M. E (EE) Ist Semester Examination 2011
Power System Operation & Control
(EE-910)

Time: 3 Hours

Full Marks: 100

Answer any FIVE questions taking at least three from first
half and two from second half

FIRST HALF

1. (a) What is incremental fuel cost?
    (b) What are secondary constraints in economic operation of energy generating sources and what are their implications?
    (c) What is objective function in determination of economic generation schedules of thermal plants? How do you obtain constraint function and apply Lagrangian's method for contained optimization in developing economic operation schedules of thermal units without considering line loss.
    (d) Briefly state the steps of algorithm of the economic operation problem solution using Lagrangian Optimization Method.   1+2+6+2

2.   There are two thermal generators (namely A and B) connected to Bus 1 and 2 respectively. A, being connected to bus 1, transfers power to bus 2 through a transmission lines in which the line ohomic loss is 0.0002 P_1^2 where P_1 is the real power generation of A. Both the generators are loaded at 250MW each and the load is connected at bus 2 where the load demand is 500 MW. Due to transmission loss 12.5 MW of power is lost. Where should the extra 12.5 MW be generated for economic operation. Assume the maximum and minimum real power generation limit of each of the generators are 400 MW and 70 MW respectively. The cost function of both the units is identical and is given by $400 + 7P + 0.002P^2$. Also attempt a rescheduling plan to minimize the transmission loss and comment on your findings.   11

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?
                9+2

4.   (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.   2+9

5   (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?   2+3+6

SECOND HALF

6 a) Obtain the Composite Power / frequency characteristic of Power System and show that the composite regulating characteristic of the system is equal to $1/\beta$ where 'β' is the stiffness of the system.

A 200 MW Turbine-Generator has a regulation parameter 'R' of 4%. If the frequency drops by 0.05Hz but the turbine power must remain unchanged. Calculate the amount of load to be lowered by speed changer.   [7+3]

b)   State the Control specification for a single area case. How supplements control improves the performance of ALFC Loop. Define Area Control error (ACE). Show that the Dynamic response of ALFC Loop depends on the gain of the integrator.   [10]

7 a) State and explain the present status of Indian Power sector.   [10]

b)   State the objective of i) Demand Estimation,   ii) Transmission outage Planning, iii) Demand Management and iv) Operating margin , v) Generation Planning from the operational point of view of National Grid.   [10]

8 a) Obtain mathematical model of speed control system of steam Turbine. Derive the open loop transfer function of the system.   [12]

b)   What is Availability Based tariff ? State the importance of unscheduled Interchange (UI) clause. How it improves the frequency performance of an intercommoned system ?   [8]

9 a) What is Black start ? Is it necessary to provide black start facility against each generating unit? What should be the amount of power required for this purpose?
b) Explain in detail the Restoration task to be followed in case of total collapse of power system.   [8+12]