

Ans 1.

	Bus 1	Bus 2
Line 1	0.454	-0.303
Line 2	0.454	0.696
Line 3	0.545	0.303

Ans 2.

Initial flow Gen 1= 160 MW

Base Case:

Forward Gen 1= 285 MW

Backward Gen 1= -125MW

Line Number	From Number	To Number	Circuit	X	Lim A MVA	Forward Overload	Backward Overload	Forward	Backward
						Gen 1	Gen 1	Capacity	Capacity
						(MW)	(MW)	(MW)	(MW)
Base Case						285	-125	125	-285
1	1	2	1	0.06	200	200	-55	40	-215
2	1	3	1	0.24	200	200	-125	40	-285
3	2	3	1	0.18	80	300	-120	140	-280
4	2	4	1	0.18	100	300	-120	140	-280
5	2	5	1	0.12	150	215	-140	55	-300
6	2	6	1	0.06	200	220	-40	60	-200
7	3	4	1	0.03	100	280	-90	120	-250
8	4	5	1	0.24	60	275	-155	115	-315
9	7	5	1	0.06	200	285	-200	125	-360
10	6	7	1	0.24	200	285	-255	125	-415
11	6	7	2	0.24	200	285	-255	125	-415

Implies, UTC= 40MW as minimum of all modulus values including forward and backward is 40MW.

Ans 3.

	1	2	3	4	5	6	7
1	0.8108	-0.0314	0.1799	0.1362	0.0105	-0.0210	
2	0.1892	0.0314	-0.1799	-0.1362	-0.0105	0.0210	
3	-0.0180	0.0524	-0.2998	-0.2270	-0.0175	0.0349	
4	0.0105	0.0664	-0.2130	-0.2875	-0.0221	0.0442	
5	0.3789	0.3999	0.2951	0.2672	-0.1333	0.2666	
6	0.4395	0.4500	0.3976	0.3836	0.1834	-0.3667	
7	0.1711	0.0838	0.5204	-0.3632	-0.0279	0.0559	
8	0.1816	0.1502	0.3073	0.3493	-0.0501	0.1001	
9	0.5605	0.5500	0.6024	0.6164	0.8166	0.3667	
10	0.2197	0.2250	0.1988	0.1918	0.0917	0.3167	
11	0.2197	0.2250	0.1988	0.1918	0.0917	0.3167	
12							

Ans 4.

For an outage of the line between 4 → 5, the LODF for the line 1→2 is: 0.2093

Ans 5.

For a double outage of 4→5 and 2→ 6,

the LODF for 1→2 is: $d^8_1 = 0.2093$ $d^6_1 = -0.0571$ $d^6_8 = 0.2730$ $d^8_6 = 0.3333$

$$\Rightarrow \text{lodf} = [d^8_1, d^6_1] * [1, -d^6_8 ; -d^8_6, 1] - 1 = [0.2093 \quad -0.0000]$$

\Rightarrow found using MATLAB, result may vary if found manually.

Ans 6.

line	OTDF
1	0.8429