Mansoura University
Faculty of Engineering
Dept. of Electrical Engineering

Third Year Exam (12/1/ 2014)
Full Mark : 70
Time allowed: 3 Hours

Electric Power Systems (2)

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Please Answer The Following Questions:

Question # 1: (20 Mark)

For the power system shown in Fig.1, the data of various system components are as follows:

G: 30 MVA, 11 kV, X= 0.3 p.u.
T1: 30 MVA, 11/33 kV, X= 5 Ω/phase referred to low voltage side.
T2: 25 MVA, 33/6.6 kV, X= 12 Ω/phase referred to high voltage side.
Line: Z= 4+ j20 ohms/phase.
Load: S= 6+ j 4 MVA, 6.6 kV.

a- Draw the impedance diagram with all values on per unit (Base 30 MVA and 6.6 kV in load side).
b- Calculate the generator voltage and generator output power under loading conditions.
c- Voltage regulation of the system.

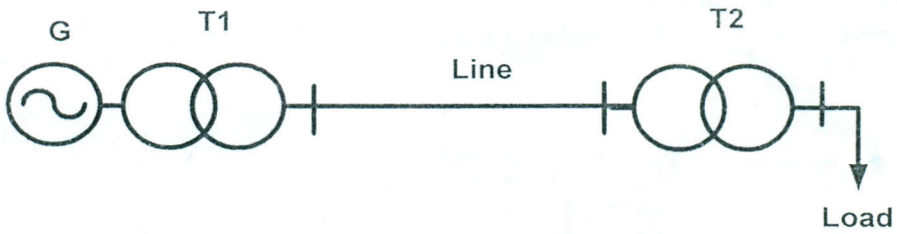

Fig. 1

Question # 2: (15 Mark)

For the power system given in figure 2, a 3-phase to ground fault occurs at the motor terminal, neglecting the prefault load current find:

(i) Subtransient fault current in kA. **(ii) Voltage of bus 1 in kV.**
(iii) Momentary current of breaker A in kA.

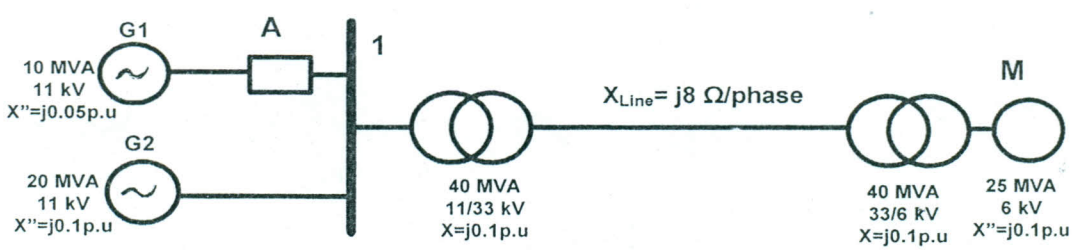

Fig.2

Question # 3: (15 Mark)

A Y-connected solid earthed voltage source with unbalanced voltage $V_{an} = 277\angle 0^{o}$, $V_{bn} = 260\angle -120^{o}$, and $V_{cn} = 295\angle 115^{o}$ V. The source is connected to a Δ- balanced load through a line. The line impedance is $1\angle 83^{o}$ Ω/phase and phase impedance of Δ-connected load is $30\angle 40^{o}$ Ω.

a- Calculate symmetrical components of the source voltages.

b- Draw the sequence networks.

c- Determine the source currents I_a, I_b, and I_c using the method of symmetrical components.

Question # 4: (20 Mark)

The equipment ratings and per-unit reactances for the power system shown in figure (3) are as follows:

G1: 50 MVA, 11 kV, X1=X2=0.25, X0=0.08 p.u.

G2: 30 MVA, 11 kV, X1=X2= 0.2, X0=0.05 p.u.

T1: 50MVA, 11/220 kV, X=0.1 p.u.

T2: 30 MVA, 11/220 kV, X=0.08 p.u.

Line (L): X1=X2=180 ohms/phase, X0=550 ohms/phase.

The system operates at rated values and a single line to ground fault occurs at bus 1 through fault impedance $Z_f = j15$ Ω, find:

(i) Fault current.

(ii) Voltage of bus 1 (a, b, c).

(iii) Current supplied by G1 during a fault.

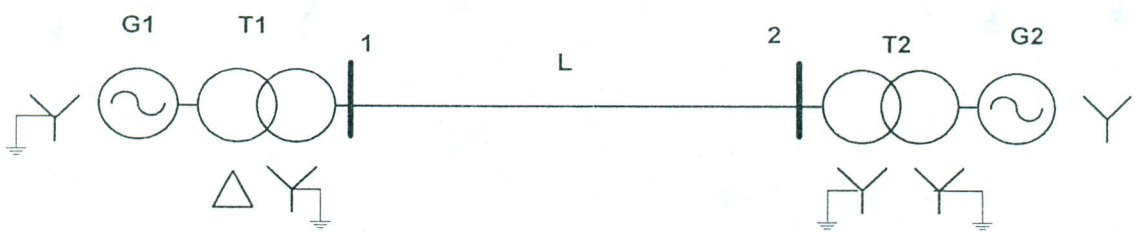

Fig.3

With My Best Wishes

Prof. Dr. Mohammed El-Saied