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Code No: 07A70203 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
POWER SYSTEM OPERATION AND CONTROL
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. 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]

2. Give algorithm for economic allocation of generation among generators of a thermal system taking into account transmission losses. Give steps for implementing this algorithm and also derive necessary equations. [16]

3. (a) Discuss in detail about incremental heat rate curve and cost curve?
   (b) Write the expression for hourly loss of economy resulting from error in incremental cost representation. [8+8]

4. Obtain an expression for steady state response of a load frequency controller with integral control. How it is different from with out integral control. [16]

5. Two turboalternators rated for 110MW and 210MW have a governor droop characteristics of 5% from no load to full load. They are connected in parallel to share the load of 250MW. Determine the load shared by each machine assuming free governor action. [16]

6. Give 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. In a two plant operation system, the Hydro plant is operate for 12 hrs. during each day and the hydro plant is operate all over the day. The characteristics of the steam and hydro plants are
   $C_T = 0.3\ P_{GT}{}^2 + 20\ PGT + 5$ Rs/hr
   $W_H = 0.4 P_{GH}{}^2 + 20\ PGH$ m^3/ sec
   When both plants are running, the power flow from steam plant to load is 300 MW and the total quantity of water is used for the hydro plant operation during 12 hrs is 180×10^6 m^3. Determine the generation of hydro plant and cost of water used. [16]

8. A Generator in single area load frequency control has the following parameters:
   Total generation capacity = 2500 MW
   Normal operating load =1500 MW

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Inertia constant=5 kW-seconds per kVA; Load damping constant, B=1 %; frequency, f=50 Hz; and Speed regulation, R=2.5 Hz / p.u MW. If there is a 1.5 % increase in the load, find the frequency drop

(a) without governor control

(b) with governor control. [8+8]

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Code No: 07A70203 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
POWER SYSTEM OPERATION AND CONTROL
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What is load factor and loss factor and state the criterion for economic operation of power system? [16]

2. (a) Define in detail the following:
   i. Control variables
   ii. Disturbance variables
   iii. State variables.
   (b) Draw incremental fuel cost curve. [8+8]

3. Design a static var compensator for a low voltage distribution system with the following specifications:
   System voltage = 440 V
   System frequency = 50 Hz
   Coil inductance, L=5.37 mH
   The inductor saturates at 950 A and settles to a value of 1.8 mH at 1800 A. Compensation is required over a range of -80 kVAR to +30 kVAR per phase. [16]

4. Two control areas have the following characteristics:

Area-1:	Speed regulation	= 0.02 pu
	Damping co-efficient	= 0.8 pu
	Rated MVA	= 1500
Area-2:	Speed regulation	= 0.025 pu
	Damping co-efficient	= 0.9 pu
	Rated MVA	= 500

   Determine the steady state frequency change and the changed frequency following a load change of 120MW occurs in area-1. Also find the tie-line power flow change. [16]

5. Obtain the dynamic response of load frequency controller with integral control action in two area load frequency control system. [16]

6. A 80 MVA synchronous generator operates on full load at a frequency of 50Hz. The load is suddenly reduced to 40 MW. Due to time lag in the governor system, the steam valve begins to close after 0.3 secs. Determine the change in frequency that occurs in this time. H=4 KW-s/KVAof generator capacity. [16]

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7. Two generating stations A & B have full load capacities of 300 MW and 250 MW respectively. The inter connector connecting the two stations has a motor-generator set (Plant 'C') near station A of full load capacity of 100 MW. Percentage changes of speed of A, B and C are 5, 4 and 3 respectively. The loads on bus bars A and B are 200 MW and 100 MW respectively. Determine the load taken by set C and indicate the direction in which the energy is flowing. [16]

8. A single area consists of two generators with the following parameters:
Generator 1 = 1200 MVA; R=6 % (on machine base)
Generator 2 = 1000 MVA; R=4 % (on machine base)
The units are sharing 1800 MW at normal frequency 50 Hz. Unit supplies 1000 MW and unit 2 supplies 800 MW. The load now increased by 200 MW.
   (a) Find steady state frequency and generation of each unit if B=0.
   (b) Find steady state frequency and generation of each unit if B=1.5. [8+8]

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Code No: 07A70203 **R07** **Set No. 1**

IV B.Tech I Semester Examinations,November 2010
POWER SYSTEM OPERATION AND CONTROL
Electrical And Electronics Engineering

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

Answer any FIVE Questions
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1. The fuel cost for a two unit steam power plant are given by
   $C_1 = 0.1\ P_1^2 + 25\ P1 + 1.6$ Rupees/hour
   $C_2 = 0.1\ P_2^2 + 32\ P2 + 2.1$ Rupees/hour
   Where p's are in megawatt. If there is an error of 1% in the representation of the input data, find the loss in operating economy for a load of 250 MW. [16]

2. The load at receiving end of a three-phase, over head line is 25.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end and the voltage at both the ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has a resistance of 4.5 ohms per phase and inductive reactance (line to neutral) of 20 ohms per phase. [16]

3. (a) Explain the following terms with reference to power plants: Heat input - power output curve, Heat rate input, Incremental input, Generation cost and Production cost.
   (b) What are the methods of scheduling of generation of steam plants? Explain their merits and demerits? [8+8]

4. Describe the objective function is minimize the cost of generation of hydro thermal scheduling. [16]

5. Derive the model of a speed governing system and represent it by a block diagram. [16]

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

7. The two area system has the following data:
   Capacity of area 1, P_{r1} =1000 MW,
   Capacity of area 2, P_{r2} =2000 MW,
   Nominal load of area 1, P_{D1}=500 MW
   Nominal load of area 1, P_{D1}=1500 MW
   Speed regulation of area 1=4%
   Speed regulation of area 2=3%
   Find the new steady state frequency and change in the line flow for a load change of area 2 by 125 MW. For both the areas each percent change in frequency causes 1 percent change in load. Find also the amount of additional frequency drop if the interconnection is lost due to certain reasons. [16]

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8. 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]

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

Answer any FIVE Questions
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1. A power System consists of two, 125 MW units whose input cost data are represented by the equations :
   $C_1 = 0.04\ P_1^2 + 22\ P_1 + 800$ Rupees/hour
   $C_2 = 0.045\ P_2^2 + 15\ P_2 + 1000$ Rupees/hour
   If the total received power $P_R = 200$ MW. Determine the load sharing between units for most economic operation. [16]

2. (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]

3. Draw flow chart for economic scheduling with out considering line losses. [16]

4. Describe the mathematical model of **Speed - Governing** System. [16]

5. Two control areas connected by a tie line have the following characteristics.

Area 1	Area 2
R=0.01 pu	R=0.02 pu
D=0.8 pu	D=1.0 pu
Base MVA=2000	Base MVA=500

   A load change of 100 MW (0.2 pu) occurs in area 1. What is the new steady state frequency and what is the change in the tie flow? Assume both areas were at nominal frequency (60 Hz) to begin. [16]

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

7. A system consists of 4 identical 250 MVA generators feeding a load of 510 MW The inertia constant H of each unit is 2.5 on the machine base. The load varies by 1.4% for a 1 % change in frequency. If there is a drop in load of 10 MW, determine the system block diagram expressing H and B on the base of 1000 MVA. Give the expression for speed deviation, assuming there is no speed governor. [16]

8. In a two plant operation system, the hydro plant is operation for 10 hrs, during each day and the steam plant is to operate all over the day. The characteristics of the steam and hydro plants are
   $C_T = 0.04\ P_{GT}^2 + 30\ P_{GT} + 10$ Rs/hr
   WH $= 0.12\ P_{GH}^2 + 30$ PGH m^3/ sec
   When both plants are running, the power flow from steam plant to load is 150 MW

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and the total quantity of water is used for the hydro plant operation during 10 hrs is 150×10^6 m^3. Determine the generation of hydro plant and cost of water used. Neglect the transmission losses. [16]

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