14AC,1A0945

R13

Code No: 117GQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 2017

POWER SYSTEM OPERATION AND CONTROL

(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define incremental fuel cost and production cost. [2]
b) What is a penalty factor? What is its importance in optimal operation of generators in thermal power stations? [3]
c) What is a pumped storage plant? [2]
d) Name various components of hydroelectric power plant. [3]
e) What are the different components of speed governor mechanism? [2]
f) Write the transfer function of turbine model and represent in a block diagram. [3]
g) What are the assumptions made in dynamic response of uncontrolled case in single area load frequency control? [2]
h) What is meant by tie-line bias control? [3]
i) What is the need of reactive power control in a power system? [2]
j) What is meant by load compensation? [3]

PART-B

(50 Marks)

2.a) Derive an expression for economic distribution of load between generating units including the effect of transmission losses.
b) The fuel cost in Rs/h for a three thermal plants are given by
$F_1 = 350 + 7.2P_{G1} + 0.004P_{G1}^2$, $F_2 = 500 + 7.3P_{G2} + 0.0025P_{G2}^2$, $F_3 = 600 + 6.74P_{G3} + 0.003P_{G3}^2$
P_{G1}, P_{G2}, P_{G3} are in MW. Find the optimal schedule and compare the cost of this to the case when the generators share the load equally if i) P_D=450 MW ii) P_D=800 MW. [5+5]

OR

3.a) Derive general transmission line loss formula and state assumptions made for calculating B- coefficients.
b) The fuel costs of two units are given by
$$F_1 = 1.5 + 20P_{G1} + 0.1P_{G1}^2 \text{ Rs/h} \quad \text{and} \quad F_2 = 1.9 + 30P_{G2} + 0.1P_{G2}^2 \text{ Rs/h}$$
P_{G1}, P_{G2} are in MW. Find the optimal schedule neglecting the losses, when the total demand is 200 MW. [5+5]

4. What is hydrothermal scheduling? Explain the hydro thermal economic scheduling problem. Derive the necessary equations. [10]

OR

5.a) Discuss the advantages of operation of power plants with hydro thermal combinations.

b) In a two plant operation system, the hydro plant is operate for 8 hrs during each day and the steam plant is operate all over the day. The characteristics of the steam and hydro plants are

$C_S = 20 + 30P_S + 0.04P_S^2$ Rs/h and $W_H = 7.5P_H + 0.0012P_H^2$ m^3/sec

When both plants are running, power flow from steam plant to load is 190 MW and the total quantity of water is used for hydro plant operation during 8 hrs is 220×10^6 m^3. Determine generation of hydro plant and cost of water used. Neglect transmission losses. [5+5]

6. Derive transfer function of speed governor and represent its block diagram [10]

OR

7. What is an excitation system? What are its characteristics? Derive its transfer function and represent block diagram [10]

8.a) Show that the steady change in frequency in load frequency control of an isolated power can be reduced to zero if the change in controlling force applied to the speed changer is equal to the change in load demand.

b) Distinguish between load frequency control and economic dispatch control. [6+4]

OR

9.a) Draw the block diagram of load frequency control in two area control system and explain.

b) Determine the primary ALFC loop parameters for a control area with the following data: Total generation capacity = 2500 MW; Normal operating load =1500 MW; 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. [5+5]

10.a) Explain briefly about the shunt and series compensation of transmission systems.

b) A short transmission line having an impedance of (2+j3) ohms interconnects two power stations A and B both operating at 11 kV; equal in magnitude and phase. To transfer 25 MW at 0.8 p.f. lagging from A to B determine the voltage boost required at plant A. [5+5]

OR

11.a) Write short notes on compensated and uncompensated transmission lines.

b) 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. [4+6]

---ooOoo---