

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Computer Techniques in Power System Analysis

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. With neat sketches, explain the following:
 i) Oriented graph
 ii) Basic cut sets
 iii) Tree branch path incidence matrix. (06 Marks)
- b. The bus incidence matrix of 8 elements and 5 nodes is given below. Reconstruct the graph of the network.

n \ b	1	2	3	4	5	6	7	8
A	-1	0	0	0	1	0	1	0
B	0	-1	0	0	-1	1	0	1
C	0	0	-1	1	0	-1	0	0
D	0	0	0	-1	0	0	-1	-1

- c. For the network shown in Fig.Q1(c), obtain the matrices A, B and C. Assume G as reference bus and AB, DF as links. (06 Marks)

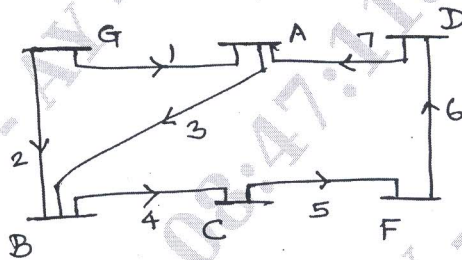


Fig.Q1(c)

(08 Marks)

- 2 a. For the data given below, obtain the YBUS using singular transformation. Take bus 4 as reference bus.

Line	Bus (p - q)	Z _{pu}	Bus (r - s)	Z _{pu}
1	1-2	0.2		
2	2-3	0.3	1-2	0.05
3	3-4	0.4		
4	4-1	0.5		

(10 Marks)

- b. Form the Z_{BUS} for the power system shown in Fig.Q2(b). Select node 1 as reference bus. The line reactances are marked in p.u.

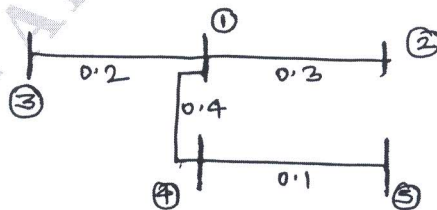


Fig.Q2(b)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 3 a. What is the importance of load flow in power system? Enumerate the data required to carry load flow analysis. (08 Marks)
- b. Following is a system flow data of load flow solution:

Bus code	Admittance
1-2	$2 - jB$
1-3	$1 - j4$
2-3	$0.666 - j2.664$
2-4	$1 - j4$
3-4	$2 - jB$

The schedule of active and reactive power are as follows:

Bus code	P	Q	V	Remarks
1	-	-	1.06	Slack
2	0.5	0	$1.04 + j0$	PV
3	0.4	0.3	-	PQ
4	0.3	0.1	-	PQ

The reactive power constraint at bus 2 is $0.1 \leq Q_2 \leq 1.0$ pu. Determine the voltage at the end of first iteration using Gauss-Seidel iterative method. Assume acceleration factor $\alpha = 1.4$.

(12 Marks)

- 4 a. Explain the fast decoupled load model with stating all the assumptions made. (08 Marks)
- b. In the system shown in Fig.Q4(a), bus 1 is slack bus with a voltage of $V = 1.0 \angle 0^\circ$ pu and at load bus $P = 125$ MW, $Q = 60$ MVA. The line impedance are $(0.15 + j0.19)$ pu on the base of 100 MVA, using Newton-Raphson method obtain $|V|$ and δ upto first iteration.



Fig.Q4(a)

(12 Marks)

PART - B

- 5 a. What is the need of economic operation of power systems? Explain four types of performance curves used for economic generation scheduling. (10 Marks)
- b. The fuel cost functions for the three plants in Rs./hr are given by
- $$F_1 = 0.004 PG_1^2 + 5.3 PG_1 + 500$$
- $$F_2 = 0.006 PG_2^2 + 5.5 PG_2 + 400$$
- $$F_3 = 0.009 PG_3^2 + 5.8 PG_3 + 200$$
- where PG_1, PG_2, PG_3 are in MW. Find the optimal dispatch and total cost, when the total load is 975 MW, with the following generator limits
- $$100 \text{ MW} \leq PG_1 \leq 450 \text{ MW}; \quad 100 \text{ MW} \leq PG_2 \leq 350 \text{ MW}; \quad 100 \text{ MW} \leq PG_3 \leq 225 \text{ MW}.$$
- (10 Marks)
- 6 a. What are B-coefficients? Obtain the expressions for the transmission loss coefficients for a 3 bus system. (10 Marks)
- b. A power system having two plants 1 and 2 connected to the buses 1 and 2 respectively as shown below. There are two loads and four branches. The ref bus with a voltage of $1.0 \angle 0^\circ$ pu is shown in the diagram. The branch currents and impedances are:
- $$I_a = (2 - j0.5) \text{ pu} \quad I_b = (1.6 - j0.4) \text{ pu}$$
- $$I_c = (1 - j0.25) \text{ pu} \quad I_d = (3.6 - j0.9) \text{ pu}$$
- $$Z_a = (0.015 + j0.06) \text{ pu} = Z_b \quad Z_c = (0.01 + j0.04) \text{ pu} = Z_d$$
- Calculate the loss coefficients of the system in pu, if the base MVA is 100 MVA. (10 Marks)

- 7 a. With the help of a flow chart, explain the method of finding the transient stability of a given power system using Runge Kutta method. (10 Marks)
- b. Consider a system having the following parameters. $p_m = 3.0$ pu, $\gamma_1 p_m = 1.2$ pu, $\gamma_2 p_m = 2.0$ pu, $H = 3.0$, $f = 60$ Hz, $\Delta t = 0.02$ sec, $p_e = 1.5$ pu. Determine the rotor angle and angular frequency at the end of 0.02 second using modified Euler's methods. (10 Marks)
- 8 a. Explain the following:
- i) Network performance equations
 - ii) Load models employed for stability studies
- (10 Marks)
- b. Explain various methods employed for improving the transient stability. (10 Marks)
