國 立 臺 北 科 技 大 學

九十八學年第二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. Answer the following questions concisely: (25%)
   (1).What is the pump-storage hydro-plant? (5%)
   (2).What is the short-rang hydro-scheduling? (5%)
   (3).What is the spinning reserve? (5%)
   (4). List three thermal unit constraints in unit commitment. (5%)
   (5). List three solution methods for unit commitment problems. (5%)
2. Describe the Gauss-Seidel method by formulating the iterative equations of bus voltages and drawing the flow chart of the solution procedure. (25%)
3. Draw the flowchart to illustrate the contingency analysis procedure. (20%)
4. Consider a power system with three generator units (G-1, G-2 and G-3), four buses (BUS-1, BUS-2, BUS-3 and BUS-4), and four transmission lines (TL-1, TL-2, TL-3 and TL-4); G-1, G-2 and G-3 are connected to BUS-1, BUS-2 and BUS-3, respectively. BUS-1 is the swing bus with voltage 1.0 (pu), and BUS-2 and BUS-3 are generating buses (PV buses) with voltage magnitudes 1.15(pu) and 1.2(pu), respectively. BUS-4 is the load bus which delivers power 5 + j4(pu) to load, and the output real powers from generators G-2 and G-3 are 2.5(pu) and 1.5(pu), respectively. All the transmission lines have the same impedances of j0.2 (pu), and they are used for interconnection between buses as follows: (30%)
   TL-1: between BUS-1 and BUS-2, TL-2: between BUS-2 and BUS-3
   TL-3: between BUS-3 and BUS-4, TL-4: between BUS-4 and BUS-1
   (1). Draw the single-line diagram of this system; (5%)
   (2). Write the bus admittance matrix of this system; (5%)

(3). Derive the power flow equations which express the bus injected real powers **(P_i)** and reactive power (**Q_j)** as functions of bus voltage phase angles (**δ_i**)and voltage magnitude ($|\mathbf{V_j}|$), where the subscripts i and j are bus number (i=2,3,4 and j=4); (10%)

(4). Calculate the Jacobian matrix of the system based on Newton-Raphson method and operating points:**$\delta_2=\delta_3=\delta_4=0^o$, $|\mathbf{V_4}|=1$** (pu). (10%)