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CALCULATOR IS ALLOWED

HDD3010 Electric Circuits

MATERIALS ARE NOT ALLOWED

Exam : 22.04.2026

Max : 100 points

Exercise 1 (20 points)State whether the following sentence is **true** or **false**:

- Voltage and current sources are passive elements in electric circuits
- Phase difference of voltage and current of an ideal resistor is zero
- Average rectified values of current and voltage are used in phasor calculation
- Equation for complex power is $\mathbf{P} = \mathbf{U} \cdot \mathbf{I}$
- Mesh-current method applies Kirchhoff's voltage law

Exercise 2 (20 points)

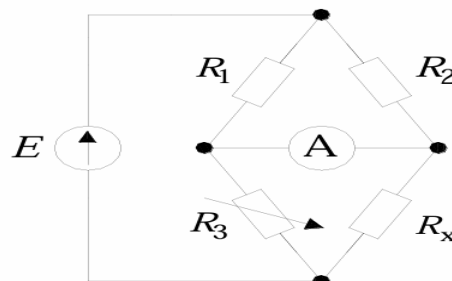
A flashlight is powered by four 2V batteries in series connection. The resistance R of the lamp is 16Ω .

- What is the current I in the circuit?
- Calculate the power of the flashlight?

Exercise 3 (20 points)

The Wheatstone bridge (**Figure**) is used to define component's unknown resistance values. The bridge includes a DC voltage source, a precise current meter together with 3 known resistors and one unknown resistor. Definition of unknown resistance value can be done for example so that the resistance value R_3 is varied until current meter indicates 0 A.

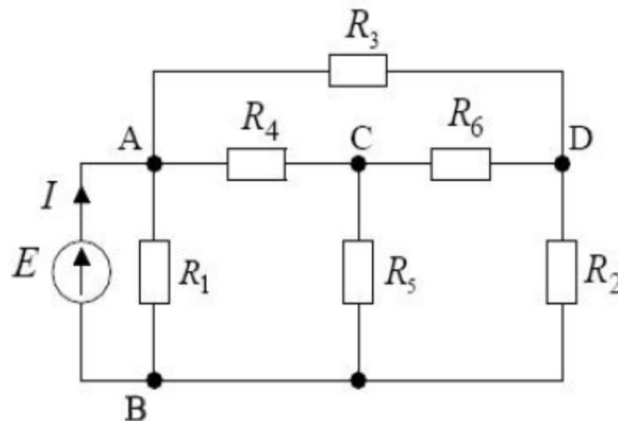
- Derive equation for the unknown resistance $\mathbf{R_x}$
- Calculate its value when bridge is balanced with $R_3 = 140 \Omega$, $R_1 = 90 \Omega$, $R_2 = 1000 \Omega$, $E = 6 \text{ V}$.



Exercise 4 (20 points)

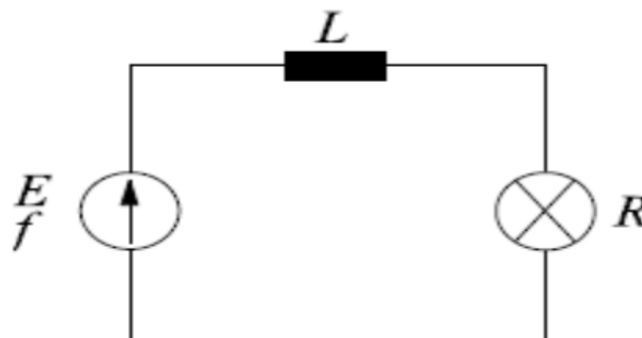
Calculate the total resistance R_{tot} and total current I for the circuit using wye-delta transformation for wye formed by R_4 , R_5 and R_6 .

Values: $R_1 = 5\Omega$, $R_2 = 2\Omega$, $R_3 = 5\Omega$, $R_4 = 7\Omega$, $R_5 = 2\Omega$, $R_6 = 3\Omega$ and $E = 3V$.

**Exercise 5 (20 points)**

Bicycle's generator voltage is dependent on generator's rotation speed n and so also on frequency f . Also, the same dependency can be found in the inductance's impedance Z_L . The resistance of lamp, R , is assumed to be constant.

- What is the power of the lamp, P , if $R = 50\Omega$, $L = 0.4\text{ H}$ and $E = kf$, where $k = 0.3\text{ Vs}$ and a) $f = 50\text{ Hz}$, b) $f = 100\text{ Hz}$ and c) $f = 200\text{ Hz}$?



Good Luck