Code No: M0223/R07

Set No. 1

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Write the expression for hourly loss of economy resulting from error in incremental cost representation. [16]

2. Derive the coordination equations for economic scheduling including the effect of network losses in a purely thermal system and explain the λ - iteration method of solving them with the help of flow chart. [16]

3. .Discuss optimal power flow procedures with its inequality constraints, and how to handle dependent variables with penalty function. [16]

4. What is meant by excitation system? Write different schemes of excitation systems? [16]

5. With a neat block diagram explain the load frequency control for a single area power system. [16]

6. (a) Explain load frequency control problem in a Multi-area power system.
   (b) Derive an expression for steady-state change of frequency and tie-line power transfer of a two-area power system. [8+8]

7. Explain the state variable model of two area load frequency controller with integral action. [16]

8. (a) Explain about the losses that occur due to VAR flow in power systems.
   (b) Explain how the generators act as VAR sources in a power network. [8+8]

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Code No: M0223/R07

Set No. 2

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Describe in detail, with suitable examples, the methods of optimum scheduling of Generation of power from a thermal station. [16]

2. The incremental fuel cost for two plants are
$\frac{dC_1}{dP_{G_1}} = 0.075\ P_{G_1} + 18$ Rs./MWh
$\frac{dC_2}{dP_{G_2}} = 0.08\ P_{G_2} + 16$ Rs./MWh
The loss coefficients are given as
B_{11}=0.0015 /MW, B_{12} = - 0.0004/MW and B_{22} = 0.0032/ MW for $\lambda = 25$ Rs./MWh.
Find the real power generations, total load demand and the transmission power loss. [16]

3. Determine the daily water used by hydro plant and daily operating cost of thermal plant with the load connected for total 24 hrs from the given data.
The load connected, P_D = 400MW
Generation of thermal plant, P_{GT} = 200MW
Generation of hydro plant, P_{GH} = 300MW. [16]

4. Briefly explain static excitation system? [16]

5. Explain the dynamic response of load frequency control of an isolated power system with a neat block diagram. Draw the plots of change in frequency with respect to time with and without making approximations in the analysis. [16]

6. Given a block diagram of two interconnected areas shown in figure 6 (consider the prime-mover output to be constant i.e., a blocked governor):

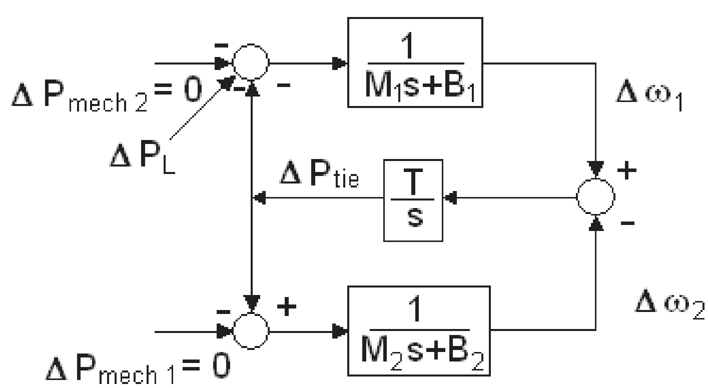

Figure 6

(a) Derive the transfer functions that relate $\Delta\omega_1$(s) and $\Delta\omega_2$(s) to a load change ΔP_L(s).

(b) For the following data (all quantities refer to a 100 MVA base),
M_1=2.5 pu B_1=1.00
M_2=4.0 pu B_2=0.75
T=377×0.02 pu =7.54 pu
Calculate the final frequency for a load step change in area 1 of 0.2 pu (i.e., 200 MW). Assume the frequency was nominal and tie flow was 0 pu. [8+8]

7. Discuss the merits of proportional plus integral load frequency control of a system with a neat block diagram. [16]

8. Show with the aid of a vector diagram, how the voltage at the receiving end of a transmission line can be maintained constant by the use of a synchronous phase modifier. [16]

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Code No: M0223/R07

Set No. 3

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011

POWER SYSTEM OPERATION AND CONTROL

(Electrical & Electronic Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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1. The fuel cost functions in Rs./hr. for three thermal plants are given by
   $C_1 = 400+8.4P_1+0.006{P_1}^2$, $100 \leq P_1 \leq 600$
   $C_2 = 600+8.93P_2+0.006{P_2}^2$, $60 \leq P_2 \leq 300$
   Where P_1, P_2, are in MW. Neglecting line losses and including generator limits, determine the optimal generation scheduling where $P_D = 820$MW. [16]

2. What are the important points for the solution of economic load dispatch problems when transmission losses are included and coordinated. [16]

3. Explain the problem of scheduling hydro - thermal power plants and What are the constraints in the problem? [16]

4. An inter connector with inductive reactance of 25 ohms and negligible resistance of two units of generation with voltages are 33KV and 30KV at its ends. The load of 6MW is to be transferred from 33KV to 30KV side of a inter connector determine the power factor of power transmitter and other necessary conditions between two ends. [16]

5. (a) A 125 MVA turbo alternator operates on full load at 50 Hz. A load of 50 MW is suddenly reduced on the machine. The steam valves to the turbine commence to close after 0.5 seconds due to the time lag in the governor system. Assuming inertia constant H= 6 kW - sec per kVA of generator capacity, calculate the change in frequency that occurs in this time.
   (b) Explain the necessity of keeping the frequency constant in a power system. [8+8]

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. (a) Obtain the dynamic response of load frequency controller with integral control action in single area frequency control.
   (b) Distinguish between load frequency control and economic dispatch control. [8+8]

8. Two substation are connected by two lines in parallel with negligible impedance, but each containing a tap changing transformer of reactance 0.18 pu on the basis

of its rating of 200 MVA. Find the net absorption of reactive power when the transformer taps are set to 1:1.1 and 1:0.9 respectively. Assume p.u., voltages to be equal at the two ends and at sub-station. [16]

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Code No: M0223/R07 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM OPERATION AND CONTROL
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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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) Derive the conditions to be satisfied for economic operation of a loss less power system.
   (b) What is the objective in economic scheduling? [8+8]

3. A two plant system having a thermal station near the load center and a hydro power station at remote location as shown in figure 3.

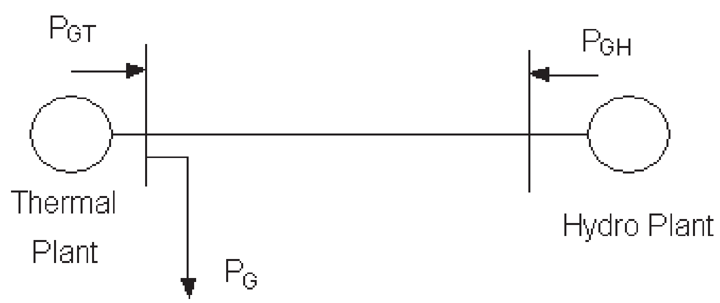

Figure 3

The characteristics of both stations are

$C_1 = (20 + 0.03)P_{GT})\ P_{GT}$ Rs/hr

$W_2 = (8 + 0.002\ P_{GH})\ P_{GH}\ m^3/sec$

and $\gamma 2 = Rs.\ 5 \times 10^{-4} / m^3$

The transmission loss co-efficient $\beta_{22} = 0.0005$

Determine the power generation at each station and the power received by the load when $\lambda = 50$ Rs / MWhr. [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) A 125 MVA turbo alternator operates on full load at 50 Hz. A load of 50 MW is suddenly reduced on the machine. The steam valves to the turbine commence to close after 0.5 seconds due to the time lag in the governor system. Assuming inertia constant H= 6 kW - sec per kVA of generator capacity, calculate the change in frequency that occurs in this time.

   (b) Explain the necessity of keeping the frequency constant in a power system. [8+8]

6. (a) Explain the effect of bias factors on the system regulation.

   (b) Two control areas connected by a tie line have the following characteristics.

Area 1:	R=0.11 pu	Area 2: R=0.018 pu
	D=0.8 pu	D=0.9 pu
	Base MVA=1000	Base MVA=500

   A load change of 200 MW occurs in area 2. Determine the tie-line power flow deviation. Assume both areas were at nominal frequency 50 Hz. [8+8]

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

8. A load of (66+j60)MVA at the receiving end is being transmitted via a single circuit 220 kV line, having resistance of 21 ohms and reactance of 34 ohms. The sending end voltage is maintained at 220 kV. The operating conditions of power consumers require that at this load voltage drop across the line should not exceed 5 percent. In order to reduce voltage drop, standard single phase, 66 kV, 40 kVAr capacitors are to be switched in series in each phase of the line. Determine the required number of capacitors, rated voltage and installed capacitors of the capacitor tank. The losses in the line are neglected. [16]

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