Pls. Answer All the Following Questions (Total Score 45 Marks)

Question 1 (25 Marks):

1. Consider the four-bus sample system of the shown Figure 1.1, where the line reactances are indicated in pu. Line resistances are considered negligible. The magnitudes of all four bus voltages are specified to be 1.0 pu. The bus powers are specified in table.

Bus	Real Demand	Reactive Demand	Real Generation	Reactive Generation
1.	$P_{D1}=1.0$	$Q_{D1}=0.5$	$P_{G1}=?$	Q_{G1} (unspecified)
2.	$P_{D2}=1.0$	$Q_{D2}=0.4$	$P_{G2}=4.0$	Q_{G2} (unspecified)
3.	$P_{D3}=2.0$	$Q_{D3}=1.0$	$P_{G3}=0.0$	Q_{G3} (unspecified)
4.	$P_{D4}=2.0$	$Q_{D4}=1.0$	$P_{G4}=0.0$	Q_{G4} (unspecified)

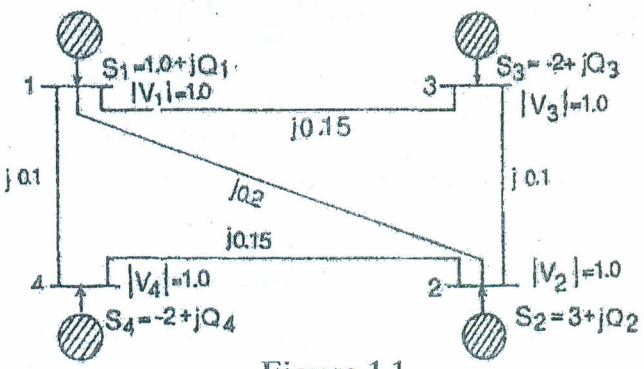


Figure 1.1

Find the unknown values in the above table and also the reactive power losses. *(5 Marks)*

2. Figure 1.2 shows the one-line diagram of a simple three-bus power system with generation at bus 1. The voltage at bus 1 is $V_1 = 1.0\angle 0^\circ$ per unit. The scheduled loads on buses 2 and 3 are marked on the diagram. Line impedances are marked in per unit on a 100 MVA base. For the purpose of hand calculations, the line resistances and line charging susceptances are neglected.

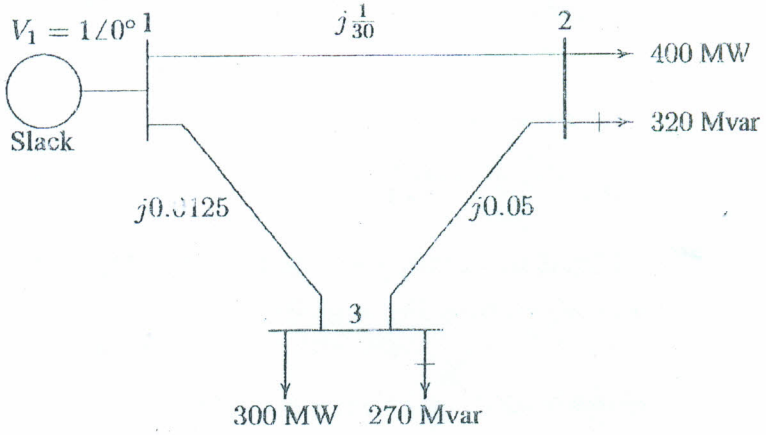


Figure 1.2

i. Find the complete load flow solution at the end of the first iteration using Gauss-Seidel method. *(10 Marks)*

ii. If after several iterations, the bus voltages converges to *(5 Marks)*

$V_2 = 0.90\text{-}j0.10$ pu and $V_3 = 0.95\text{-}j0.05$ pu.

Determine the line flows and line losses and the slack bus real and reactive power.

iii. Construct a power flow diagram and show the direction of the line flows *(5 Marks)*

Question 2 (20 Marks):

1. a). If the incremental costs of two generators are shown in Figure 2.1. Determine the total load to be supplied if P_{G2}=300 MW and also what will be the maximum load.

   b). Explain how to load the generators which are shown in Figure 2.2 in order to reach a merit method of dispatch.

(5 Marks)

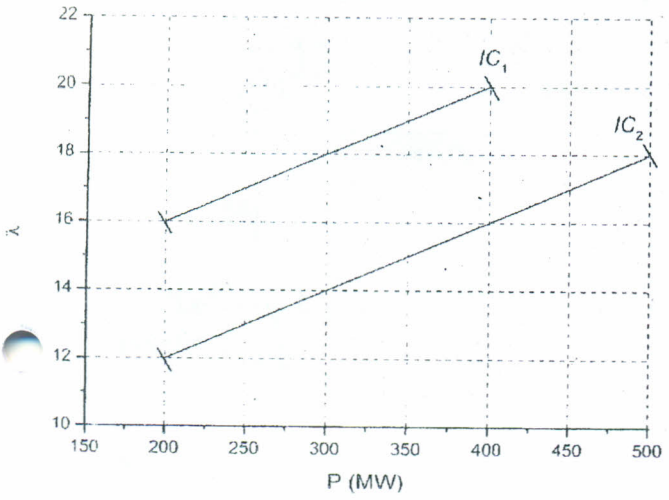


Figure 2.1

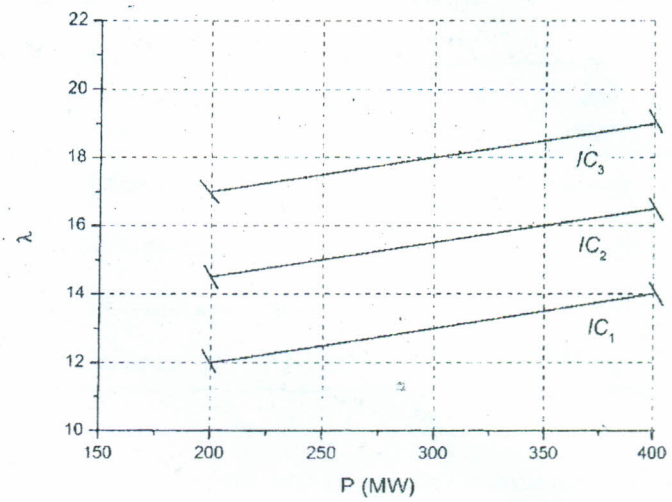


Figure 2.2

2. The fuel-cost curves of two generators are given as follows:

$$C_1(P_{G1})=900+45P_{G1}+0.01P_{G1}^2 \quad \& \quad C_2(P_{G2})=2500+43P_{G2}+0.003P_{G2}^2$$

i. The total load to be supplied is $P_D=P_{D1}+P_{D2}$= 700 MW. Use the optimal dispatch rule (Special case) to find P_{G1} and P_{G2}. *(5 Marks)*

ii. Find the optimal dispatch for P_D =700 MW if the generator limits are:

$$50 \text{ MW} \le P_{G1} \le 200 \text{ MW} \quad \text{and} \quad 50 \text{ MW} \le P_{G2} \le 600 \text{ MW}$$

Find also the system incremental cost and compare it with the result in point (i).

(5 Marks)

iii. Consider a range of possible values for P_D rather than the single fixed value 700 MW.

   a. *Plot P_{G1} and P_{G2} versus P_D for optimal dispatch.*

   b. *Find the system incremental cost λ as a function of total generator output, $P_D=P_{G1}+P_{G2}$.*

(5 Marks)

Good Luck and with my Best Wishes Dr. Eng. Mohamed ELADAWY

Mansoura University
Faculty of Engineering
Electrical Engineering Dept.
Third Year-Second Semester
Course Title: Electrical Power-3
Course Code: 2321EE

Final exam (part two)
Time: 1.5 hours
Date: 9th June 2014

Answer all of the following questions

Questions No. 1: (10 Marks)

A 2-wire d.c. distributor AB, 1000 m long has a total resistance of 0·1 Ω. The ends A and B are fed at 240 V. The distributor has concentrated loads of 120 A, 60 A, 100 A, and 40 A at points distant 200 m, 400 m, 700 m, and 900 m respectively from end A. If the last section of the distributor from end A is uniformly loaded at 0.5 A/meter lengths, Calculate:

(i) The point of minimum potential

(ii) Value of minimum potential

(iii) Current fed at both ends

Questions No. 2: (15 Marks)

A 3-phase ring distributor *ABCDA* fed at A at 11 kV supplies balanced loads of 40 A at 0·8 p.f. lagging at *B*, 50 A at 0·707 p.f. lagging at C and 30 A at 0·8 p.f. lagging at D, the load currents being referred to the supply voltage at A.

The impedances per phase of the various sections are:

Section $AB = (1 + j\,2)\ \Omega$, Section $BC = (2 + j\,3)\ \Omega$

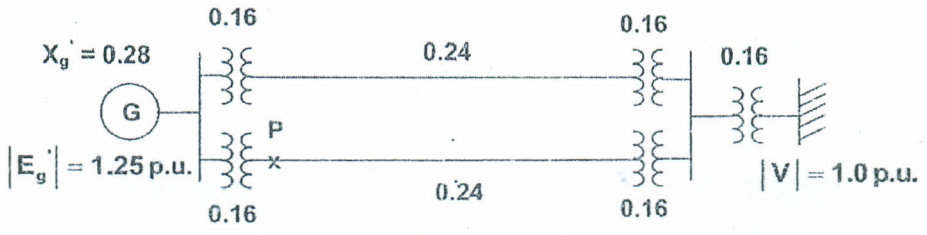
Section $CD = (1 + j\,1)\ \Omega$, Section $DA = (3 + j\,4)\ \Omega$

If the points A and C are linked through an interconnector of impedance $(1 + j\,1)\ \Omega$, determine the new voltage at each load point.

Questions No. 3: (20 Marks)

3-a) Drive an expression to obtain the value of clearing angle. **(5 Marks)**

3-b) in the power system shown, three phase fault occurs at point (p) and the faulty line was opened a little later. At clearing angle 80°, the system lost stability. Use EAC to specify that, the capacitive reactance of 0.4 p.u. makes the system stable or not if it inserted to the nearest bus after fault clearing angle mentioned above. **(15 Marks)**



Values marked are p.u. reactances

With best luck: Dr. Esam Ali Saafan