



THE ANNUAL TECHNICAL FEST OF ELECTRONICS ENGINEERING DEPARTMENT OF IIT (BHU)

UDYAM'21

CONTINUUM

PROBLEM STATEMENT

ROUND 2

Task:

Design a frequency-dependent analog system that squares, integrates, and differentiates signals at different frequencies that lie max 5 Hz apart.

Explanation:

- Say your system produces a squared output of the input voltage when the input ac source frequency is “x Hz”. Similarly, when the input frequency is “y Hz” then, say, it produces the differentiation of the input voltage, and say at “z Hz” it integrates the input signal to produce the output.

And say $x < y < z$; then $|x-y| \leq 5$ Hz and $|y-z| \leq 5$ Hz and $|x-z| \leq 10$ Hz, and $x \neq y \neq z$





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- You can choose any 3 frequencies such that they lie in a range of 10 Hz, say for example (50,55,60) or (120,124,128) or (900,903,908),..... and so on.
- Also, you can produce the outputs in any order, i.e., say the frequencies are x,y,z Hz then any of the three frequencies could be allotted to any of the three operations, but it should follow the constraint $x \neq y \neq z$.
- **Design should have only one input terminal and one output terminal.**

Example:

Say you create an analog calculator that integrates the input at 50 Hz, squares at 54 Hz, and differentiates at 57 Hz (this is just for demonstration purposes, you can take any values).

So you could test your design by sending input as a Square wave at 50 Hz and you should expect a triangle wave at the output (some errors/phase shifts are tolerable).

And say you send input a Sine wave at 57 Hz then you should expect a cosine ($\pi/2$ phase-shifted sinusoid) at the output. Or say a triangle wave input at 57 Hz should give the output as a square wave..... and so on for various cases.

Similarly, you can test and verify your design with various different input signals and frequencies.





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Software to be used:

- OrCAD

Judging Criteria:

1. Desired output and received output phase/magnitude difference.
2. Overall cost of final device

Cost:

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





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Submission Guidelines:

- The deadline for submission is **16th 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 the following**
 - **A screenshot** of the schematic (the circuit) you designed in OrCAD
 - **3 screenshots of the 3 simulation cases** which demonstrate output is the square/integral/differentiation of input at three different frequencies, you can use any type of sources.
 - **Small description** (example of description shown below)
- Keep the mail subject as **“Continuum 21”<space>“Team Name”<space>“Round 2”** and send to one or all of the following e-mails:
 - mohitshringi.ece18@itbhu.ac.in
 - pshyamprasad.ece18@itbhu.ac.in
 - rishabhborad.ece18@itbhu.ac.in





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Example description: (it could be typed pdf or handwritten scanned pages/photos or you can write this in the mail body as well, as per your convenience)

-----**EXAMPLE**-----

Team Name: _____

Team members: _____

Squarer frequency = "x" Hz

Integrator frequency = "y" Hz

Differentiator frequency = "z" Hz.

(Mention numeric values in place of x,y,z)

Any other explanation/description related to your design which you would like to tell.

-----**EXAMPLE**-----





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