Year 1 Assessed Problems

Semester 2

Assessed Problems 8

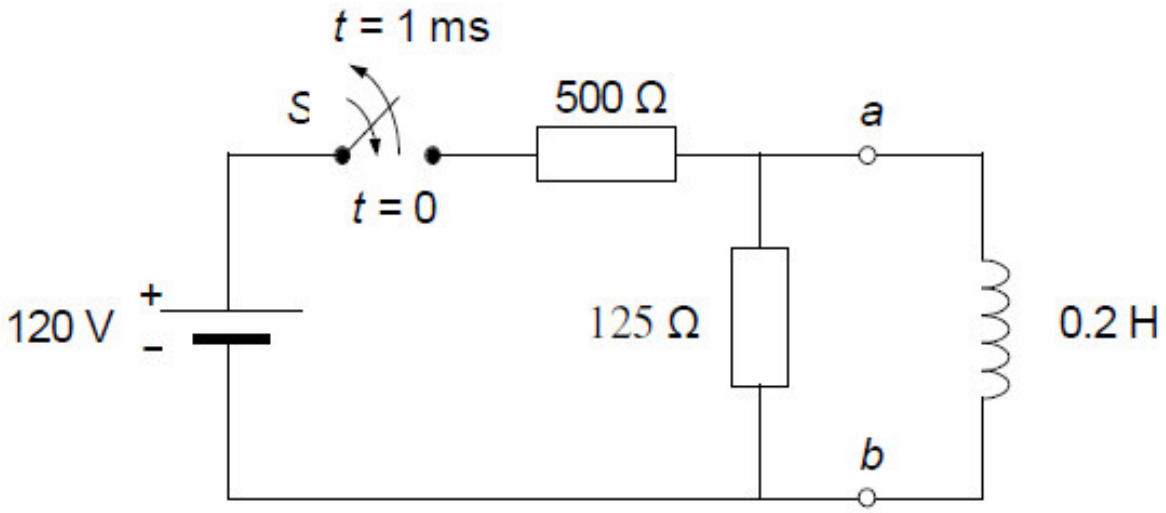
SOLUTIONS TO BE SUBMITTED ON CANVAS BY

Wednesday 19th March 2025 at 17:00

Electric Circuits

Assessed Problem 4

After being open for a long time, the switch, S, in the circuit shown below is closed at $t = 0$ for 1 ms, and then opened again.



Quiz Question 1:

What is the behavior of the inductor immediately after the switch is closed at t = 0?

[1]

Quiz Question 2:

What is the initial voltage across the 125 Ω resistor immediately after the switch is closed ($0 < t < 1$ ms)?

[1]

Quiz Question 3:

After a sufficiently long time after the switch has been closed, how does the inductor behave?

[1]

Quiz Question 4:

After a sufficiently long time after the switch is closed, what will be the voltage across the 125 Ω resistor?

[1]

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Quiz Question 5:

While the switch is closed, what is the Thévenin equivalent resistance looking back into the circuit from the inductor's perspective?

[1]

Quiz Question 6:

What is the time constant of the circuit when $0 < t < 1$ ms?

[1]

Quiz Question 7:

What is the voltage across the 125 Ω resistor at $t = 1$ ms?

[1]

Quiz Question 8:

What is the current flowing through the inductor at $t = 1$ ms?

[1]

Quiz Question 9:

What is the voltage across the 125 Ω resistor immediately after the switch is opened ($t > 1$ ms)?

[1]

Quiz Question 10:

What is the time constant of the circuit after the switch is opened ($t > 1$ ms)?

[1]

Continuous Assessment IV

Continuous Assessment for Chaos is centred around two analogue exam questions which can be found on canvas.

Consider the non-linear mapping

$$x_{n+1} = \frac{ax_n}{1 - x_n^2}$$

where a is a contol parameter.

7. Find all the 2-cycles and establish when they are stable. **[5]**

8. Find the algebraic relationship between $\tan \pi y$ and $\tan \frac{\pi y}{2}$. **[5]**

Maths for Physicists 1B Assessed Problem 4

Evaluate the following indefinite integrals providing full working (2 marks each).

(a) $\int \sin\left(\sqrt{x}\right) dx$;

(b) $\int \dfrac{dx}{a^2 \cos^2 x + b^2 \sin^2 x}$ where $a > 0$, $b > 0$;

(c) $\int \dfrac{1 - \tan x}{1 + \tan x}\, dx$;

(d) $\int \dfrac{dx}{\sqrt{1 + \sqrt{x}}}$;

(e) $\int \dfrac{dx}{\cos x + \sin x}$.