

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

ME (EE) First semester final examination 2013

Power System Operation and Control (EE 910)

Time= 3Hrs.

Full Marks: 70

Attempt five questions taking any three questions from group A and any two questions from group B.

Group A

1. (a) What is the difference between standalone system and longitudinal power system?
(b) Briefly describe the state transition diagram and justify its implication.
(c) What is loadability of power transmission lines? How do you determine the loadability of a 400 kV 3 phase power line having surge impedance of 400 ohm per phase when the power angle is 30 degree and line angle is 10 degree electrical? [3+4+7]

2. Two thermal plants A and B are interconnected by a line whose power loss in MW is given by the following equation

$P_l = 0.0002P_A^2$, where P_A and P_B are the power generation of plants A and B respectively. The maximum and minimum generation limits of A and B are 400MW and 70MW for each of these plants. The cost function of both the plants is identical and is expressed by the following expression

$$F(P) = 400 + 7P + 0.002P^2$$

When both the plants are loaded at 250MW and load is 500MW on bus station B, then 12.5MW power is lost in the line. Find where should the extra power be generated for economic operation for a constant load of 500MW on bus of station B? What is the value of line loss at the state of economic operation of both the plants? Attempt a rescheduling to minimize transmission loss and comment on your result. [14]

3. (a) Develop a detail short term hydrothermal scheduling solution with network losses considered. How would you solve the problem using computational methods?

(b) What do you mean by long term and short term hydrothermal scheduling? [4+10]

4. a) What is unit commitment? Explain the concept of unit commitment and state briefly the procedure for solution of unit commitment problem.

b) What do you mean by State transition diagram? What is the function of SCADA in power system control? [10+4]

5. (a) What do you mean by small signal stability problems in power transmission systems?

(b) For a SMIB system develop a small signal stability model using state matrix and explain the implication of the corresponding state equation in determining small signal stability application.

[4+10]

Group-B

6. a) Define 'Black Start' of the grid. State the importance of 'Survival Power' particularly for thermal power station. Is it necessary to provide black start facility against each power station?

b) Explain in detail the Restoration task to be followed in case of partial collapse of grid.

[6+8]

7. a) State the present status of National Grid in India. State the advantages of formation of National Grid.

b) Draw the block diagram of steam turbine Control System. Derive the model transfer function of Speed Governor, Speed Relay & Servo Motor.

[6+8]

8. a) State the Control Specification of an area. Obtain mathematical relation of Area Control Error(ACE).

b) State & explain Load Frequency Control (LFC) of two area system connected by a tie line.

[7+7]

9. a) Define Speed Regulation of a Governor. Show that the amount of load picked up by parallel units depend on the droop characteristics of each unit.

b) What is composite power/frequency characteristics of power system? Show that the composite regulating characteristic of the system is equal to $1/\beta$, where β is the stiffness of the system.

[6+8]