]

5. (a) Explain the concept of control area in a load control problem.
   (b) Derive the expression for the frequency deviation, when a step load disturbance occurs in a single control area. [8+8]

6. Two generating stations A and B have the capacities 500MWand 800MW respectively are inter-connected by a short line. The percentage speed regulations from no-load to full load of the two stations are 2 and 3 respectively. Find the power generation at each station and power transfer through the line if the load on bus of each station is 200MW. [16]

7. Derive the transfer function $(\Delta F(s)/\Delta P_D(s))$ for proportional and integral control of a single area system. [16]

8. A 3-Φ transmission line has resistance and inductive reactance of 25 Ω and 90 Ω respectively. With no load at the receiving end a synchronous compensator there takes a current lagging by 90^0, the voltage at the sending end is 145 kV and 132 kV at the receiving end. Calculate the value of the current taken by the

compensator. When the load at the receiving end is 50 MW, it is found that the line can operate with unchanged voltages at sending and receiving ends, provided that the compensator takes the same current as before but now leading by 90^0. Calculate the reactive power of the load. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05410204 **Set No. 4**

IV B.Tech I Semester Regular Examinations, November 2008
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the role of incremental fuel cost in thermal plant operation?
   (b) Draw Heat curve and explain its significance. [8+8]

2. 100 MW, 150 MW and 280 MW are the ratings of three units located in a thermal power station. Their respective incremental costs are given by the following equations:
   dc1/dp1 = Rs(0.15p1 + 12);
   dc3/dp3 = Rs(0.21p3 + 13)
   dc2/dp2 = Rs(0.05p2 + 14)
   Where P_1, P_2 and P_3 are the loads in MW. Determine the economical load allocation between the three units, when the total load on the station is 300 MW. [16]

3. Derive the co-ordination equation for the optimal scheduling of hydro-thermal interconnected power plants. [16]

4. Two synchronous generators operate in parallel and supply a total load of 400MW, the capacities of machines are 200MW and 500MW and both have generator drooping characteristics of 4% from no load to full load. Calculate the load taken by the each machine. Assuming free governor action also find system frequency at this load. [16]

5. (a) What are the various specifications that are to be considered in load frequency control?
   (b) Explain briefly the control area concept and control area error. [8+8]

6. The two control areas of capacity 2000MW and 8000MW are interconnected through a tie-line. The parameters of each area based on its own capacity base are R = 1Hz / Pu MW and B = 0.02 Pu MW / Hz. If the control area-2 experiences an increment in load of 180MW, determine the static frequency drop and the tie-line power. [16]

7. Show that steady state frequency error can be reduced to zero if the proportional and integral controller is used in single area load frequency control. [16]

8. A three phase transmission line has resistance and inductive reactance of 25 ohms and 90 ohms respectively. With no load at the receiving end a synchronous compensator there takes a current lagging by 90^0, the voltage at the sending end is 145 kV and 132 kV at the receiving end. Calculate the value of the current taken

by the compensator. When the load at the receiving end is 50 MW, it is found that the line can operate with unchanged voltages at sending and receiving ends, provided that the compensator takes the same current as before but now leading by 90^0. Calculate the reactive power of the load. [16]

⋆ ⋆ ⋆ ⋆ ⋆