[06 – 4210]

IV/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

POWER SYSTEM OPERATION AND CONTROL

(Common with Dual Degree in EEE)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR questions from the remaining.

All questions carry equal marks.

1. (a) (i) What do you understand by "Decoupling" in load flow studies?

(ii) Define Penalty factor.

(b) Explain briefly about various aspects of optimal operation of the power system.

(c) Give the importance of automatic generation control and voltage control in the operation of power systems.

(d) What is control area? Distinguish between single area control and two area control.

(e) What is the function of the hydraulic amplifier in the turbine speed governing mechanism?

(f) Name the various stability enhancement methods adopted in power systems.

(g) What do you understand by load frequency control of a two area system?

2. (a) Develop the Decoupled load-flow models with the help of necessary equations and assumptions.

(b) In a 3-bus system, each bus is connected each other with one line between them of a series impedance (0.025 + j 0.085) p.u. and half line charging admittance of 0.01 p.u. Obtain FDLF for one iteration using the following pu. data table.

Bus No.	Bus type	Real Load	Reactive Load	Real Gen	Reactive Gen	Voltage
1	Slack	2.0	1.0	–	–	1.05
2	PQ	1.5	0.6	–	–	1.00
3	PV	0.0	0.0	0.5	–	1.04

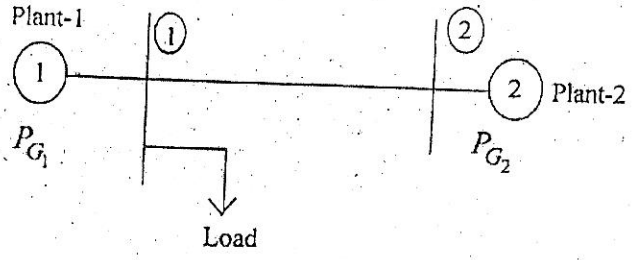
3. (a) Explain what is an optimal power flow problem and derive the expressions for obtaining optimal power schedules when power system losses are taken into consideration.

(b) The incremental cost characteristics of a two plant system shown below are given by :

$$\frac{dC_1}{dP_{G_1}} = 60 + 0.2P_{G_1} \text{ Rs/MWh}$$

$$\frac{dC_2}{dP_{G_2}} = 40 + 0.3P_{G_2} \text{ Rs/MWh}$$

Calculate the optimum generation schedule considering transmission losses to supply a load of 227. 5 MW. It is given that when 100 MW is transmitted from plant 2 to the load, a loss of 10 MW is incurred in the transmission line.



4. (a) Draw a neat sketch of a typical turbine speed governing system and derive its block representation. What is the transfer function of the system?

(b) Two generators rated 400 MW and 600 MW are operating in parallel. The droop characteristics of the governors are 4% and 5% from no-load to full-load respectively. Assume that the machines are operating at 60 Hz on no-load. How would a total load of 1000 MW shared between them? What will be the corresponding system frequency?

5. (a) Discuss in detail the problem formulation of Hydro-thermal co-ordination along with the solution technique.

(b) Describe the power system security analysis.

6. (a) Draw the AGC block diagram of a two area power system and discuss the issues involved in static response of uncontrolled case.

(b) A two area system connected by a tie line has the following parameters on a 1000 MVA base.

Area		1	2
Speed Regulation	R	0.05	0.0626
Frequency-sensitive load coefficient	D	0.6	0.9
Inertia constant	H	5	4
Base power	MVA	1000	1000
Governor time constant	T_g (s)	0.2	0.3
Turbine time constant	T_t (s)	0.5	0.6

The units are operating in parallel at the nominal frequency of 60 Hz. The synchronizing power coefficient based on initial operating condition is P_g = 2.0 p.u. A load change of 187.5 MW occurs in area 1. Determine the new steady state frequency and the change in the tie line flow.

7. (a) Discuss how the reactive power management and the voltage control are related in a power system.

(b) Draw the schematic diagram of a typical voltage regulator and explain its operation.

8. Write short notes on the following :

(a) Application of Sparse techniques to load flow models.

(b) Optimal unit commitment.

(c) Centre of inertia.
