Year 1 Assessed Problems

Semester 2

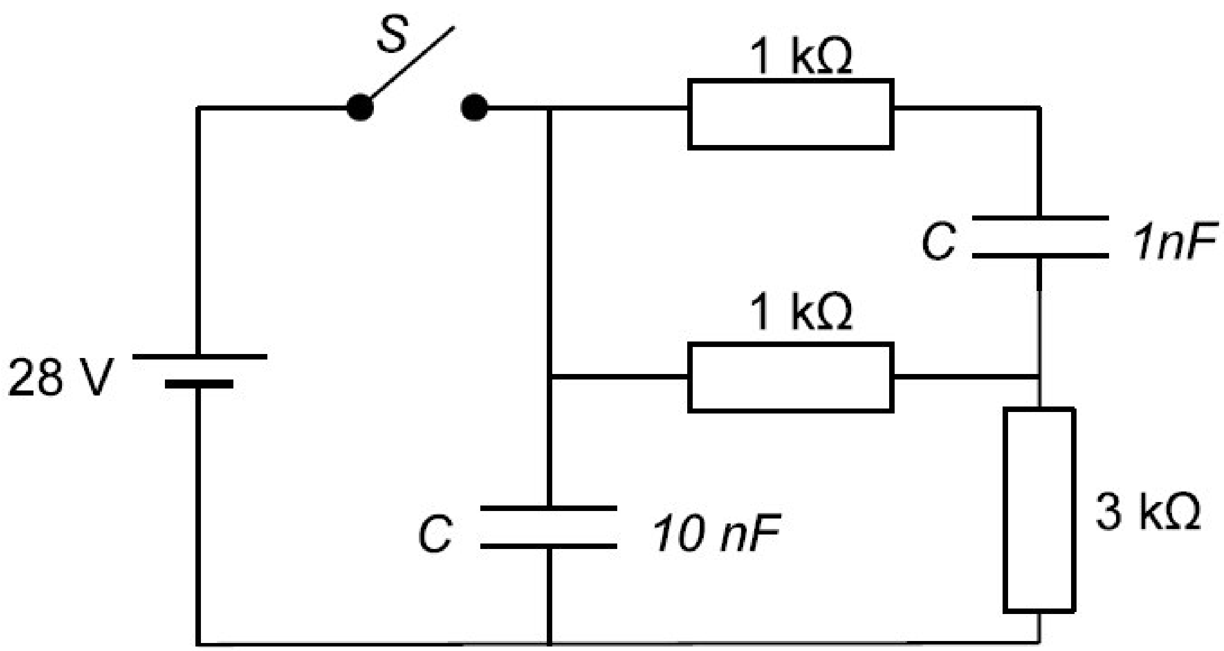
Assessed Problems 6

SOLUTIONS TO BE SUBMITTED ON CANVAS BY

Wednesday 5th March 2025 at 17:00

Assessed problem EC

Q: In the circuit shown below, find the initial and final values of the voltage across the 3 kΩ resistor after the switch, S, is closed. Find the initial and final values of the power dissipated in the network.



Quiz Question 1:

In the circuit shown above, what is the initial voltage across the 3 kΩ resistor immediately after the switch S is closed?

[2 points]

Quiz Question 2:

In the circuit shown above, what is the final voltage across the 3 kΩ resistor after the switch S has been closed for a long time?

[2 points]

Quiz Question 3:

In the circuit shown above, what is the initial power dissipated in the network immediately after the switch S is closed?

[3 points]

Quiz Question 4:

In the circuit shown above, what is the final power dissipated in the network after the switch S has been closed for a long time?

[3 points]

Continuous Assessment III

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

5. Explain why the trajectory might also be described by

$$\frac{d^2X}{dt^2} + X = -\frac{3}{4}R^2\left[1 + \cos 2\omega(t - t_0)\right] - \frac{1}{8}R^3 \cos 3\omega(t - t_0) - \frac{3}{8}R^2 X$$

with an appropriate choice of ω that you should choose. Solve this new equation and compare the new solution to the previous, suggesting which one is physically more appropriate. **[5]**

Consider the non-linear mapping

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

where a is a contol parameter.

6. Find all the 1-cycles and establish when they are stable. **[5]**

Maths for Physicists 1B Assessed Problem 3

(a) Find the solution of the differential equation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 2x^2$$

where $y(0) = y'(0) = 0$. **[5]**

(b) Find the solution of the differential equation

$$\frac{dy}{dx} + y^2 = \frac{2}{x^2}$$

where $y(1) = 1$. You may find useful the substitution $y = \frac{1}{u}\frac{du}{dx}$. **[5]**