2002 SCHEME

EE72

Seventh Semester B.E. Degree Examination, Dec 08 / Jan 09
Computer Techniques in Power Systems

ıe: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

a. The bus incidence matrix, A for a network of 8 – elements and 5 nodes (4 – buses) is as given below. Reconstruct the oriented graph. Hence obtain the One – line – diagram of the system indicating the generator – positions. **(06 Marks)**

$A =$

↓Nodes →	Elements 1	2	3	4	5	6	7	8
(1)	1	0	0	0	-1	0	-1	0
(2)	0	1	0	0	1	-1	0	-1
(3)	0	0	1	-1	0	1	0	0
(4)	0	0	0	1	0	0	1	1

b. Derive an expression for finding the bus admittance matrix, Y_{BUS} by Singular Transformation Analysis. **(08 Marks)**

c. Determine Y_{BUS} by Singular transformation for the system with data as below : **(06 Marks)**

Element No.	1	2	3	4	5
Bus Code p – q	0 – 1	1 – 2	2 – 3	3 – 0	2 – 0
Self admittance pn	1.4	1.6	2.4	2.0	1.8

a. Obtain the generalized algorithm equations for finding the elements of Bus – impedance matrix, Z_{BUS} when a coupled branch element is added to its partial network. **(08 Marks)**

b. In 2(a)above, based on the equations derived, arrive at the simplified equations corresponding to the following sub – cases:
   i) Addition of a non – coupled branch element to the reference bus
   ii) Addition of a non – coupled branch element to a non – reference bus.
   iii) Removal of an element (Give only the procedural steps needed). **(06 Marks)**

c. From Z_{BUS} by building algorithms analysis for the system with data as follows, by adding the elements in the sequence : 1 – 2 and 1 – 3. Treat bus – 1 as reference. **(06 Marks)**

Self Impedance		Mutual Impedance	
p - q	z_{pq-pq} (pn)	r – s	z_{pq-rs} (pn)
1 – 2	j 0.5	-	-
1 – 3	j 0.6	1 – 2	j 0.1

a. Discuss on the characteristic features of Iterative methods used for the solution of non – linear and differential equations during power system calculations. **(04 Marks)**

b. Write a note on : i) Classification of buses for load flow studies and ii) Need and importance of slack bus. **(08 Marks)**

c. Using G – S load flow procedure, determine the bus voltages at buses – 2 and 3 of the system shown in figure 3(c) at the end of first iteration. The values shown are pu impedances. **(08 Marks)**

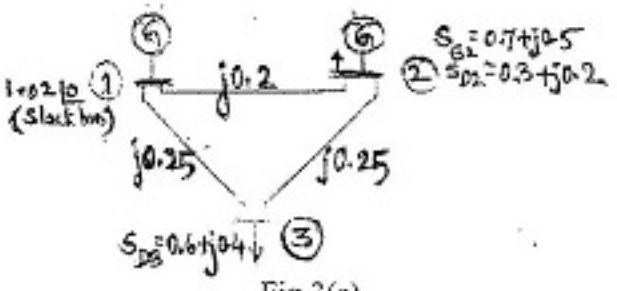

Fig.3(c)

1 of 2

4 a. Establish that the presence of a P-V bus simplifies the order of Jacobian matrix in NRLF solution. Illustrate the same with reference to a sample system of 3 buses with bus – 1, as slack bus, bus – 2 as PV bus and bus – 3 as PQ bus. **(06 Marks)**

b. Listing out the important assumptions involved, explain the Fast – Decoupled load flow method. **(08 Marks)**

c. The table below gives a part of the line data of a 28 – bus power system. The parameters are in pu. Find the element Y_{BUS} (22, 22) of the bus – admittance matrix. **(06 Marks)**

'From' node	'To' node	R	X	B/2	Off – nominal ratio, a
22	8	0.02	j 0.06	j 0.03	1.0
4	8	0.02	j 0.03	j 0.10	1.0
22	4	0.06	j 0.18	j 0.05	1.0
6	22	0	j 0.10	0	0.95

5 a. Explain the equal incremental cost criterion with reference to economic operation of power systems. **(08 Marks)**

b. Given that the Incremental costs of 2 plant – units are $IC_1 = 0.008P_1 + 8.0$ Rs/ MWh $IC_2 = 0.0096P_2 + 6.4$ Rs / MWh. Determine the economic operation schedule and corresponding cost of generation, if the maximum and minimum loading on each unit is 625 MW and 100 MW respectively. The demand is 900 MW and the losses are negligible. **(08 Marks)**

c. Determine the saving in fuel cost in Rs /hr for the economic distribution of the total load of 900 MW between the two units described in part 5(b) above, compared with equal distribution of the same load between the two units. **(04 Marks)**

6 a. With the help of a block diagram, develop the mathematical model of speed governing system of steam turbine used in load frequency control problem. **(10 Marks)**

b. A 100 MW generator is operated on – to an infinite bus network. If the generator has R = 4% (0.04 pu) frequency being 60 Hz, how much will the turbine power increase when the frequency drops by 0.1 Hz, with reference unchanged? If the frequency drops by 0.1 Hz and the turbine power is held constant, then by how much should the reference setting be changed? **(10 Marks)**

7 a. Define steady stat stability and transient stability phenomena. Distinguish between the corresponding power limits. **(06 Marks)**

b. Discuss on the representation of the following for transient stability studies : i) Synchronous machines ii) Loads. **(08 Marks)**

c. Through a flow diagram, provide the procedural steps used for solving swing equation by point by point method. **(06 Marks)**

8 Write brief explanatory notes on any Four of the following :

a. Node elimination used during Z_{BUS} building.

b. Importance of Y_{BUS} in load flow studies.

c. Penalty factors and B – coefficients.

d. Area control errors and Tie line control.

e. Modified Euler's method for solution of equations in stability studies. **(20 Marks)**