Mansoura University
Faculty of Engineering
Dept. of Electrical Engineering
Power System 4

Fourth grade
Final Exam
Time: 3 hours for 2 part
Date: 22 – 1 - 2013

طلبة قديم والطلاب من الخارج

Please, Attempt All the following Questions, Exam is in 2 pages

Question 1 [20 marks]

(a) Show how to perform the contingency analysis using sensitivity analysis, use flowchart or algorithm to explain your answer.

(b) For the system shown in Figure 1, the generation shift factor and line outage distribution factor are listed in Table 1 and Table 2, respectively. Bus 1 is the slack bus.

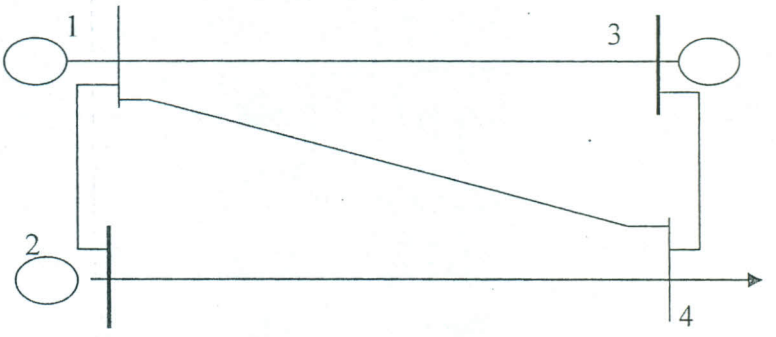

Figure 1

Table 1. Generation Shift Factor

	Bus 2	Bus 3
L=1 (bus 1 – bus 2)	-0.5	0.3
L=2 (bus 1 – bus 3)	-0.3	-0.2
L=3 (bus 1 – bus 4)	0.1	-0.15
L=4 (bus 2 – bus 4)	0.2	-0.3
L=5 (bus 3 – bus 4)	0.15	0.05

Table 2. Line Outage distribution facto

	k=1 (bus 1 – bus 2)	k=2 (bus 1 – bus 3)	k=3 (bus 1 – bus 4)	k=4 (bus 2 – bus 4)	k=5 (bus 3 – bus 4)
L=1 (bus 1 – bus 2)	X	-0.6	-0.5	0.7	-0.1
L=2 (bus 1 – bus 3)	0.5	X	-0.25	0.3	0.05
L=3 (bus 1 – bus 4)	0.4	-0.2	X	0.05	-0.1
L=4 (bus 2 – bus 4)	-0.2	-0.5	0.15	X	-0.1
L=5 (bus 3 – bus 4)	-0.3	0.3	-0.2	0.1	X

i. **If the original flow at line L5 connecting bus 3 to bus 4 equals 150 MW, calculate the change in all the system lines when the line, L5 goes out of service.**

ii. **if the flow at the line L4equals to 290 MW. What actions could be taken to force the flow at line L4 to be 260 MW only? If the output of G2 equals 250 MW and the output of G3 equals to 190 MW. G2 has a maximum generation of 400 MW and minimum generation of 50 MW. G3 has a maximum generation of 450 MW and a minimum generation of 80 MW.**

Question 2 [20 marks]

(a) **What are the types of state estimation, list them with the equation used to solve each type.**

(b) **You are given the following network with meters at locations as shown in Figure 2. Line impedances (per unit) are as follows: X_{12}= 0.25, X_{13}=0.35, X_{24}=0.45 and X_{34} = 0.1. While measurements values (MW) are as follows: M_{12} = 21.4, M_{31}= 71.9, M_{34}=20.5, and M_{42}=69. Measurement errors are as follows: σ_{12}=0.015, σ_{31}=0.01, σ_{34}=0.01, and σ_{42}=0.015. Solve for θ_1, θ_3 and θ_4 considering θ_2 as a reference. Then find the flow in all lines.**

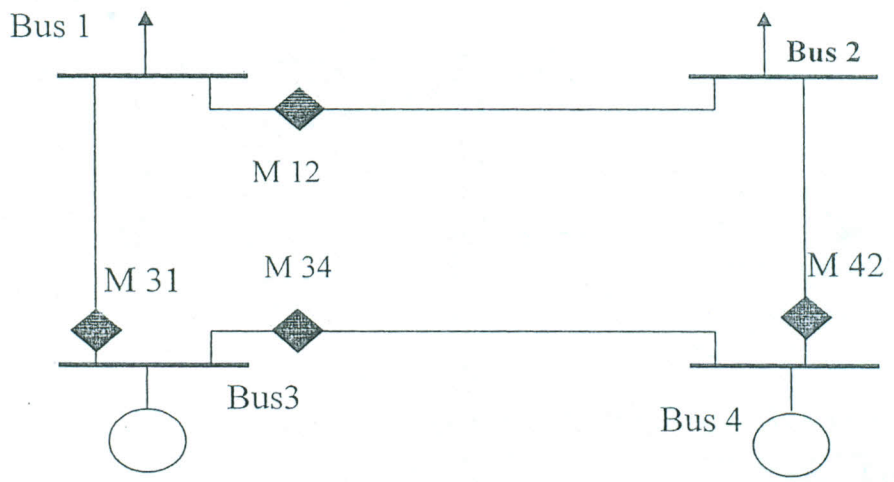

Figure 2

Question 3 [15 marks]

(a) **What are the possible market models? Draw each of them showing the main feature of each model.**

(b) **Define the short run marginal cost and the long run marginal cost and the difference between them.**

(c) **State the Ramsey pricing for several groups of consumers. And what we are using it for?**

(d) **What are the supply side options and the demand side options?**

With my best Wishes
Dr. Sahar Kaddah

MANSOURA UNIVERSITY- FACULTY OF ENGINEERING
ELECTRICAL ENGINEERING DEPARTMENT
EXAMINATION OF
POWER SYSTEM ANALYSIS [4- OLD]
TIME OF EXAMINATION THREE HOURS
DATE OF EXAMINATION 15\ 1\ 2013

ANSWER THE FOLLOWING QUESTIONS:- *PARTR I*

Q-1) *The one line diagram of an unloaded power system is shown in fig.1 Reactance of the two sections of transmission line are shown on the diagram. The generators and transformers:-*
Generator 1:20,000 kva, 6.9kv, X" = 0.15 per unit
Generator 2:10,000 kva, 6.9kv, X" = 0.15 per unit
Generator 3:30,000 kva, 13.8kv, X" = 0.15 per unit
Transformer T_1: 25,000 kva, 6.9Δ-115Ykv, X-10%
Transformer T_2 :12,,500 kva, 6.9Δ-115Ykv, X-10%
Transformer T_3 :single-phase units each rated 10,000 kva, 7.5-75kv, X=10%
Draw the impedance diagram with all reactances marked in per unit and with letters to indicate points corresponding to the out line diagram.
Choose a base of 30,000kva, 6,9kv in the circuit of generator 1.

Q-2) *Write the node equations necessary to solve for the voltages of the busses of Fig. 2. The capacitors of the circuit are such that :*

$$Y_g = Y_h = Y_j = j0.05 \text{ per unit ;}$$

$$Y_f = -j0.91pu,\ Y_i = -j1.0pu,\ Y_k = j1.05 \text{ per unit}$$

Q-3) *Incremental fuel costs in dollars per mega-watt hour for two units comprising a plant are given by the following equations:*

$$df_1 / dp_1 = 0.010p_1 + 2.0$$
$$df_2 / dp_2 = 0.012p_1 + 1.6$$

Assume the both units are operating at all times, the total load varies from 50 to 250 mw, and the maximum and minimum loads on each unit are to be 125 and 20 mw, respectively. Find the incremental fuel cost .

انظر الورقة الخلفية ←

Q-4)Formulate the static for single electrical; for the following cases:-

a) the simple electrical system consisting of a generator connected to bus bar;

b) two electrical stations (two electrical generators') of about the same capacity operate on a common load;

c) an electrical station (equivalent generator) connected through a transmission line to the load.

1- characteristics of the load;
2- equivalent circuit of the system;
3- steady-state stability criterion;
4- critical condition criterion;
5- conditions of approach to the electrical point.

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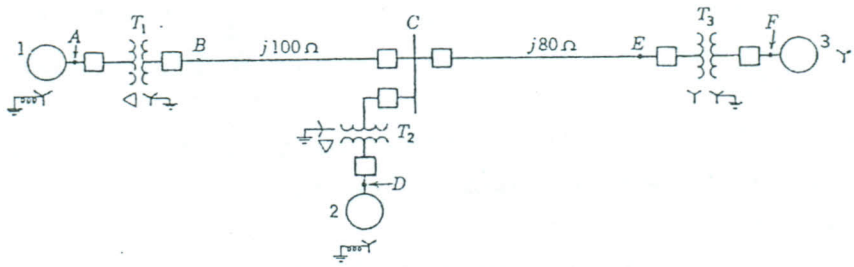

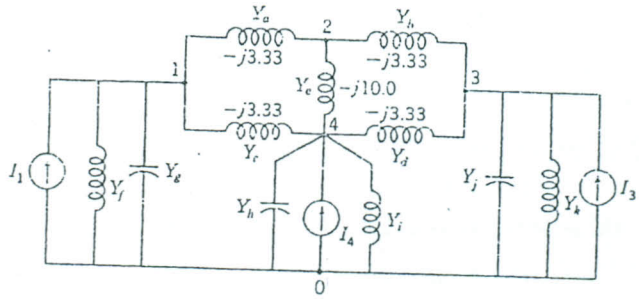

A.M.M. Aly