Menoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Examination
Academic Year: 2012-2013
Date: 11/6/2013

Department: Electrical Engineering
Year: 3rd Year
Time allowed: 3 Hours
Course Title/Code: Optimization methods in electric power systems. (Elective Course 4) / ELE 322B

Allowed Tables and Charts: None

Answer the following questions: [100Mark]

Question (1) [23Mark]

(a) Define: (3Mark)

Optimization– Incremental fuel rate– Economic Power dispatch.

(b) The incremental costs for a plant consisting of three units are: (20Mark)

$df_1/dp_1 = 0.03\ P_1 + 6$ \$/MWh

$df_2/dp_2 = 0.09\ P_2 + 3$ \$/MWh

$df_3/dp_3 = 0.02\ P_3 + 4$ \$/MWh

Assume the total load varies from 150 to 450 MW with step 50 MW and the power output limits are $50 \le P_1 \le 100$ MW and $40 \le P_2 \le 100$ MW. Find the incremental fuel cost of the plant and the allocation of load between units for the minimum cost of operation.

Question (2) [25Mark]

(a) State the mathematical formulation of multi-objective environmental/economic power dispatch problem. Then show how to use Ɛ-constraint method to find optimal solutions of this problem. Take No_x objective function as the primary objective function. (10Mark)

(b) A power system has two thermal generating units with parameters: (15Mark)

$a_1 = 4.036 * 10^{-3}$ $a_2 = 4.812 * 10^{-3}$

$b_1 = 5.93$ $b_2 = 6.02$

Given that this system has the following *B*-coefficients,

$B_{11} = 3.95 * 10^{-4}$ $B_{22} = 4.63 * 10^{-4}$

and the total generated power from the two units is 700 MW, Calculate:

1. The incremental fuel cost
2. Efficiency of the system

Question (3)

[26Mark]

(a) Write short notes about: (6Mark)

Regression analysis– Load curve– Load forecasting classifications– Extrapolation technique.

(b) The yearly demand for a system is tabulated below: (20Mark)

Year	2005	2006	2007	2008	2009	2010	2011
Peak Demand (MW)	151.2	164.7	177.3	188.1	200.7	211.5	220.5

Project the load up to 2015 using the following analytical function:

$P_{Di} = e^{(a+bX_i+cX_i^2)}$

Question (4)

[26Mark]

(a) Discuss: (6Mark)

The constraints of unit commitment problem - The difference between economic power dispatch problem and unit commitment problem.

(b) A power system has 3 thermal generating units with parameters listed in the table below. Determine the most economical units to be committed for a load of 4 MW. Let the load change be in step of 1 MW. The cost function equation is: $F_i(x) = a_i P_i^2 + b_i P_i + c_i$ and the power of each unit varies from 1.0 MW to 5.0 MW. Use Dynamic programming method. (20Mark)

Units	Cost curve coefficients		
	a_i	b_i	c_i
1	0.77	47.0	50
2	1.60	53.0	50
3	2.00	60.0	50

Good Luck, *Dr. Shaimaa Rabah*

ملحوظة:هذا الجدول خاص بالجوده ولا يعني الطالب

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	a1-1, a13-1, a23-1	b1-1, b7-1, b13-1, b16-1, b16-2	C7-1, c17-1,	