Computer Aided Power System Analysis

Con. 3163-08. **CO-3358**

(REVISED COURSE)

(3 Hours) [Total Marks : 100

MASTER

N.B.(1) Question No. **1** is **compulsory.**
(2) Attempt **four** question's out of **remaining** questions.
(3) **Figures** to the **right** indicates **full** marks.

B.E. (E.E.) VII Elec Comp. Aided Power Syst. Analys

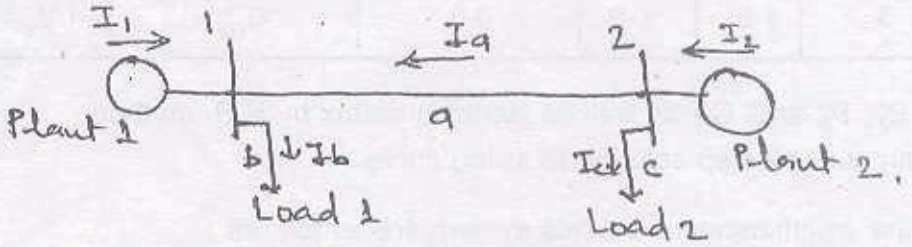
26/5/08

1. Write short notes on :— 20
   (a) Necessity of slack bus.
   (b) Comparison of G.S. and N.R. methods for load flow.
   (c) Physical interpretation of co-ordination equation i.e. penalty factor.
   (d) Assumptions made in transient stability.

2. (a) The **figure** shows a system having to plants 1 and 2 connected to buses 1 and 2 respectively. There are two loads and a network of three branches. The bus 1 is the reference bus with voltage $1{\cdot}0 < 0°$ p.u. The branch currents and impedances are 10

$I_a = 2 - j\,0{\cdot}5$ p.u., $I_b = 1{\cdot}6 - j\,0{\cdot}4$ p.u. , $I_c = 1{\cdot}8 - j\,0{\cdot}45$ p.u.

$Z_a = 0{\cdot}06 + j\,0{\cdot}24$ p.u., $Z_b = 0{\cdot}03 - j\,0{\cdot}12$ p.u., $Z_c = 0{\cdot}03 - j\,0{\cdot}12$ p.u.



Calculate the loss formula coefficient of the system in p.u. and in reciprocal of MW if the bus is 100 MVA.

(b) Incremental fuel costs in rupees per MWh for a plant consisting of two units are : 10

$dc_1 / dP_{G1} = 0{\cdot}20\ P_{G1} + 40$

$dc_2 / dP_{G2} = 0{\cdot}40\ P_{G2} + 30$

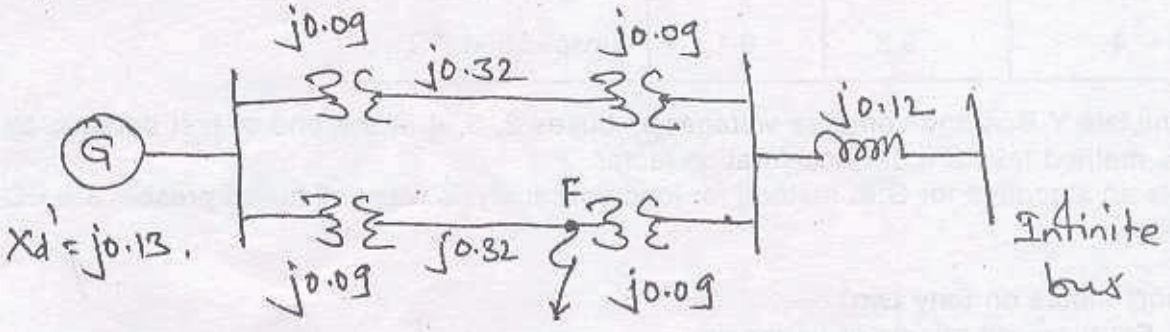
and the generator limits are as follows :

$30\ MW \leq P_{G1} \leq 175\ MW.$

$20\ MW \leq P_{G2} \leq 125\ MW.$

Assume that both units are operating at all times. How will the load be shared between the two units as the system load varies over the full range of the load values ? What are the corresponding values of the plant incremental costs ?

3. (a) Explain equal area criterion to determine stability of a system. 10
   (b) The **figure** shows a transmission network. The p.u. reactances of the equipments are as shown. The voltage behind transient reactance of a generator is 1·10 p.u. and of infinite bus is 1·0 p.u. The system is transmitting 1·0 p.u. power prior to fault at point F. Determine (i) transfer reactance for prefault, during fault, post fault condition. 10
   (ii) Critical clearing angle.



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4. (a) Draw (Don't derive) complete block diagram representation of load frequency control of an isolated power system. Hence explain its steady state analysis. 10

(b) Explain dynamic response of change in frequency for a step change in load of an isolated power system. How dynamic response changes with integral control action ? 10

5. (a) For a 3 bus system, the Y bus matrix is given by : 10

$$Y_{BUS} = \begin{bmatrix} 24{\cdot}23 < -75{\cdot}95 & 12{\cdot}13 < 104{\cdot}04 & 12{\cdot}13 < 104{\cdot}04 \\ 12{\cdot}13 < 104{\cdot}04 & 24{\cdot}13 < -75{\cdot}95 & 12{\cdot}13 < 104{\cdot}04 \\ 12{\cdot}13 < 104{\cdot}04 & 12{\cdot}13 < 104{\cdot}04 & 24{\cdot}23 < -75{\cdot}95 \end{bmatrix}$$

and bus specification and power are as follows :

Bus code	P_D	Q_D	P_G	Q_G	Voltage
1	2·0	1·0	Unspecified	Unspecified	$V_1 = 1{\cdot}04 < 0°$
2	0·0	0·0	0·5	1·0	PQ Bus
3	1·5	0·6	0·0	$Q_{G3} = ?$	$\lvert V_3 \rvert = 1{\cdot}04$ (PV Bus)

Find P_2°, P_3° and Q_2° as well as jacobian matrix by N.R. method.

(b) Explain step by step solution to swing curve. 10

6. (a) The line admittances of a 4 bus system are as follows : 10

Bus code	Admittance
1—2	2—j 8
1—3	1—j 4
2—3	0·666—j 2·664
2—4	1— j 4
3—4	2—j 8

The schedule for active and reactive power is :

Bus code	P_i	Q_i	V
1	—	—	$1{\cdot}06 < 0°$ slack
2	0·5	0·2	unspecified PQ
3	0·4	0·3	unspecified PQ
4	0·3	0·1	unspecified PQ

Formulate Y Bus and compute voltages at buses 2, 3, 4 at the end of first iteration by G.S. method take $\alpha = 1{\cdot}6$ acceleration factor.

(b) Write an algorithm for G.S. method for load flow analysis when all buses present are PQ buses. 10

7. Write short notes on (any **two**) :— 20

(a) Sources and effects of harmonis

(b) Methods of voltage control

(c) Explain fast decoupled method