國 立 臺 北 科 技 大 學

九十七學年第一學期電機系博士班資格考試

電力系統運轉與控制試題

注意事項：

1. 本試題共【4】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。

1. A power system has three generator units, their maximum and minimum outputs and input-output curves are listed in the following table. Solve the following problems: (30%)

Gen.Unit	P_{max}(MW)	P_{min}(MW)	Input-output curve equation H(MBtu/h)
Unit 1	600	150	$510.0 + 7.2P_1 + 0.00142P_1^2$
Unit 2	400	100	$310.0 + 7.85P_2 + 0.00194P_2^2$
Unit 3	200	50	$78.0 + 7.97P_3 + 0.00482P_3^2$

*P is output power in MW

(1). Determine the cost function (F) of each unit with respect to the fuel costs of unit 1, unit 2 and unit 3 are 1.1$/MBtu, 1.0$/MBtu and 1.0$/MBtu, (7%)

(2). Derive the incremental cost function dF/dP of each unit, (7%)

(3). If the total load is 850MW, determine the optimum dispatch of each unit output power (neglect the transmission loss), (8%)

(4). Find the total saving cost by optimum dispatch compared with average dispatch (P_1=P_2=P_3=850/3 MW). (8%)

2. Describe the fast decoupled power flow method. What is the advantage of this method compared with Newton power flow method. (20%)

3. Describe the unit commitment via forward dynamic programming by a flow chart. In this flow chart, the recursive algorithm to compute the minimum cost in hour K with combination I is, (30%)

$$F_{cost}(K,I) = \min_{\{L\}}\left[P_{cost}(K,I) + S_{cost}(K-1,L:K,I) + F_{cost}(K-1,L)\right]$$

where,

$F_{cost}(K,I)$=least total cost to arrive at state (K,I)

$P_{cost}(K,I)$=production cost for state (K,I)

$S_{cost}(K\text{-}1,L:K,I)$=transition cost from state (K-1,L) to state (K,I)

and state (K,I) is the I^{th} combination in hour K. Note use the two new variables,

X=number of states to search each period.

N=number of strategies, or paths, to save at each step.

4. Terminology explanations: (20%)

(1). penalty factor, (5%)

(2). coordination equation, (5%)

(3). λ-iteration method, (5%)

(4). optimal power flow. (5%)