Aalto-yliopisto
Teknillinen korkeakoulu

Exercise Session 3

Power systems

Question 1

Transform load $\underline{S}$=(200 + j150) kVA into equivalent resistance and reactance which are connected:

- in series
- in parallel

Voltage is 20 kV.

Question 2

- A certain load curve can be presented with the following equation:

$$P(t) = \left(1 - 0.5 \sin\left(\frac{t}{12\text{months}}\pi\right)\right)\text{MW}$$

Calculate:

a) Annual energy

b) mean power for one year P_k

c) load factor

d) load duration time t_k

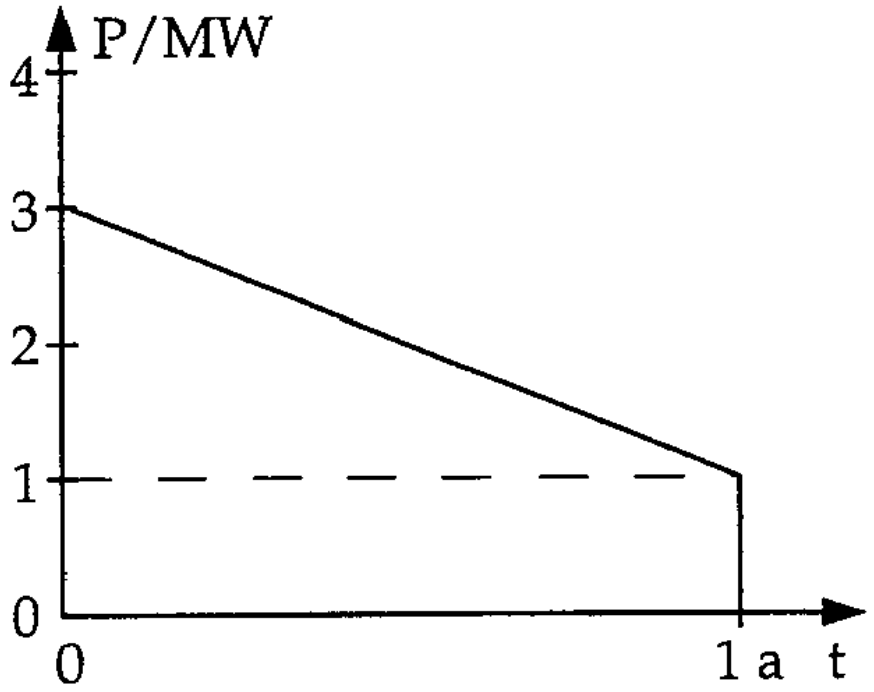
Question 3

At the end of a three-phase line the voltage is 20 kV. The line has following properties: resistance 0.8 Ω and reactance 0.6 Ω per phase. The load at the end of the line has a load duration curve as shown in the picture below. The power factor of the load is constant $\cos\varphi=0.8_{ind}$. Calculate:

a) active power losses P_{hmax} and P_{hmin}

b) reactive power losses Q_{hmax} and Q_{hmin}

c) energy losses W_h



Question 4

The variation of load (P) with time (t) in a power supply system is given by the expression:

$$\boxed{P(t) = 4000 + 8t - 0.00091t^2 \text{(kW)}}$$

where t is in hours over a total period of one year.

This load is supplied by three 10-MW generators and it is advantageous to fully load machine before connecting the others.

Determine:

a) the load factor on the system as a whole;
b) the total magnitude of installed load if the diversity factor is equal to 3;
c) the minimum number of hours each machine is in operation;
d) the approximate peak magnitude of installed load capacity to be cut off to enable only two generators to be used.