

**MEDIAN**

Autumn 2019

Duration: 90 minutes

- You are advised to take knowledge of the entire text before answering any question.
  - Answers must respect the used notation and specify in each case the question number.
  - Most attention will be given to the clarity of writing, presentation, the diagram and the presence of measurement unit
- Results will be put in frames

**Exercises are independent****Documentation: A4 double face is authorized (handwritten), Calculator authorized, phone forbidden****Exercise 1:**

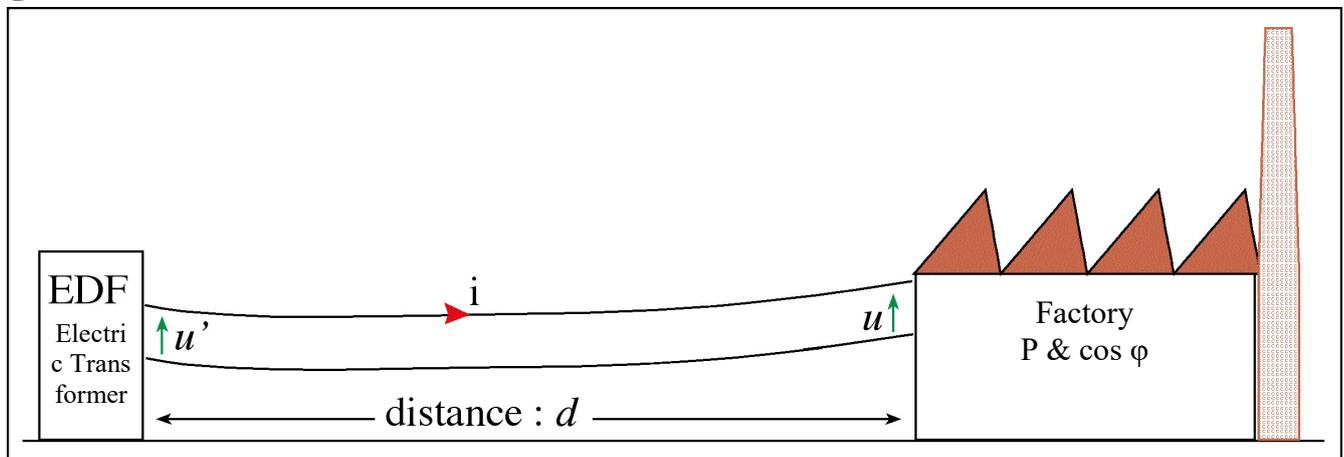
A heart defibrillator delivers 400 J of energy by discharging a capacitor initially at  $10^4$ V.

1. What is its capacitance  $C$  in Farad?
2. Find the amount of the stored charge in Coulomb.
3. The energy stored in the capacitor of a second defibrillator is only 304 J but capacitors used in both defibrillators are the same. What is the initial voltage of the capacitor in the second defibrillator?

**Exercise 2:**

To heat a room, a 6 [kW] electrical radiator is installed. 2,5 minutes are needed to increase the temperature of this room with 1 [°K], calculate the necessary additional radiator to be added in order to increase the temperature of this room of 1 [°C] in only 90 [s].

[°K] : Kelvin degree, [°C] : Celsius degree.

**Exercise 3:**

A factory is supplied by Transformer from EDF. This factory consumes a power  $P = 1250$  kW under a voltage of  $u = 20$  kV, a current of  $i = 78,13$  A, a frequency of 50 Hz and a  $\cos \varphi = 0,80$ .

The electrical cable has the following characteristics:

Line resistance  $r_l = 1,47$   $\Omega$ /km. Distance  $d = 10$  km.

- 1) Calculate the cable voltage drop. Deduce the value of the voltage that should be at the output of the transformer.
- 2) Give the value of the Power that should deliver the transformer  $P_{\text{Transf}}$ ?
- 3) Calculate the efficiency of the electrical cable?
- 4) Calculate the value of the capacitance able to increase the power factor of the factory to 0,93.
- 5) For the power factor of 0,93; calculate: the new current, the transformer output voltage  $U'$ , its power  $P_{\text{Transf}}$  and the efficiency of the electrical cable.