

Appendix A

Data For IEEE 30-Bus Test System (At 100 MVA Base)

The IEEE 30-bus system is depicted by Fig.A.1. The reference [101] is the source of this data. The buses are renumbered. The data has been presented by following tables.

Table A.1: Bus Data for Generator

Bus No.	Scheduled real power generation P_G (MW)	Specified Voltage magnitude $V_{\text{spec.}}$ (p.u.)	Load	
			Real (MW)	Reactive (MVAR)
1(slack)	—	1.060	00.00	00.00
2	40.0	1.045	21.70	12.70
3	20.0	1.010	0.00	30.00
4	—	1.082	30.00	0.0
5	—	1.010	9.42	19.00
6	—	1.071	0.0	0.0

Table A.5: Line Data

Line no.	From bus	To bus	Series impedance		Shunt susceptance $\frac{1}{2}B(\text{p.u.})$
			Resistance (p.u.)	Reactance (p.u.)	
5	2	5	0.0472	0.1983	0.0209
6	2	13	0.0581	0.1763	0.0187
7	11	13	0.0119	0.0414	0.0045
8	5	12	0.0460	0.1160	0.0102
9	13	12	0.0267	0.0820	0.0085
10	13	3	0.0120	0.0420	0.0045
11	1	2	0.0192	0.0575	0.0264
12	1	27	0.0452	0.1852	0.0204
13	7	8	0.0000	0.1100	0.0000
14	2	11	0.0570	0.1737	0.0184
15	9	14	0.1231	0.2559	0.0000
16	9	15	0.0662	0.1304	0.0000
17	9	16	0.0945	0.1987	0.0000
18	14	15	0.2210	0.1997	0.0000
19	16	17	0.0824	0.1923	0.0000
20	15	18	0.1070	0.2185	0.0000
21	18	19	0.0639	0.1292	0.0000
22	19	20	0.0340	0.0680	0.0000
23	8	20	0.0936	0.2090	0.0000
24	8	17	0.0324	0.0845	0.0000
25	8	21	0.0348	0.0749	0.0000
26	8	22	0.0727	0.1499	0.0000
27	21	22	0.0116	0.0236	0.0000
28	15	23	0.1000	0.2020	0.0000
29	22	24	0.1150	0.1790	0.0000
30	23	24	0.1320	0.2700	0.0000
31	24	25	0.1885	0.3292	0.0000
32	25	26	0.2544	0.3800	0.0000

...continued

Line no.	From bus	To bus	Series impedance		Shunt susceptance $\frac{1}{2}B(\text{p.u.})$
			Resistance (p.u.)	Reactance (p.u.)	
33	25	10	0.1093	0.2087	0.0000
34	27	11	0.0132	0.0379	0.0042
35	10	29	0.2198	0.4153	0.0000
36	10	30	0.3202	0.6027	0.0000
37	29	30	0.2399	0.4533	0.0000
38	3	28	0.0636	0.2000	0.0214
39	13	28	0.0169	0.0599	0.0065
40	9	6	0.0000	0.1400	0.0000
41	7	4	0.0000	0.2080	0.0000

Table A.2: Generator Data

Gen. no.	Real generation limit		React. generation limit	
	Maximum (MW)	Minimum (MW)	Maximum (MVAR)	Minimum (MVAR)
1	300.0	50.0	150.0	−100.0
2	150.0	20.0	50.0	−40.0
3	150.0	20.0	40.0	−10.0
4	—	—	24.0	−06.0
5	—	—	40.0	−40.0
6	—	—	24.0	−06.0

Table A.3: Load Bus Data

Bus No.	Load		External shunt susceptance(p.u.)
	Real(MW)	Reactive(MVAR)	
7	0.0	0.0	0.00
8	5.8	2.0	0.00
9	11.2	7.5	0.00
10	0.0	−0.0	0.19
11	7.6	1.6	0.00
12	22.8	10.9	0.00
13	0.0	0.0	0.00
14	6.2	1.6	0.00
15	8.2	2.5	0.00
16	3.5	1.8	0.00
17	9.0	5.8	0.00
18	3.2	0.9	0.00
19	9.5	3.4	0.00
20	2.2	0.7	0.00
21	17.5	11.2	0.00
22	0.0	0.0	0.00
23	3.2	1.6	0.00
24	8.7	6.7	0.043
25	0.0	0.0	0.00
26	3.5	2.3	0.00
27	2.4	1.2	0.00
28	0.0	0.0	0.00
29	2.4	0.9	0.00
30	10.6	1.9	0.00

Table A.4: Transformer Data

Line no.	From bus	To bus	Series impedance		Tap settings
			Resistance (p.u.)	Reactance (p.u.)	
1	13	07	0.0000	0.2080	0.978
2	13	08	0.0000	0.5560	0.969
3	11	09	0.0000	0.2560	0.962
4	28	10	0.0000	0.3960	0.968

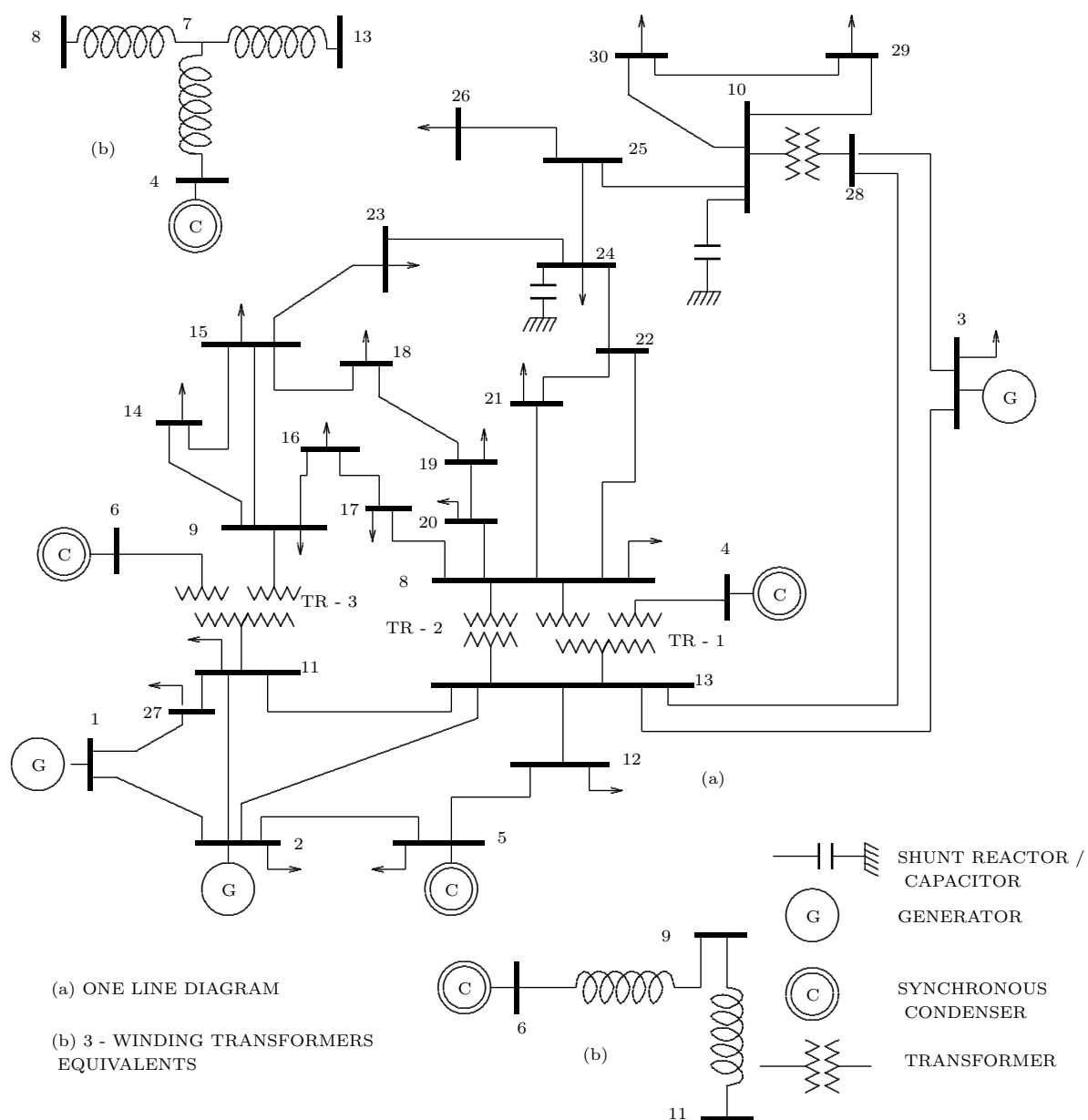


Figure A.1: IEEE 30-bus system

Appendix B

Data For 75-Bus UPSEB System (At 100 MVA Base)

The 75-bus UPSEB system is shown in Fig. B.1. The system data is taken from U.P. State Electricity Board and buses are renumbered. The relevant data are provided in following tables.

Table B.3: Transformer Data

Line no.	From bus	To bus	Series impedance		Tap settings
			Resistance (p.u.)	Reactance (p.u.)	
1	17	1	.00073	.01460	1.000
2	16	2	.00123	.02469	1.000
3	18	3	.00000	.02917	1.000
4	28	4	.00306	.06135	1.000
5	31	5	.00235	.04710	1.000
6	32	6	.00514	.10285	1.000
7	33	7	.00549	.10978	1.000
8	34	8	.00000	.04860	1.000
9	35	9	.00049	.01943	1.000
10	24	10	.00243	.04860	1.000
11	40	11	.00770	.02720	1.000
12	41	12	.00016	.00591	1.000

... continued

Line no.	From bus	To bus	Series impedance		Tap settings
			Resistance (p.u.)	Reactance (p.u.)	
13	42	13	.00030	.01199	1.000
14	43	14	.00000	.02841	1.000
15	44	15	.00000	.02273	1.000
16	19	20	.00130	.05208	1.000
17	19	20	.00130	.05208	1.000
18	17	16	.00065	.02604	1.000
19	22	25	.00130	.05208	1.000
20	22	25	.00130	.05208	1.000
21	23	24	.00130	.05200	1.000
22	23	24	.00130	.05200	1.000
23	26	27	.00130	.05200	1.000
24	26	27	.00130	.05200	1.000
25	29	30	.00129	.05208	1.000
26	29	30	.00129	.05208	1.000
27	29	30	.00129	.05208	1.000
28	36	37	.00130	.05208	1.000
29	36	37	.00130	.05208	1.000
30	38	39	.00130	.05208	1.000
31	45	44	.00112	.04444	1.000
32	45	44	.00112	.04444	1.000

Table B.1: Generator Data

Bus No.	Scheduled real power gen. P_G (MW)	Specified Voltage magnitude $V_{\text{spec.}}$ (p.u.)	Real power limits		Reactive power limits	
			Maximum (MW)	Minimum (MW)	maximum (MVAR)	Minimum (MVAR)
1(slack)	—	1.030	900.0	100.0	400.0	0.0
2	260.0	1.030	300.0	100.0	96.0	0.0
3	180.0	1.050	200.0	40.0	83.0	0.0
4	100.0	1.030	170.0	40.0	60.0	0.0
5	180.0	1.050	240.0	00.0	31.0	0.0
6	120.0	1.050	120.0	00.0	20.0	0.0
7	060.0	1.050	100.0	00.0	19.0	0.0
8	080.0	1.050	100.0	20.0	68.0	0.0
9	550.0	1.050	570.0	60.0	250.0	0.0
10	080.0	1.020	120.0	30.0	56.0	0.0
11	109.0	1.020	200.0	40.0	105.0	0.0
12	1800.0	1.050	1800.0	1800.0	344.0	0.0
13	900.0	1.050	900.0	900.0	280.0	0.0
14	150.0	1.030	150.0	150.0	84.0	0.0
15	454.0	1.010	454.0	454.0	35.0	-30.0

Table B.2: Load Bus Data

Bus No.	Load		Line Reactors in(MVAR)
	Real(MW)	Reactive(MVAR)	
16	-58.69	27.56	
17	0.00	0.00	100.0
19	0.00	0.00	50.0
20	156.37	33.93	
22	0.00	0.00	50.0
23	0.00	0.00	100.0
24	227.95	40.53	
25	210.48	43.43	
26	0.00	0.00	163.0
27	306.00	40.70	
28	127.75	28.35	
29	0.00	0.00	100.0
30	226.46	44.24	
32	78.11	11.59	
34	81.70	83.84	
35	0.00	0.00	50.0
36	0.00	0.00	50.0
37	144.28	40.93	
39	85.12	29.46	
41	0.00	0.00	223.0
42	1000.0	0.0	63.0
46	156.32	83.36	
47	74.55	8.77	
48	50.83	13.97	
49	85.72	51.58	
50	202.10	74.94	
51	57.76	0.62	

Table ... Contd.

Table B.2 (Contd.) ...

Bus No.	Load		Line Reactors in(MVAR)
	Real(MW)	Reactive(MVAR)	
52	98.27	-18.15	
53	82.63	-0.33	
54	161.95	29.00	
55	274.23	31.08	
56	140.28	34.32	
57	152.78	18.53	
58	94.19	11.29	
59	121.89	11.01	
60	74.20	7.42	
61	106.50	6.58	
62	100.18	18.13	
63	58.01	5.31	
64	56.79	13.33	
65	147.84	12.81	
66	31.74	15.18	
67	96.43	10.55	
68	42.87	33.60	
69	55.94	32.53	
70	23.34	2.30	
71	91.73	21.36	
72	52.52	11.76	
73	477.0	00.0	50.0
74	288.0	0.0	283.0
75	-444.0	0.0	

Table B.4: Line Data

Line no.	From bus	To bus	Series impedance		Shunt susceptance
			Resistance (p.u.)	Reactance (p.u.)	$\frac{1}{2}B$ (p.u.)
33	16	46	.01620	.07760	.07015
34	16	46	.01620	.07760	.07015
35	16	50	.02979	.14238	.12881
36	16	50	.02979	.14238	.12881
37	16	50	.02979	.14238	.12881
38	17	19	.00468	.04770	.62450
39	17	23	.00785	.07990	1.04738
40	19	26	.00294	.02997	.39206
41	47	50	.01093	.05221	.18892
42	47	67	.00662	.03164	.11451
43	24	27	.00505	.02416	.08730
44	24	54	.02582	.12342	.11164
45	24	54	.02582	.12342	.11164
46	25	43	.01270	.06410	.05220
47	54	28	.01060	.05060	.18320
48	28	43	.00580	.02900	.02370
49	28	56	.00370	.01780	.06440
50	56	30	.00490	.02370	.08590
51	30	57	.00750	.03840	.03110
52	53	30	.00679	.03412	.02782
53	53	61	.00666	.03390	.02672
54	30	61	.01440	.07310	.05850
55	57	58	.00670	.03390	.02670
56	57	59	.00583	.02956	.02346
57	59	39	.01410	.07180	.05700
58	39	31	.01440	.07250	.05900
59	54	63	.00990	.05090	.04010
60	55	63	.00780	.03980	.03140

Table ... Contd.

Table B.4 (Contd.) ...

Line no.	From bus	To bus	Series impedance		Shunt susceptance $\frac{1}{2}B$ (p.u.)
			Resistance (p.u.)	Reactance (p.u.)	
61	61	62	.01160	.05830	.04750
62	62	32	.01380	.07000	.0563
63	62	32	.01380	.07000	.0563
64	35	36	.00479	.04880	.63614
65	46	37	.01732	.08784	.06973
66	19	36	.00254	.02584	.33798
67	17	35	.00051	.00517	.06760
68	40	48	.00830	.04240	.03340
69	74	41	.00927	.09429	1.23293
70	74	41	.00833	.08478	1.10855
71	26	41	.00823	.08375	1.09503
72	48	49	.00930	.04750	.03740
73	49	40	.01330	.06680	.05420
74	38	29	.00370	.03762	.48870
75	38	22	.00325	.03307	.43264
76	18	47	.00437	.02552	.09399
77	30	65	.00248	.01186	.04294
78	41	42	.00031	.00310	.04056
79	42	74	.00918	.09306	1.21680
80	23	74	.00015	.00155	.02704
81	24	67	.00124	.00593	.02147
82	18	68	.00336	.01963	.01808
83	18	71	.01344	.07852	.07230
84	27	68	.01344	.07852	.07230
85	27	71	.00336	.01963	.01808
86	43	58	.01315	.06696	.05278
87	43	56	.00499	.02397	.08523
88	55	44	.01996	.09588	.08523

Table ... Contd.

Table B.4 (Contd.) ...

Line no.	From bus	To bus	Series impedance		Shunt susceptance $\frac{1}{2}B$ (p.u.)
			Resistance (p.u.)	Reactance (p.u.)	
89	55	44	.01996	.09588	.08523
90	73	45	.00121	.01109	.72815
91	29	22	.00260	.02646	.34610
92	21	65	.00083	.00396	.01431
93	34	54	.03540	.17020	.15130
94	34	54	.03540	.17020	.15130
95	39	33	.01410	.07180	.05700
96	39	33	.01410	.07180	.05700
97	31	32	.00050	.00253	.00805
98	20	40	.01160	.05880	.04710
99	20	40	.01160	.05880	.04710
100	21	30	.00695	.03500	.02843
101	28	55	.01998	.10127	.08051
102	35	41	.00031	.00310	.04056
103	37	69	.01212	.06100	.04956
104	25	60	.01660	.08430	.06720
105	51	52	.01550	.07940	.06300
106	20	64	.01830	.09270	.07390
107	70	72	.00878	.04430	.03580
108	20	66	.01325	.06667	.05416
109	29	75	.00051	.00517	.06760
110	26	22	.00650	.06617	.86521
111	23	29	.00806	.08169	1.06808
112	74	73	.00559	.05686	.74354
113	25	72	.01598	.08108	.06436
114	27	51	.01600	.08100	.06440



Appendix C

Curriculum Vitae

Umesh L Makwana, Associate Professor,
Electrical Engineering Department,
L D College of Engineering,
Ahmedabad
Gujarat, India

Educational Qualification

Sr. No	Degree	University	Result	Year of Passing	Specialization
1	M.E (Electrical)	Faculty of Tech. & Engg. M S University of Baroda, Vadodara	71.10 % Distinction	July,2008	Electrical Power Engineering
2	B.E.(Electrical)	L.E. College, Morbi, Saurashtra University	66.00 % Distinction	July, 1993	Power system