Examination of course ELEC0014 - January 2018
Answers to exercises

EXERCISE 1

Per unit data :

Cable resistance R = 4.5351e-02 pu

Cable reactance X = 6.0469e-02 pu

Cable half shunt susceptance B = 1.9051e-02 pu

Thévenin reactance Xth = 2.5000e-01 pu

Complex power flowing into the cable = 0.5 + j 0.2 pu

Current entering the cable at bus A = 4.9219e-01 – j 1.9688e-01 pu

Current flowing into the (R,X) branch = 4.9219e-01 – j 2.1623e-01 pu

Voltage at bus B = 9.8048e-01 – j 1.9956e-02 pu

Current in compensated load (load in parallel with shunt capacitor) = 4.9181e-01 – j .3491e-01 pu

Active power consumed by load = 4.8689e-01 pu

Reactive power consumed by non-compensated load (load without shunt capacitor) = 3.0175e-01 pu

Reactive power consumed by compensated load (with shunt capacitor) = 2.2051e-01 pu

Reactive power produced by shunt capacitor = 8.1242e-02 pu = 8.1242 Mvar

Susceptance of shunt capacitor = 8.4475e-02 pu = 2.1284e-03 S (S=Siemens)

Susceptance of each capacitor in the triangle = 7.0945e-04 S

Capacitance of each capacitor in the triangle = 2.2583e-06 F (F= Farad)

Thévenin voltage = 1.0651e+00 + j 1.2305e-01 pu

Voltage after tripping of cable = amplitude of Thévenin voltage = 67.547 kV

Short-circuit current = 4.2887 pu = 3.9303 kA

EXERCISE 2

Per unit data :

Voltage at bus A = 1 pu

Complex power entering the ideal transformer on the left (20 kV) side : 3.6 + j 0.4 pu

Transformer nominal current on the 225-kV side = 9.7443e-01 kA

Transformer leakage reactance on the 20 kV side = 0.16 Ω = 0.04 pu

Transformer ratio = 1.0533 pu/pu

Magnitude of voltage at node on the right of reactance X (or left of ideal transformer) = 9.7253e-01 pu

Magnitude of voltage at bus B = 1.0244 pu = 230.49 kV

Phase angle of voltage at bus B = 1.4861e-01 rad

Reactive power produced by generator = 9.5487e-01 pu

Maximum reactive power that the generator can produce = 1.7436 pu. Operation is within limits.