## 1

## GATE:EE/63

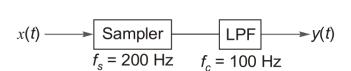
## EE23BTECH11208 - Manohar K\*

**Question:** A signal  $x(t) = 2\cos(180\pi t)\cos(60\pi t)$ is sampled at 200 Hz and then passed through an ideal low pass filter having cut-off frequency of 100 Hz.

The maximum Frequency present in the filtered signal in Hz is \_\_\_\_\_ (Round off to the nearest (GATE 2023 EE) integer.)

## **Solution:**

Given,



$$x(t) = \cos(240\pi t) + \cos(120\pi t) \tag{1}$$

symbol	value	description
x(t)	$2\cos(180\pi t)\cos(60\pi t)$	input signal
$f_s$	200Hz	sampling frequency
$f_c$	100Hz	cut-off frequency
<i>y</i> ( <i>t</i> )		output signal
$f_1$	120Hz	first signal frequency
$f_2$	60Hz	second signal frequency
TABLE I		

**PARAMETERS** 

Aliased frequencies when  $f_1$  frequency signal is sampled at 200Hz

$$f_1, |f_s \pm f_1|, |2f_s \pm f_1|...$$
 (2)

$$120, 80, 340, 280, 520...$$
 (3)

Aliased frequencies when  $f_2$  frequency signal is sampled at 200Hz

$$f_2, |f_s \pm f_2|, |2f_s \pm f_2|...$$
 (4)

$$60, 140, 260, 340, 460...$$
 (5)

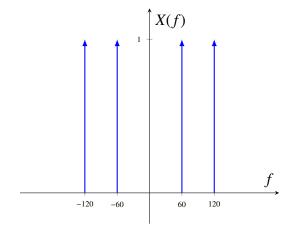
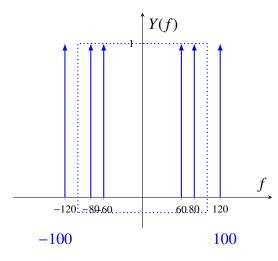


Fig. 1. delta function of input signal



Maximum Frequency present in the filtered signal

Fig. 2. delta function of sampled and filtered signal

from table  $f_c = 100Hz$ LPF output: 60Hz, 80Hz

is 80Hz.