Minoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Examination
Academic Year: 2014-2015
Cod No.:

Electrical Engineering Department
Subject: Optimal Operation for Electrical Power Systems
Second Semester Year of Doctor Science
Time Allowed: 3 hours
Date: 11 / 6 /2015
Total Marks: 100

Answer the following questions:

1- a) Defind the follows :

Security – Classical and modern power dispatch - Load forecasting - Emergency conditions. **(5 Marks)**

b) Find the types of power reserve in the electrical power stations **(10 Marks)**

c) Write the different generation cost functions in power system. **(10 Marks)**

2- The line data, power injection and generation data for a sample power system shown in Fig. 1 are presented in tables 1-3. Calculate the following:

a) Admittance matrix and impedance matrix. **(10 Marks)**

b) The sensitivity power flow coefficients related to the power generations (A and D-coefficients). **(15 Marks)**

c) The optimal power dispatch using the linear programming technique. **(20 Marks)**

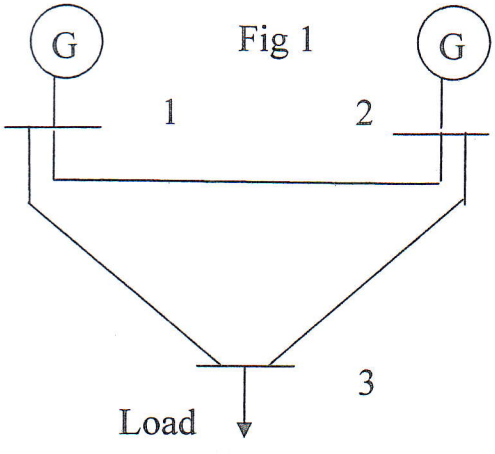

Fig 1

Table 1 Line data

Code bus	Impedance (p.u)	Half line charging	Initial flow (Mw)	Max.flow (Mw)
1-2	0.08 +J0.24	0.025	5	8
1-3	0.02+J0.06	0.020	47	45
2-3	0.06+J0.18	0.030	36	38

Table 2 Power injection

Code bus	Power injection		Initial volt
	MW	MVA	
1	52	-30	1.06
2	32	-22	1.02
3	-80	56	.976

Table 3 Power generation data

Code bus	Min limit MW	Max limit MW	Ramp rate in 10 mint MW	Cost function
1	20	70	7.0	$.025P_1^2 + 2.1\ P_1+30$
2	10	50	5.0	$0.03P_2^2+1.8P_2+25$
Total loads + losses = 84 Mw				
MVA_{base} = 100 , KV_{base} = 110				

3-a) Defined the follows:

Reliability limit – Stability limit – Different type of power system operation. **(5 Marks)**

b) Rank the bus voltages and the transmission lines, according to their severity on the power system which has sex buses and seven lines. The data of bus voltages and power flows are shown in Tables 4 and 5.

(10 Marks)

Table 4 Bus voltages data.

Bus No.	Bus voltages (P.U.)
1	1.01
2	0.96
3	0.93
4	1.03
5	1.02
6	0.97

Table 5 Lines data

Line No.	Max. Limits (MW)	Power flow (MW)
1	17	15
2	27	29
3	7	8
4	37	33
5	67	72
6	12	12
7	57	52

4- a) When does the operator use the load shedding procedure?

(5 Marks)

b) What are the objective functions and constraints for the load shedding procedure?.

(10 Marks)