Set No.1

IV B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEM OPERATION & 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) Describe in detail, with suitable examples, the methods of optimum scheduling of generation of power from a thermal station.
   (b) What is Production cost of power generated and incremental fuel rate?
   (c) Write the expression for hourly loss of economy resulting from error in incremental cost representation. [6+5+5]
2. (a) Discuss and define the loss formula coefficients.
   (b) What is the objective in economic scheduling? [8+8]
3. Discuss optimal power flow problems with and without inequality constraints. How are these problems solved? [16]
4. (a) Derive the model of a speed governing system and represent it by a block diagram.
   (b) A 100 MVAsynchronous generator operates on full load at a frequency of 50 Hz. The load is suddenly reduced to 50 MW. Due to time lag in the governor system, the steam valve begins to close after 0.4 secs. Determine the change in frequency that occurs in this time. H=5 KW-s/KVAof generator capacity. [8+8]
5. (a) Obtain the dynamic response of load frequency control of isolated power system for first order approximation.
   (b) Obtain the dynamic response of load frequency controller with and without integral control action. [16]
6. Give a typical block diagram for a two-area system inter connected by a tie line and explain each block. Also deduce relations to determine the frequency of oscillations of tie line power and static frequency drop. List out assumptions made. [16]
7. (a) Write short notes on compensated and uncompensated transmission lines
   (b) Explain briefly about the shunt and series compensation of transmission systems. [8+8]
8. A three-phase induction motor delivers 500 hp at an efficiency of 0.91, the operating power factor being 0.76 lagging. A loaded synchronous motor with a power consumption of 100 KW is connected in parallel with the induction motor. Calculate the necessary kVA and the operating power factor of the synchronous motor if the overall power factor is to be unity. [16]

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Code No: RR410204 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEM OPERATION & 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) What is an incremental fuel cost? How is it used in thermal plant operation?
   (b) Name the components of production cost and explain. [8+8]

2. (a) Derive the conditions to be satisfied for economic operation of a loss less power system.
   (b) 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:
   $^{dc_1}/_{dp_1} = Rs(0.11p_1 + 12)$;
   $dc_3/dp_3 = Rs(0.1p_3 + 13)$
   $dc_2/dp_2 = Rs(0.095p_2 + 14)$
   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
      i. 350 MW
      ii. 500 MW.

   [7+9]

3. Write short notes on:
   (a) Equations of Load flow.
   (b) Solving of Load flow equations. [16]

4. Draw the schematic diagram showing the speed changer setting, Governor and steam admission valve and indicate how steam input is regulated with the change in load. Derive the T.F.of the above system. [16]

5. (a) Obtain the dynamic response of load frequency control of isolated power system for first order approximation.
   (b) Obtain the dynamic response of load frequency controller with and without integral control action. [16]

6. Give a typical block diagram for a two-area system inter connected by a tie line and explain each block. Also deduce relations to determine the frequency of oscillations of tie line power and static frequency drop. List out assumptions made. [16]

7. (a) Describe the effect of thyristor-controlled static shunt compensators to meet reactive power requirement in the power systems

(b) Compare the technical advantages of static compensator over synchronous condenser. [8+8]

8. A three(S)phase 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]

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IV B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEM OPERATION & 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) What is an incremental fuel cost? How is it used in thermal plant operation?
   (b) Name the components of production cost and explain. [8+8]
2. (a) Describe the need for co-ordination of different power stations.
   (b) What are B_{mn} coefficients and derive them. [8+8]
3. Define the cost function of power flow problem with control variables and explain a method to obtain the solution. [16]
4. (a) Explain the necessity of maintaining a constant frequency in power system operation.
   (b) 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? What will be the system frequency at this load? Assume free governor operation. Repeat the problem if both the governors have a droop of 4%. [6+10]
5. (a) Obtain the dynamic response of load frequency control of isolated power system for first order approximation.
   (b) Obtain the dynamic response of load frequency controller with and without integral control action. [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. [7+9]
7. (a) Explain how transformers are used to control the flow of real and reactive power in the power system network
   (b) Explain the combined use of Tap-changing transformers and reactive power injection in a power system. [8+8]
8. A three(S)phase 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]

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Code No: RR410204 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEM OPERATION & 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) State what is meant by base-load and peak-load stations. Discuss the combined hydro- electric and steam station operation.
   (b) Discuss about the incremental fuel cost and production cost. [8+8]

2. The equations of the input costs of three power plants operating in conjunction and supplying power to a system network are obtained as follows:
   $C_1 = 0.06\ P_1^2 + 15\ P_1 + 150$ Rupees/hour
   $C_2 = 0.08\ P_2^2 + 13\ P_2 + 180$ Rupees/hour
   $C_3 = 0.10\ P_3^2 + 10\ P_3 + 200$ Rupees/hour.
   The incremental loss-rates of the network with respect to the plants 1,2 and 3 are 0.06, 0.09 and 0.10 per MW of generation, respectively. Determine the most economical share of a total load of 120 MW which each of the plants would take up for minimum input cost of received power is Rupees per mMWH. [16]

3. Define the lagrangian function for optimization of power flow solution with controlled variables and using the gradient method obtain the solution. [16]

4. (a) Explain the necessity of maintaining a constant frequency in power system operation.
   (b) 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? What will be the system frequency at this load? Assume free governor operation. Repeat the problem if both the governors have a droop of 4%. [6+10]

5. Draw the block diagram of a power system showingthe governor, turbine and syn.generator, indicating their transfer functions. For a step disturbance of Δ P_D, obtain the response of "increment in frequency", making suitable assumptions.
   (a) Without proportional plus integral controller, and
   (b) With proportional plus integral control. [16]

6. (a) Explain power frequency characteristics of an inter-connected 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. (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]

8. A three-phase induction motor delivers 500 hp at an efficiency of 0.91, the operating power factor being 0.76 lagging. A loaded synchronous motor with a power consumption of 100 KW is connected in parallel with the induction motor. Calculate the necessary kVA and the operating power factor of the synchronous motor if the overall power factor is to be unity. [16]

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