Menoufiya University Faculty of Engineering Shebin El-Kom Second Semester Examination Academic Year: 2013-2014 Date: 10/6/2014	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) [26Mark]

(a) **Explain the economic power dispatch problem.** (6Mark)

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

$$F_1 = 6P_1 + 0.015P_1^2$$

$$F_2 = 3P_2 + 0.045P_2^2$$

$$F_3 = 4P_3 + 0.01P_3^2$$

Assume the total load varies from 125 to 475 MW with step 50 MW and the power output limits are 25≤ P_1≤ 110 MW and 45≤ P_2≤ 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) [22Mark]

(a) **Including transmission losses, drive the condition for optimal operation of electrical power system.** (7Mark)

(b) **The two-bus system shown in the figure is used to supply a load. If a 100 MW power transmitted from plant 1 to the load, a power loss of 10 MW is incurred. Find the required generation for each plant, power losses and the power received by the load when λ=25 $/MWh. The incremental production costs of the two thermal generating units are:** (15Mark)

$$\frac{dF_1}{dp_1} = 0.02P_1 + 16$$

$$\frac{dF_2}{dp_2} = 0.04P_2 + 20$$

Question (3) [26Mark]

(a) **Write short notes about:** (8Mark)

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

(b) **The yearly demand for a system is tabulated below:** (18Mark)

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 2014.

Question (4) [26Mark]

(a) **Discuss:**

The constraints of unit commitment problem - The difference between economic power dispatch problem and unit commitment problem. (8Mark)

(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.** (18Mark)

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. ShaimaaRabah

ملحوظة: هذا الجدول خاص بالجوده ولا يعنى 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,	
Question No.	1, 2,3,4	1, 2,3,4	1, 2,3,4	