Continuum'21
Problem Statement for ROUND-1

Suppose that you have an old jar of yogurt in the refrigerator, and it is growing bacteria. For this problem, we will let P (for population) denote the number of bacteria in the jar of yogurt. Now, the number of bacteria changes with time, so P is a function of t, time. As you keep an eye on your jar of yogurt over time, you do not know much about the function P at first. In other words, you might not be able to write down a formula for the rule of the function $P : [0,\infty) \rightarrow R$. Despite this, maybe you notice that the situation is quickly getting out of control: the more bacteria there is in the yogurt, the more bacteria are "born" and added to the population when you look the next day. When you think about it, it makes sense: After looking it up on Wikipedia, you know that bacteria reproduce by binary fission – the bacterium literally just splits in two and ends up being two bacteria. If for example each bacterium splits in two once every second, then the next second when you look there would be twice as many bacteria in the yogurt jar. Now you understand bacteria a little bit better, but you still can't write down a rule for P(t). Upon thinking about it more though you might realize that the fact that the bacteria are reproducing by splitting in two means that the rate of growth of the population of bacteria is proportional to the size of the population.

Using this concept, the English sentence "the rate of growth of the population of bacteria is proportional to the size of the population" translates to math as:

dP/ dt , (the rate of growth of the population, or number of bacteria "born" each second)

which is proportional to:
P(t), (the size of the population at time t);

which gives the equation:
$dP/dt = kP(t)$ for some constant $k \neq 0$.

Your task is to build a "bacteria growth calculator" which could calculate the population of the bacteria in the jar as a function of time.

BACTERIA GROWTH CALCULATOR :

Given that on day 1 there was only one bacterium in the jar.
The bacteria multiply by binary fission (one bacteria splits into 2 per second) .
Find the plot of bacteria population vs time using analog circuits.

SOFTWARE TO BE USED :

- OrCAD

JUDGING CRITERIA :

Desired output and received output magnitude difference.
Overall cost of final device
COST :

- Operational amplifier -> 400/-
- Transistor -> 160/-
- Inductor -> 80/-
- Capacitor -> 80/-
- Diode -> 80/-
- Resistor -> 10/-

SUBMISSION GUIDELINES :

- Deadline for submission is **11th April, 2021 11:59 pm**.
- Kindly create a **"New Project"** in OrCAD and send the **full folder as a zip file.**Do not send only the schematic or the simulation files, zip the whole project folder and send via mail as instructed below.
- Also **attach a screenshot** of the schematic (the circuit) you designed in OrCAD and of the simulation showing population vs time graph. (example screenshots shown below)
- Keep the mail **subject as**

"Continuum 21"<space>"Team Name"<space>"Round 1" and mail to one or all of the following e-mails:

-> *mohitshringi.ece18@itbhu.ac.in*
-> *pshyamprasad.ece18@itbhu.ac.in*
-> *rishabhborad.ece18@itbhu.ac.in*

Example of screenshots to be attached (Note: This is just an example, this does not relate to the PS given above in any manner)