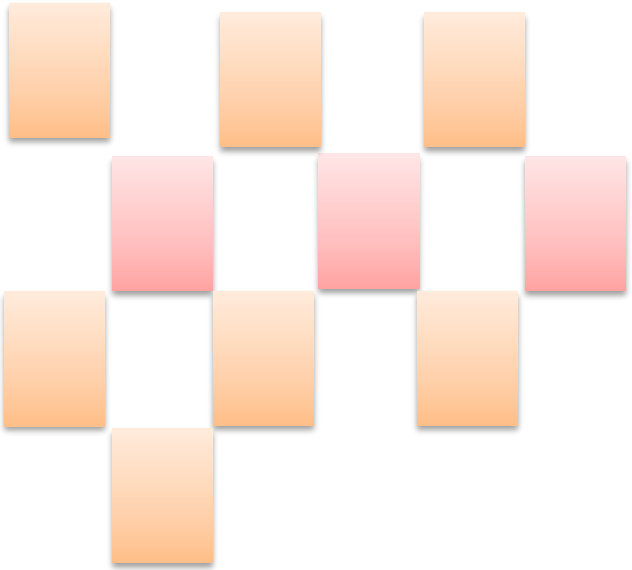


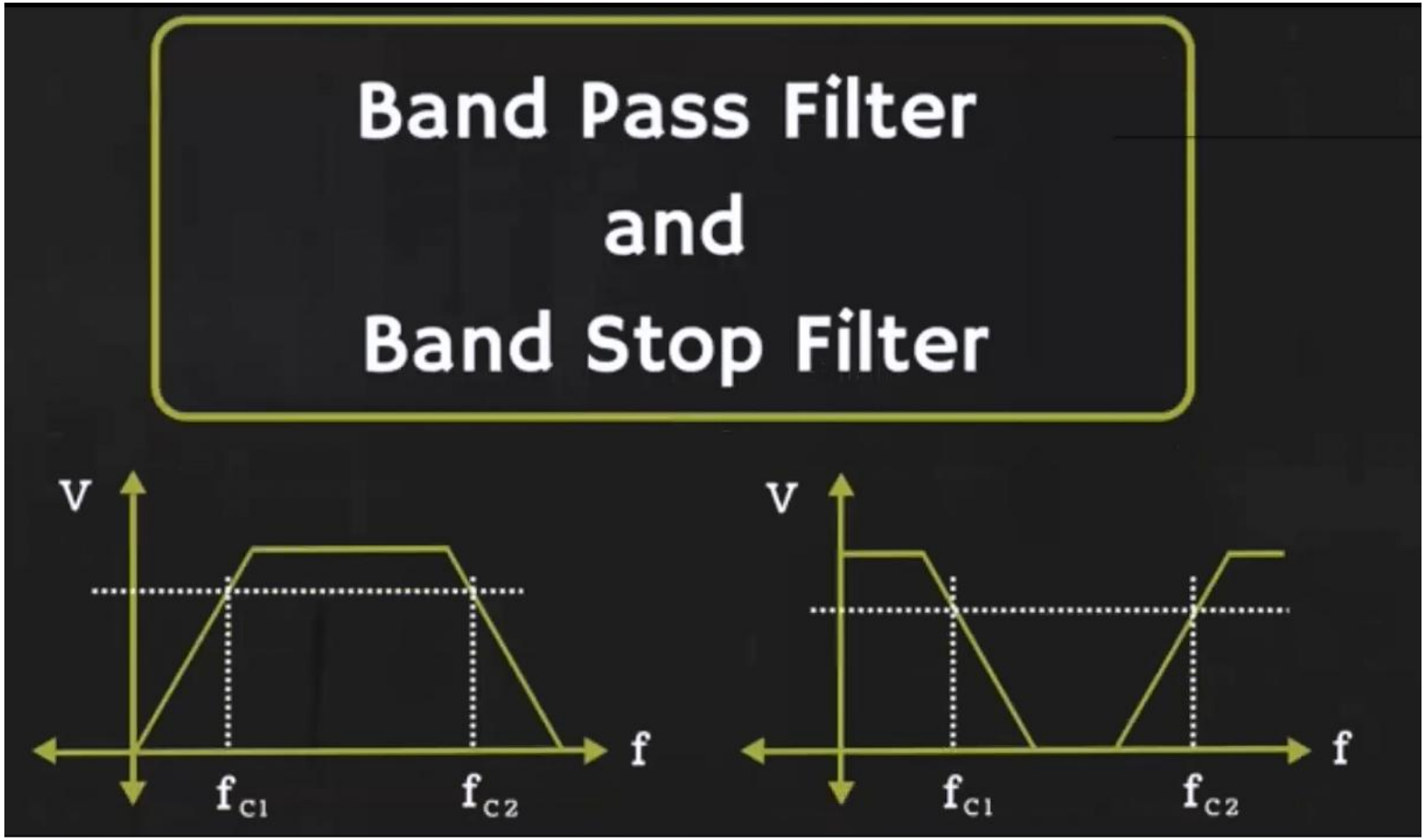
دانشگاه فنی حرفه ایی انقلاب اسلامی
دانشکده مهندسی برق

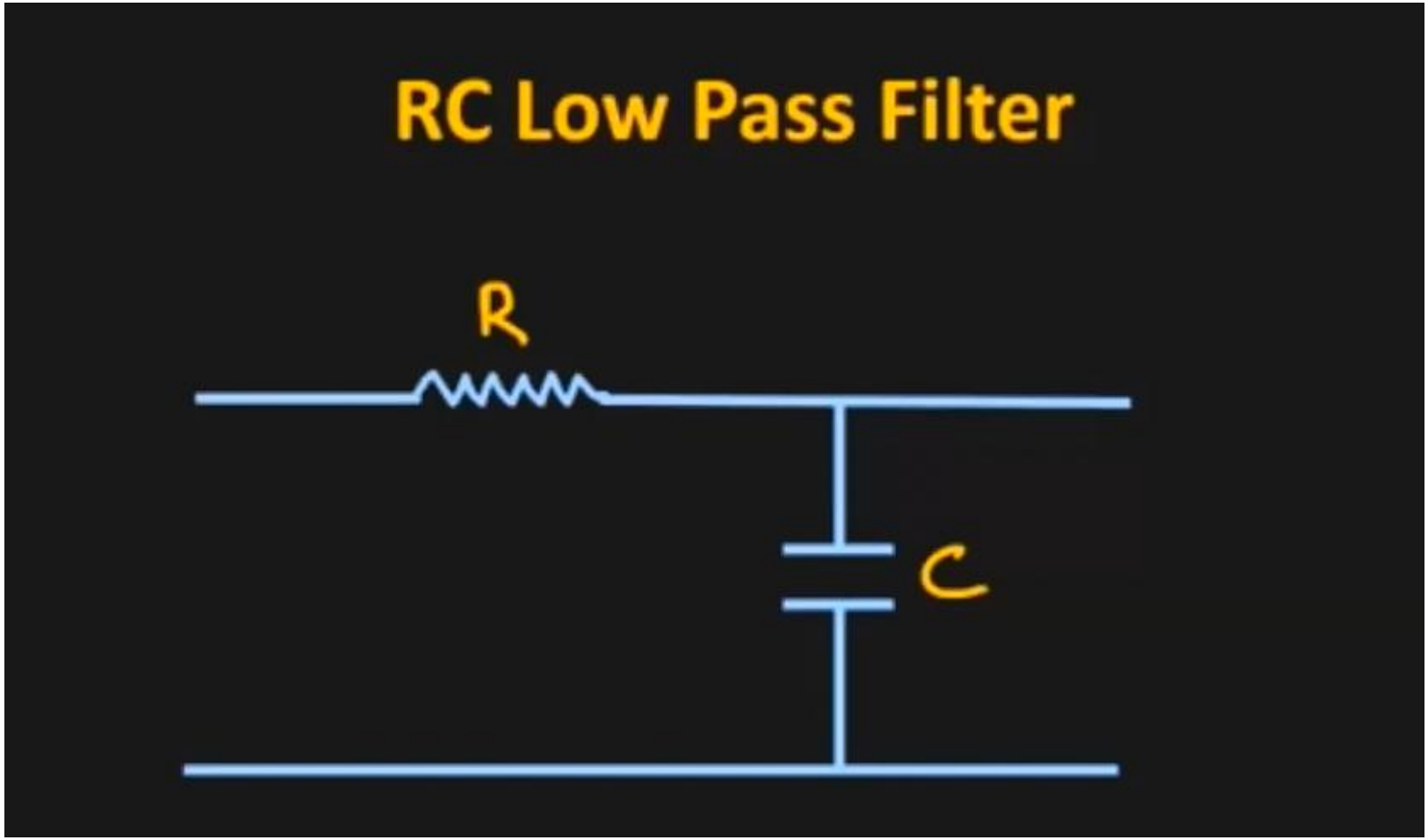
آموزش مجازی درس
مدارهای جریان متناوب

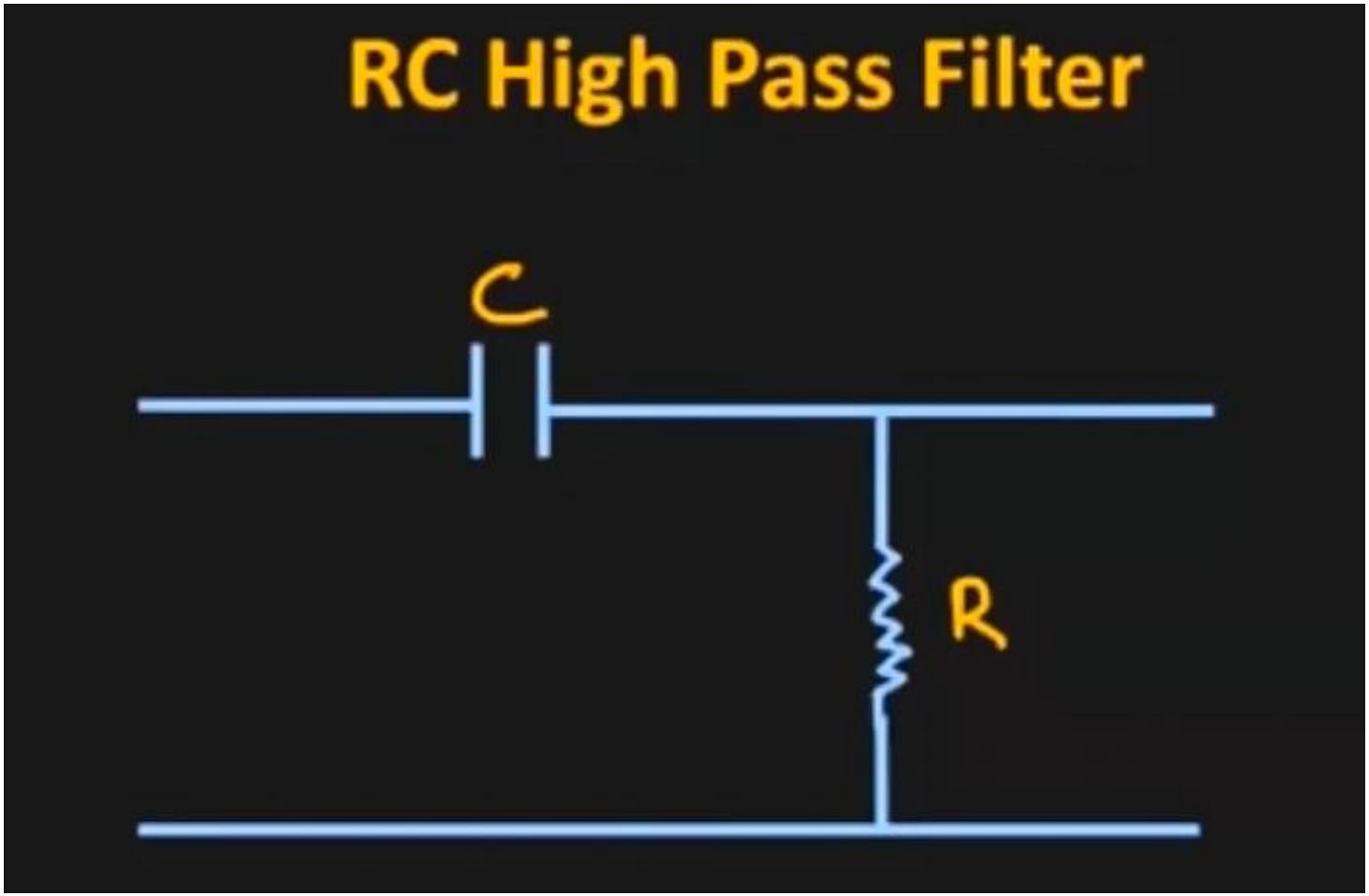
جلسه چهارم
فیلترهای میان گذر

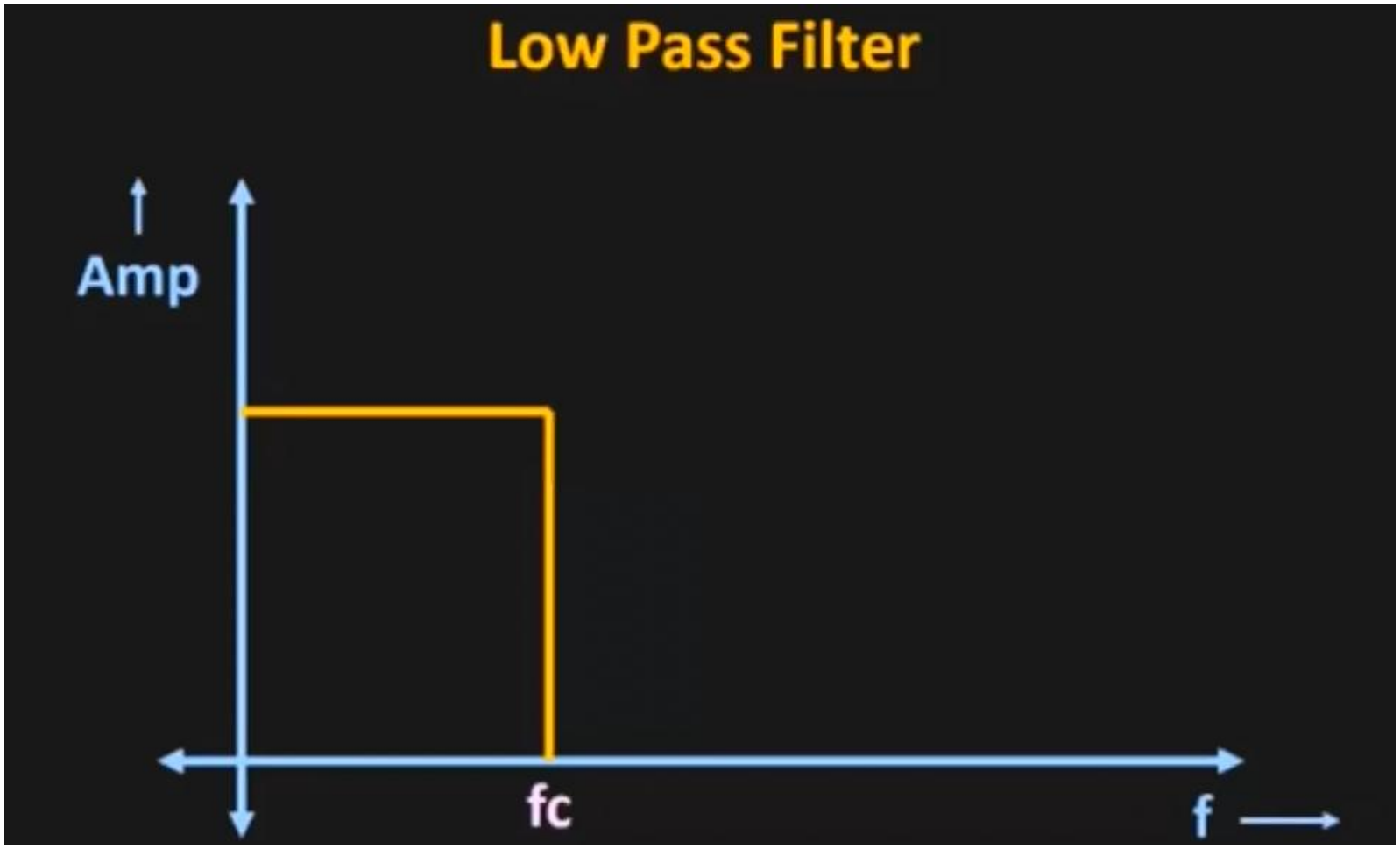
ارائه دهنده: دکتر علیرضا ناطقی

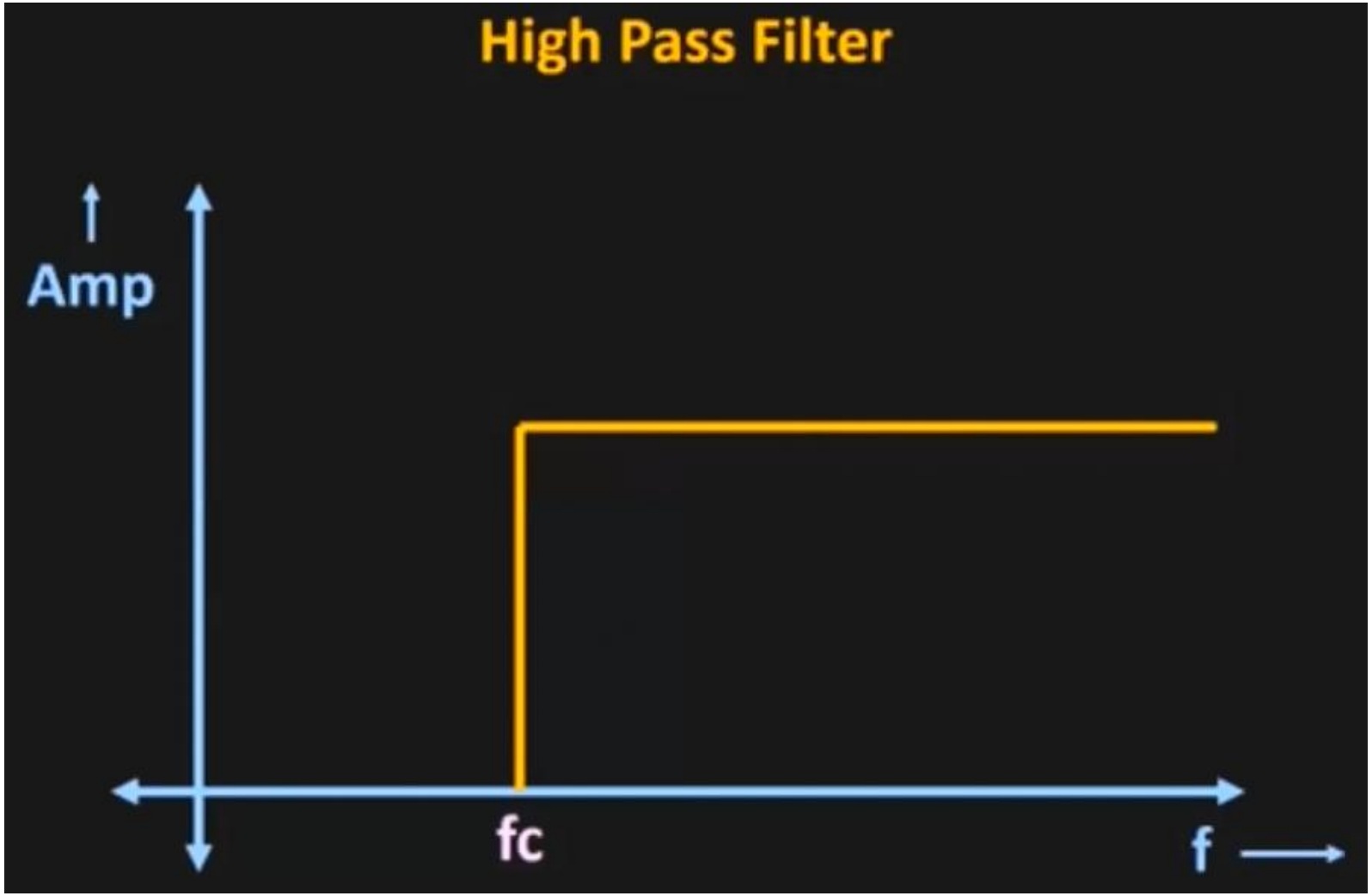
فیلتر میان گذر و میان نگذر

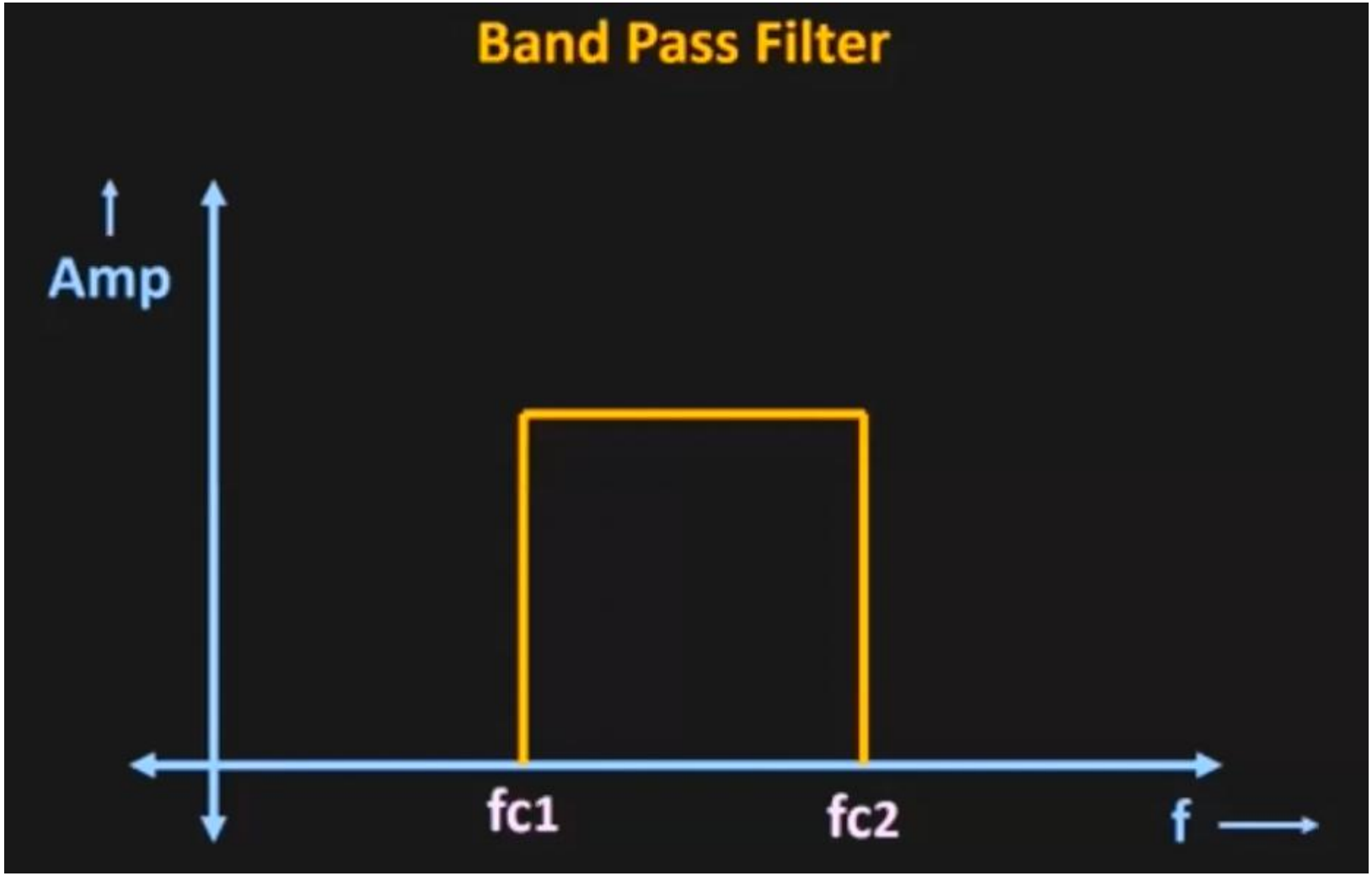


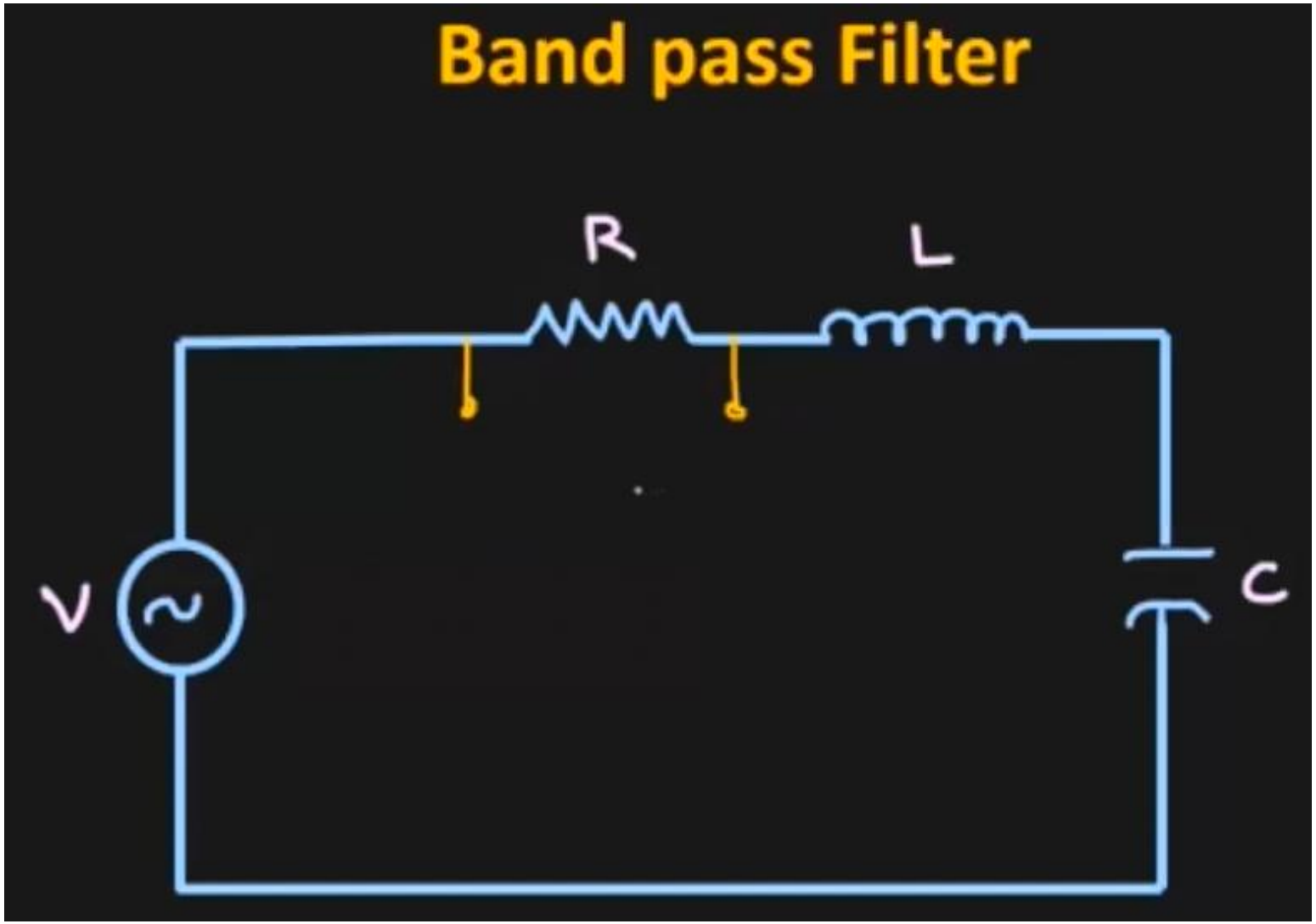

RC Low Pass Filter
R
C

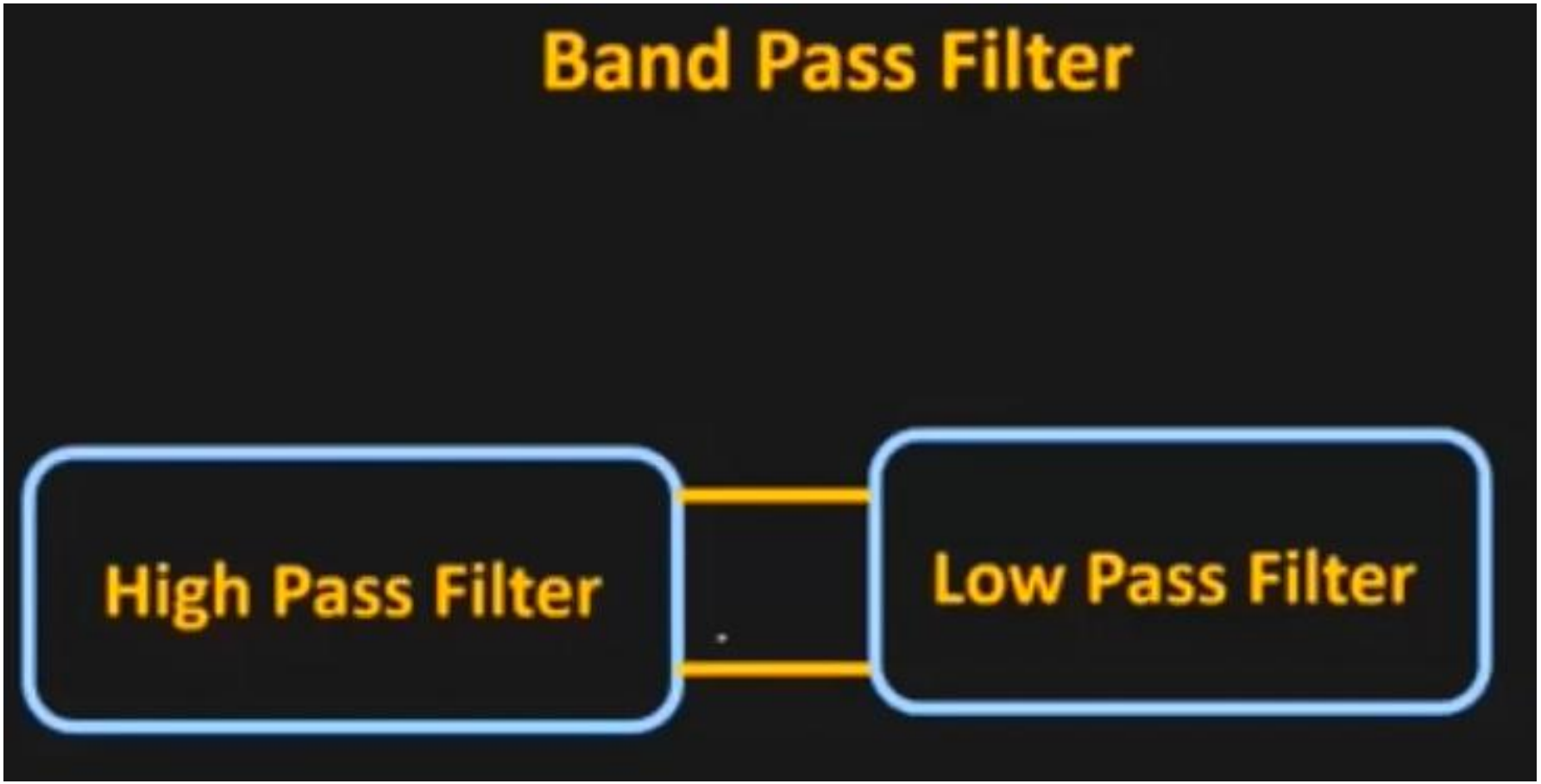

RC High Pass Filter
C
R

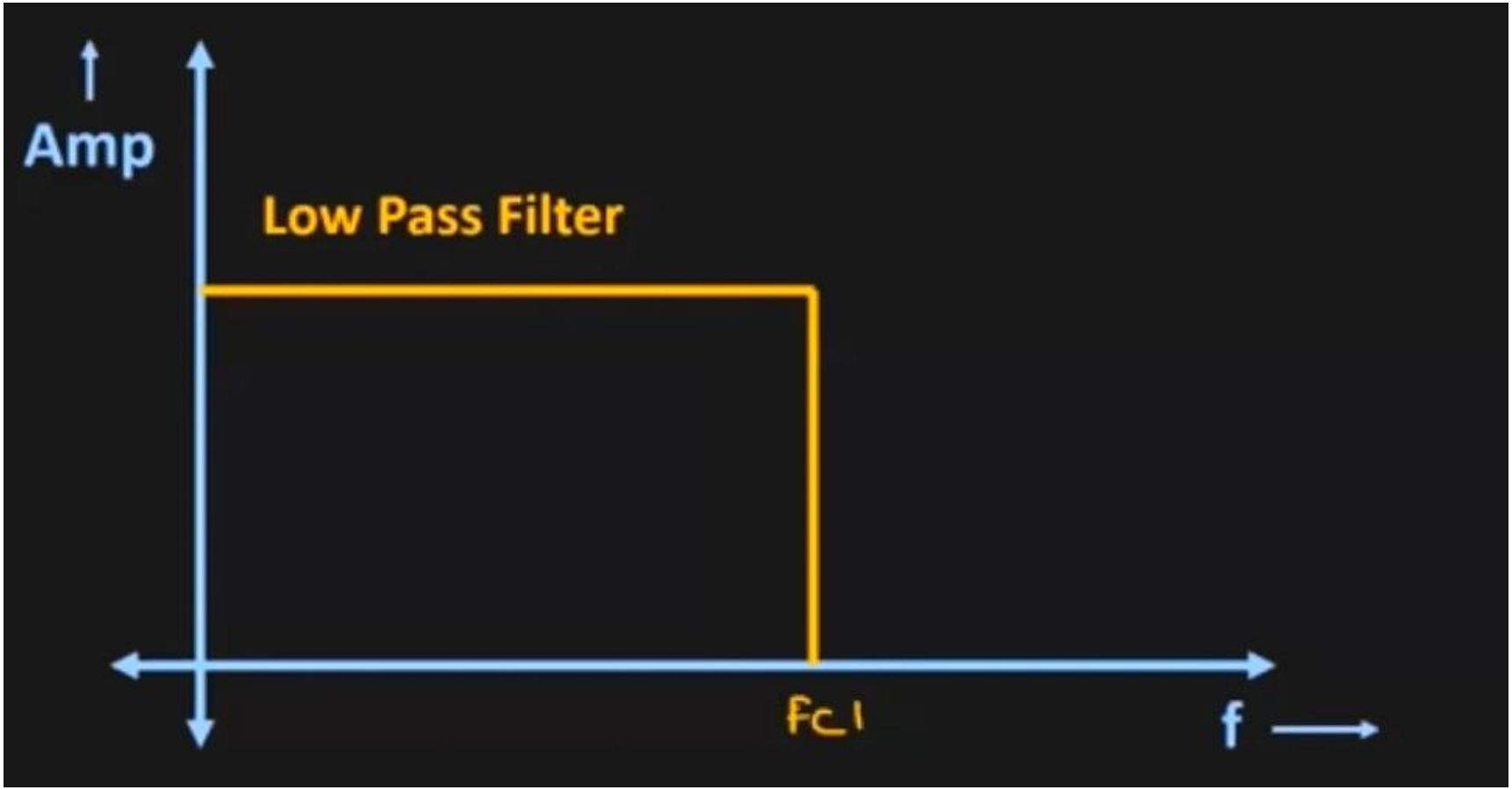

Low Pass Filter
Amp
fc
f

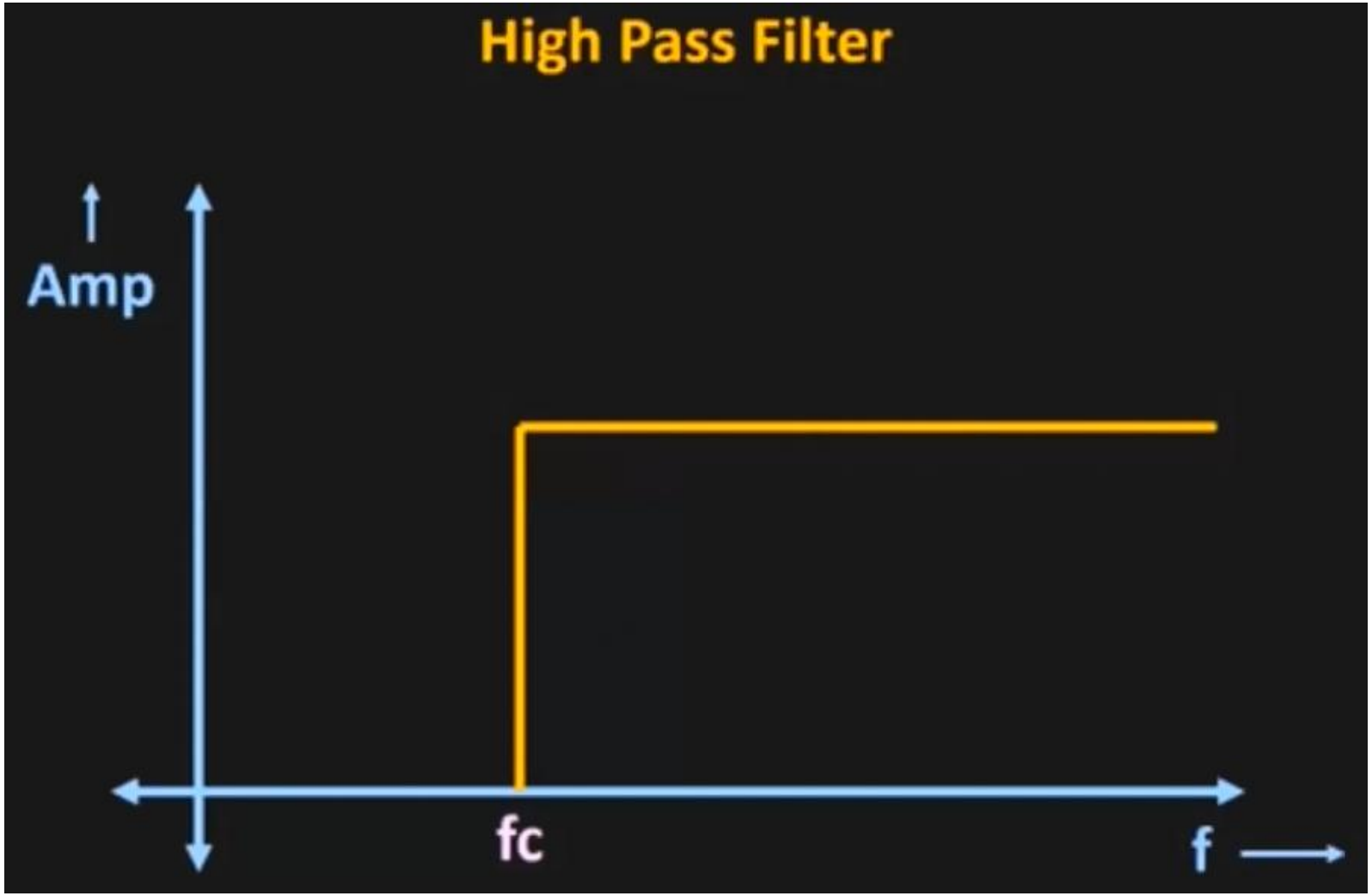

High Pass Filter
Amp
fc
f

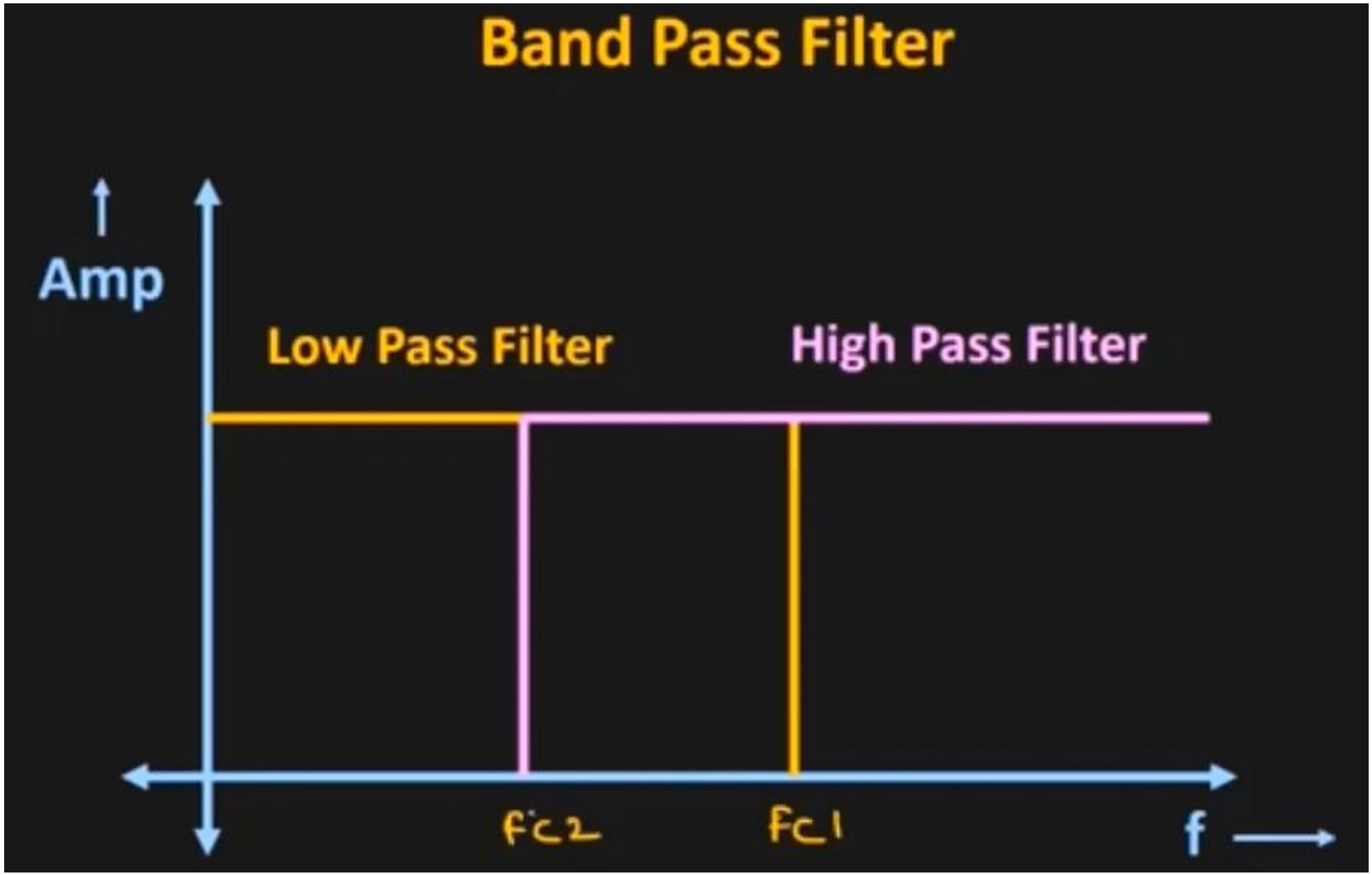

Band Pass Filter
Amp
fc1
fc2
f

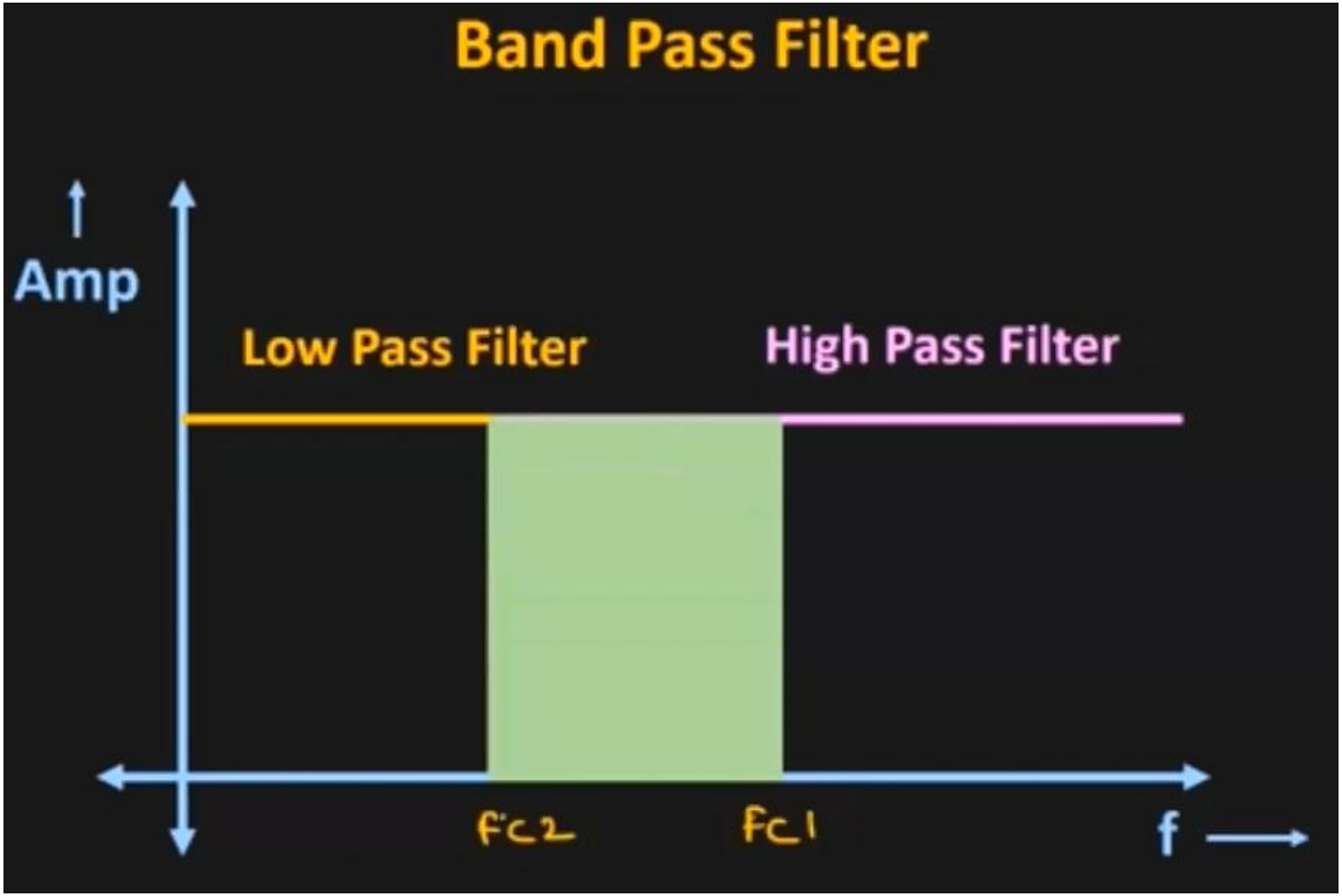

Band pass Filter
R
L
V
C

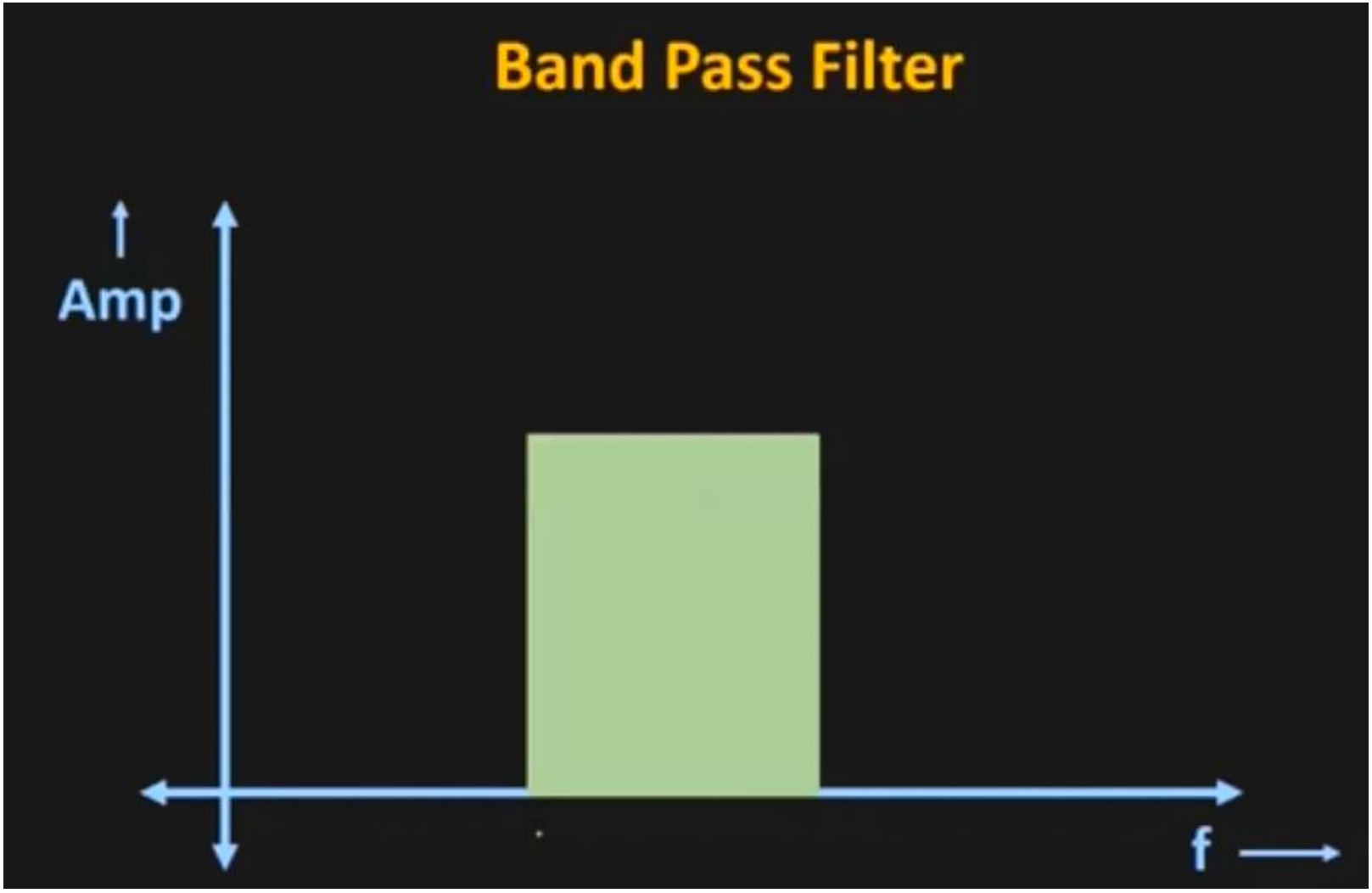

Band Pass Filter
High Pass Filter
Low Pass Filter

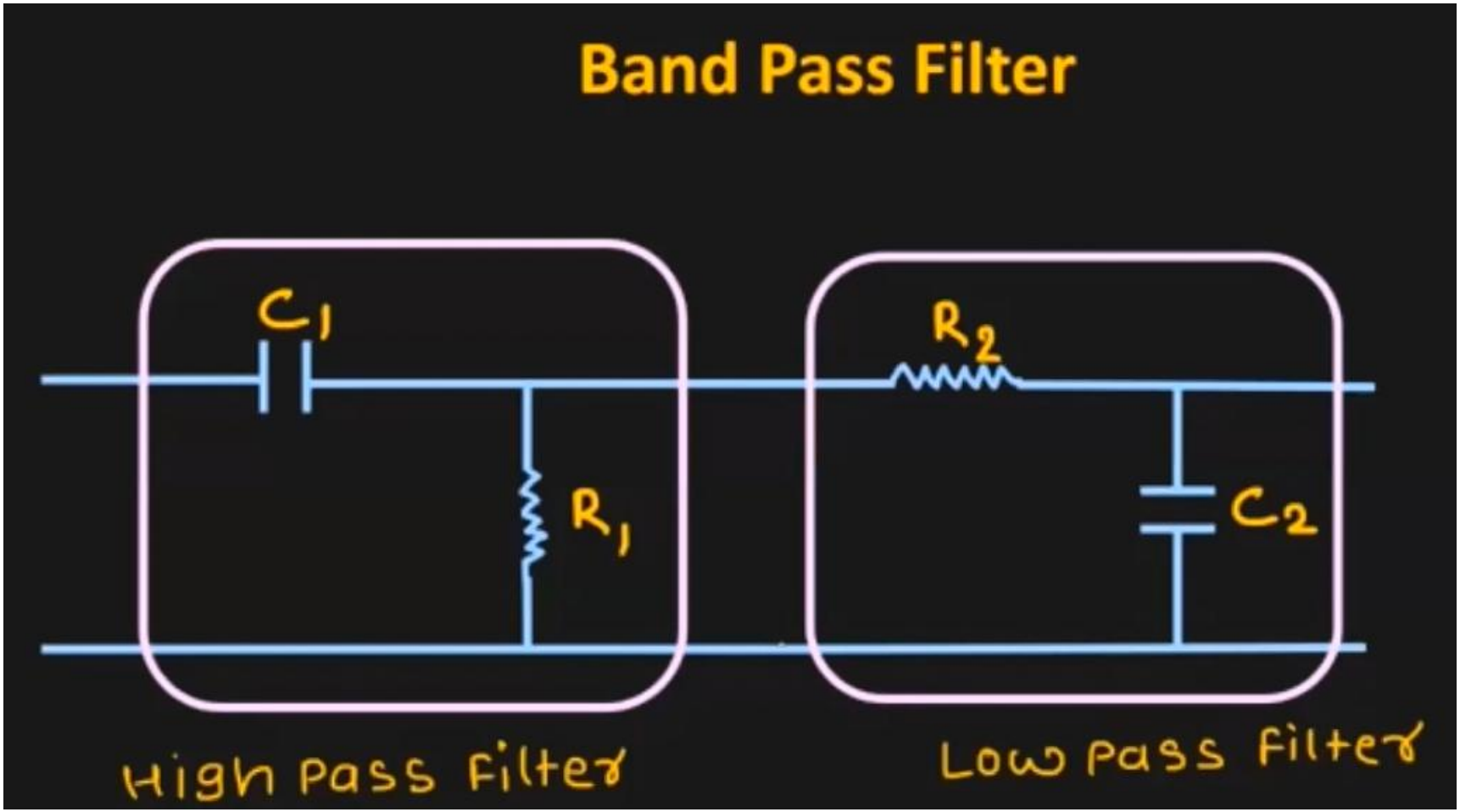

Amp
Low Pass Filter
fc1
f

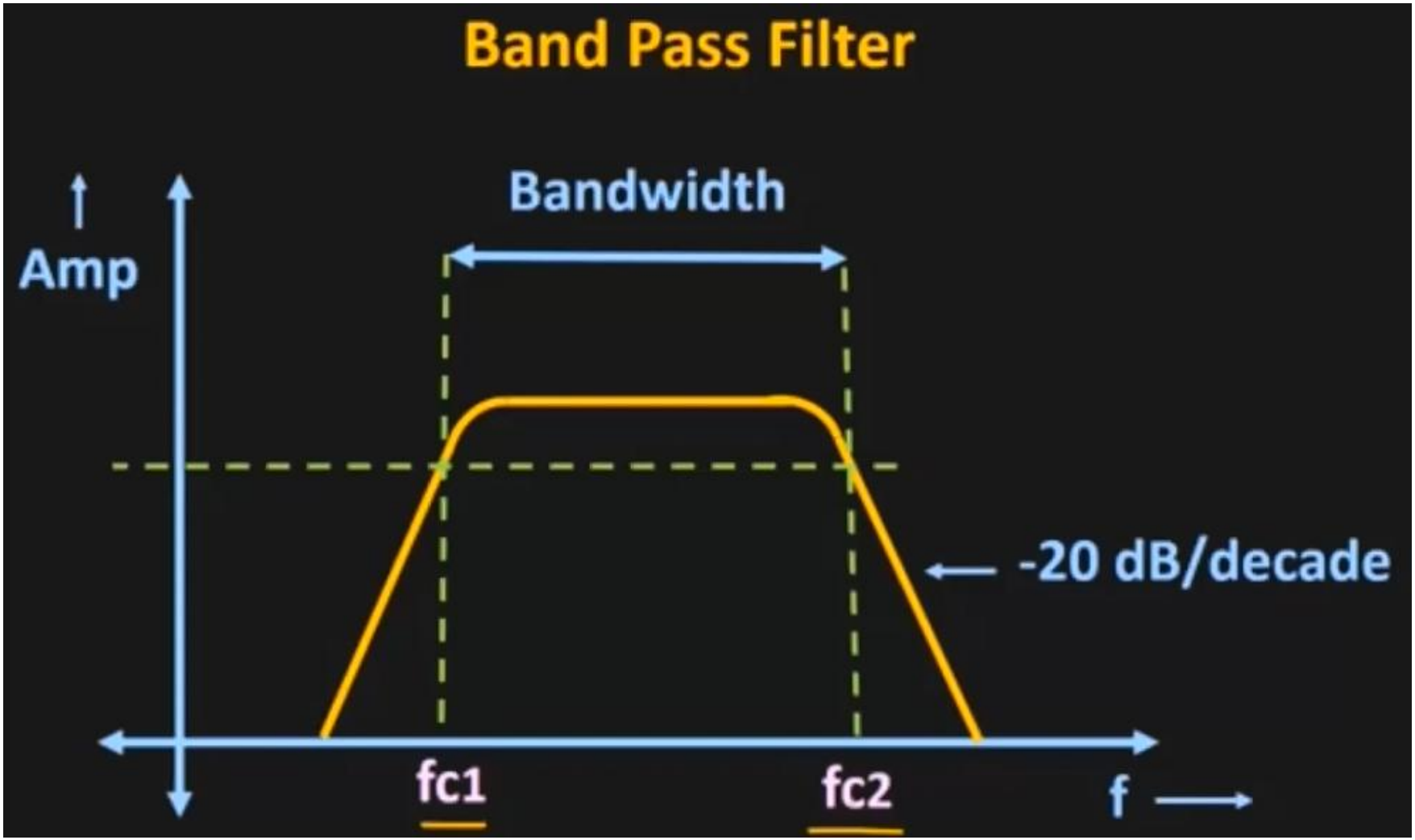

High Pass Filter
Amp
fc
f


Band Pass Filter
Amp
Low Pass Filter
High Pass Filter
fc2
fc1
f


Band Pass Filter
Amp
Low Pass Filter
High Pass Filter
fc2
fc1
f


Band Pass Filter
Amp
f

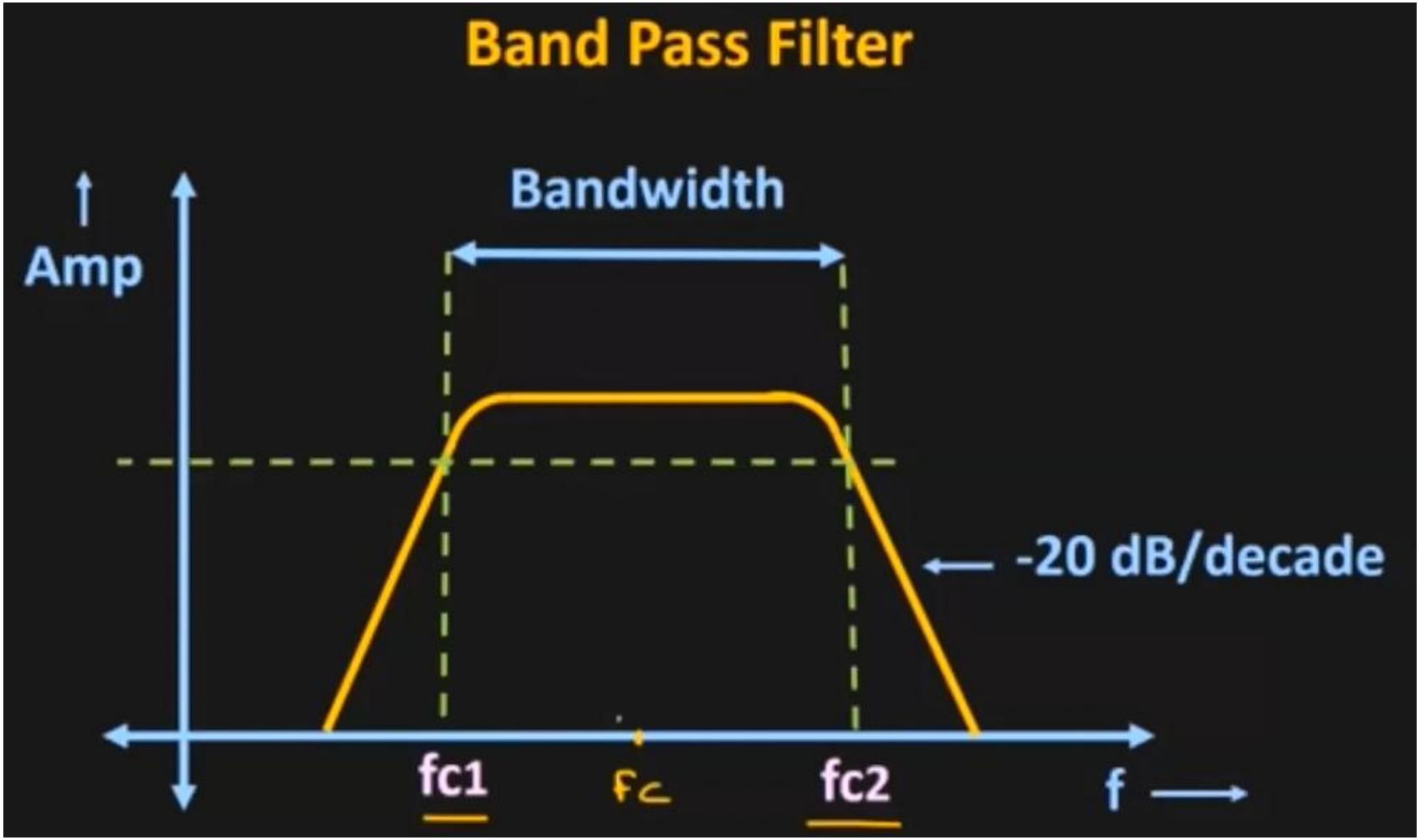

Band Pass Filter
C1
R1
R2
C2
High Pass Filter
Low Pass Filter

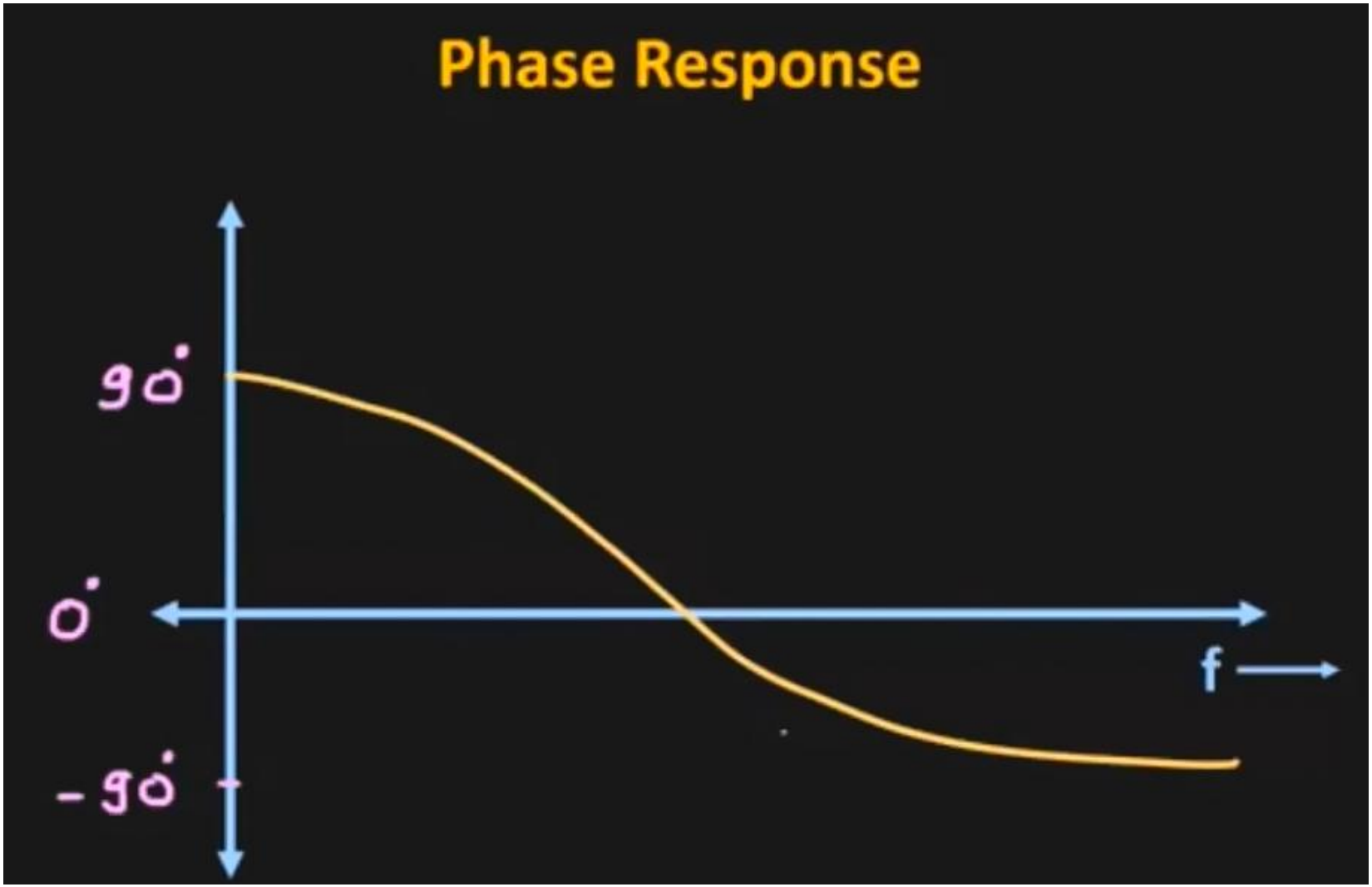

Band Pass Filter
Bandwidth
Amp
-20 dB/decade
fc1
fc2
f

Band pass Filters

Bandwidth = $fc2 - fc1$

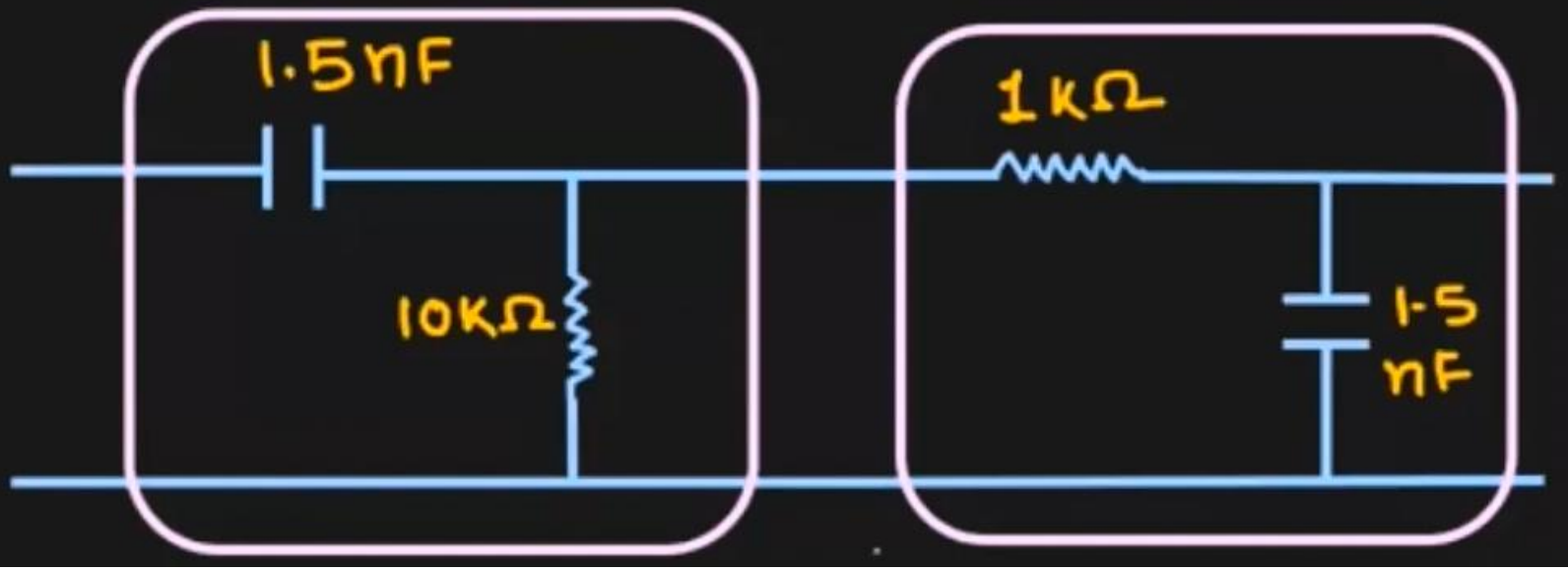
Center Frequency = $\sqrt{fc2 * fc1}$


Band Pass Filter
Bandwidth
Amp
-20 dB/decade
fc1
fc
fc2
f


Phase Response
90°
0°
-90°
f

Example

Find the bandwidth of the given Filter

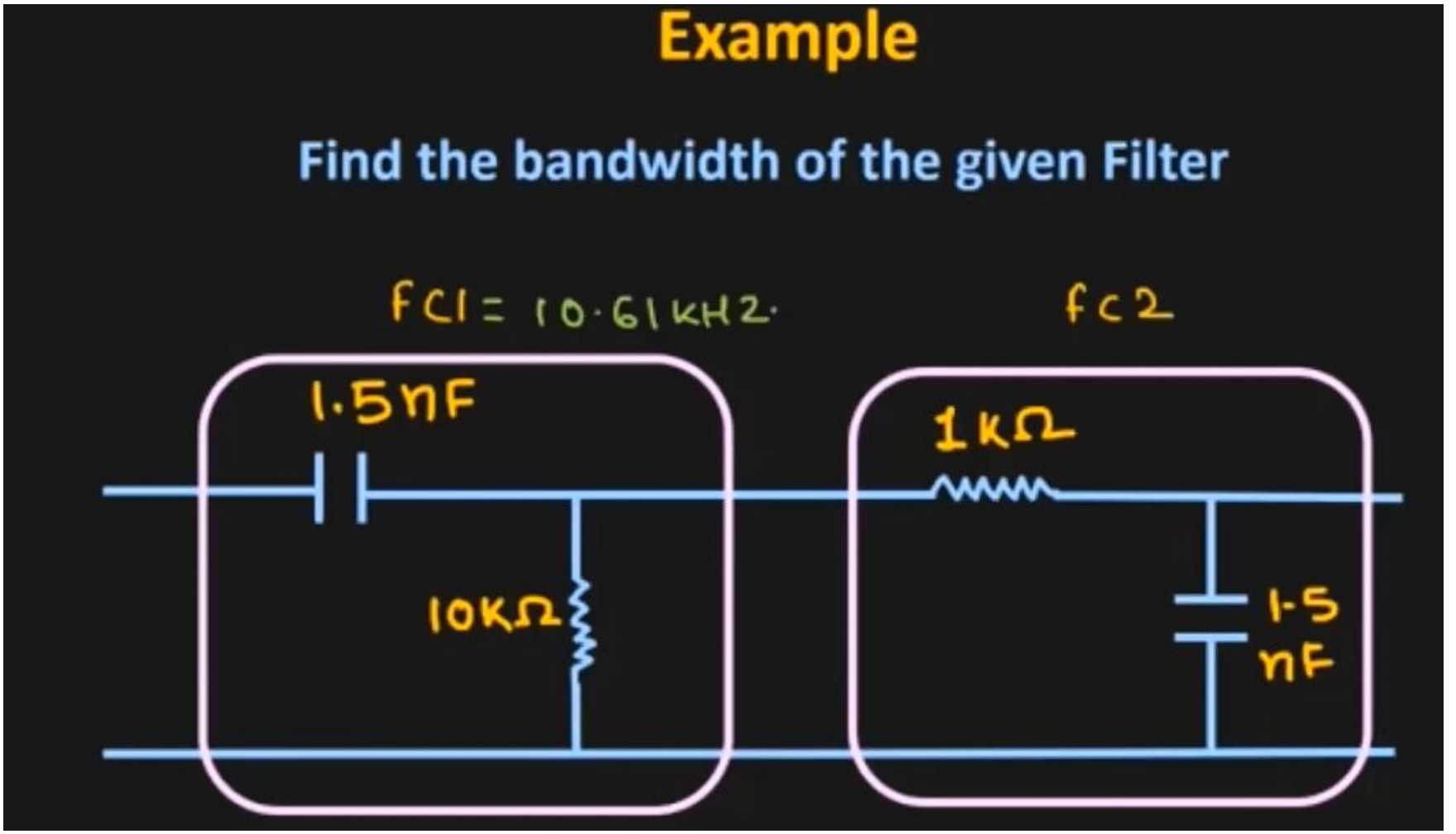


For High Pass Filter:

$$f_{C1} = \frac{1}{2\pi R C} = \frac{1}{2\pi \times (10K) \times (1.5nF)} = 10.61\,KH$$

Example

Find the bandwidth of the given Filter



For High Pass Filter:

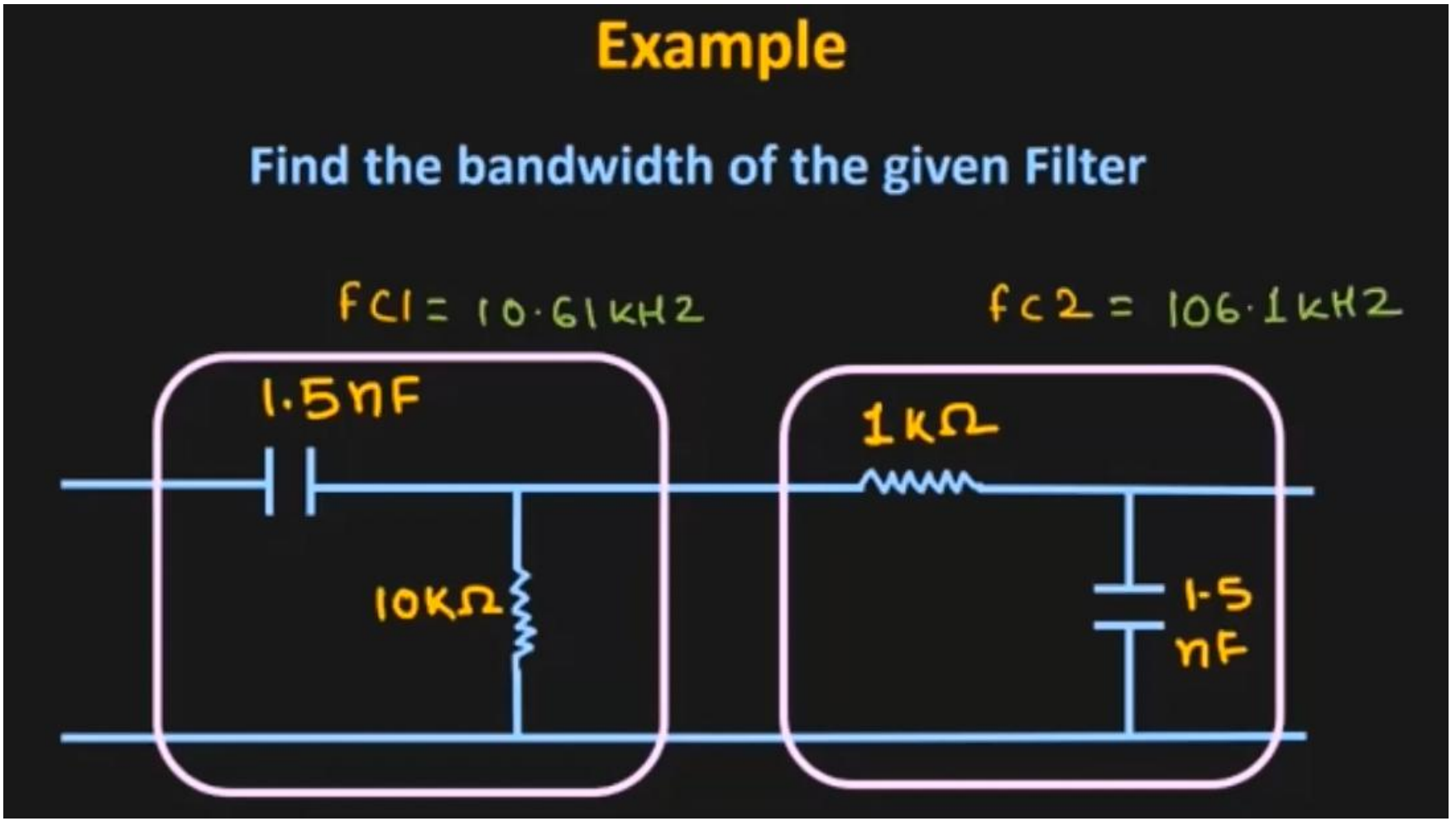
$$f_{C1} = \frac{1}{2\pi R C} = \frac{1}{2\pi \times (10K) \times (1.5nF)} = 10.61KHZ$$

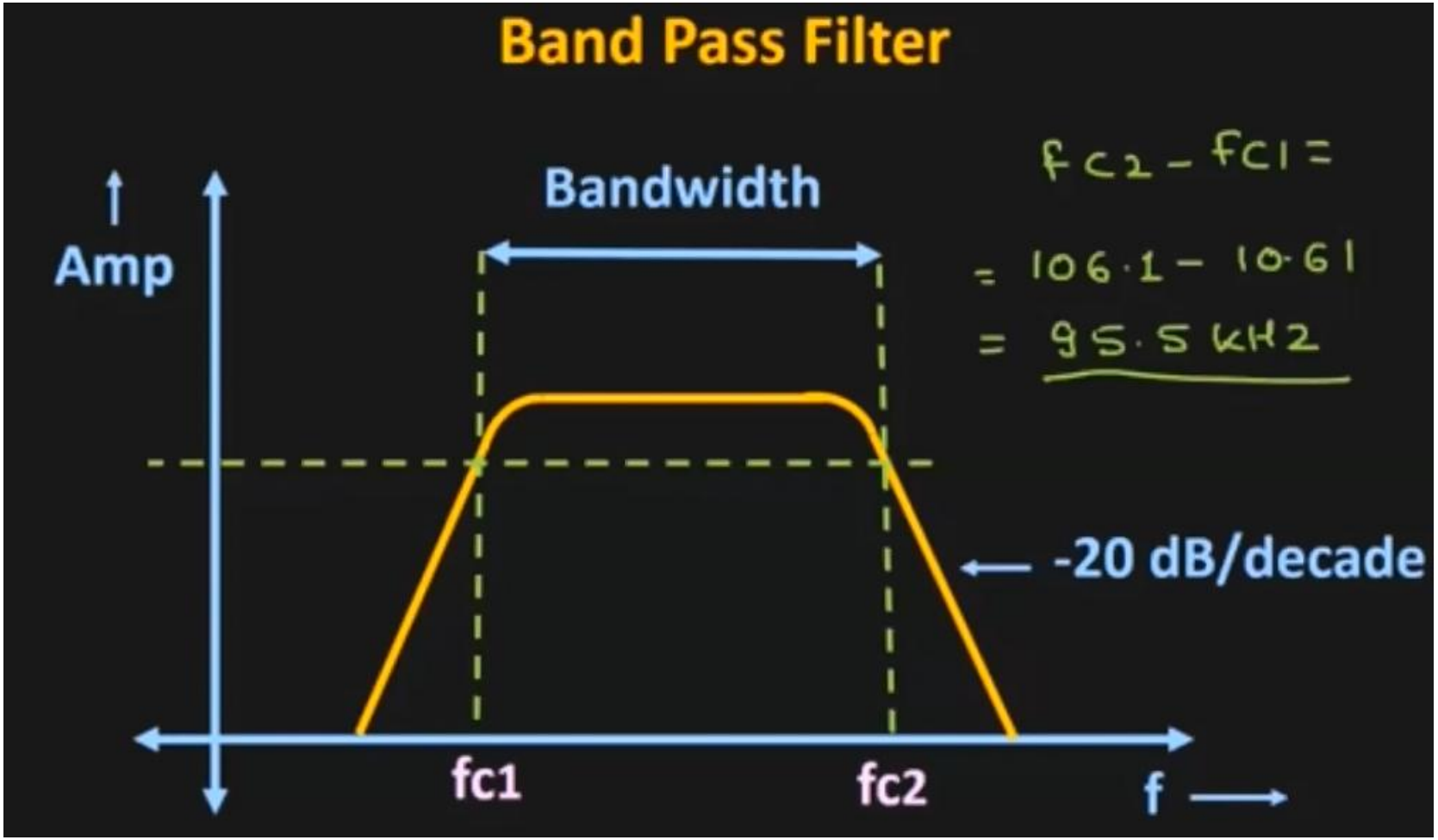
For Low Pass Filter:

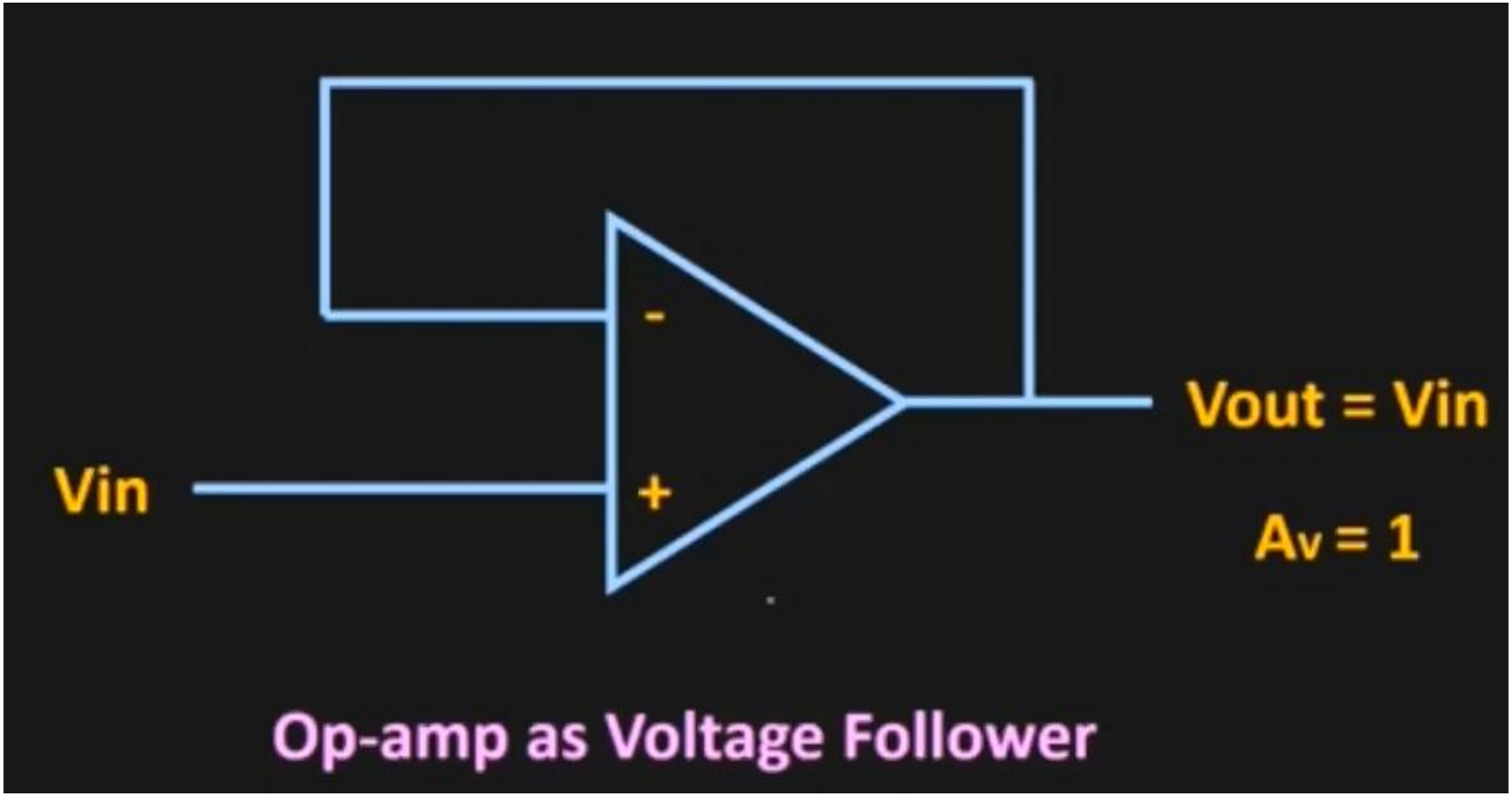
$$f_{C2} = \frac{1}{2\pi RC} = \frac{1}{2\pi \times (1K) \times (1.5nF)} = 106.1KH$$

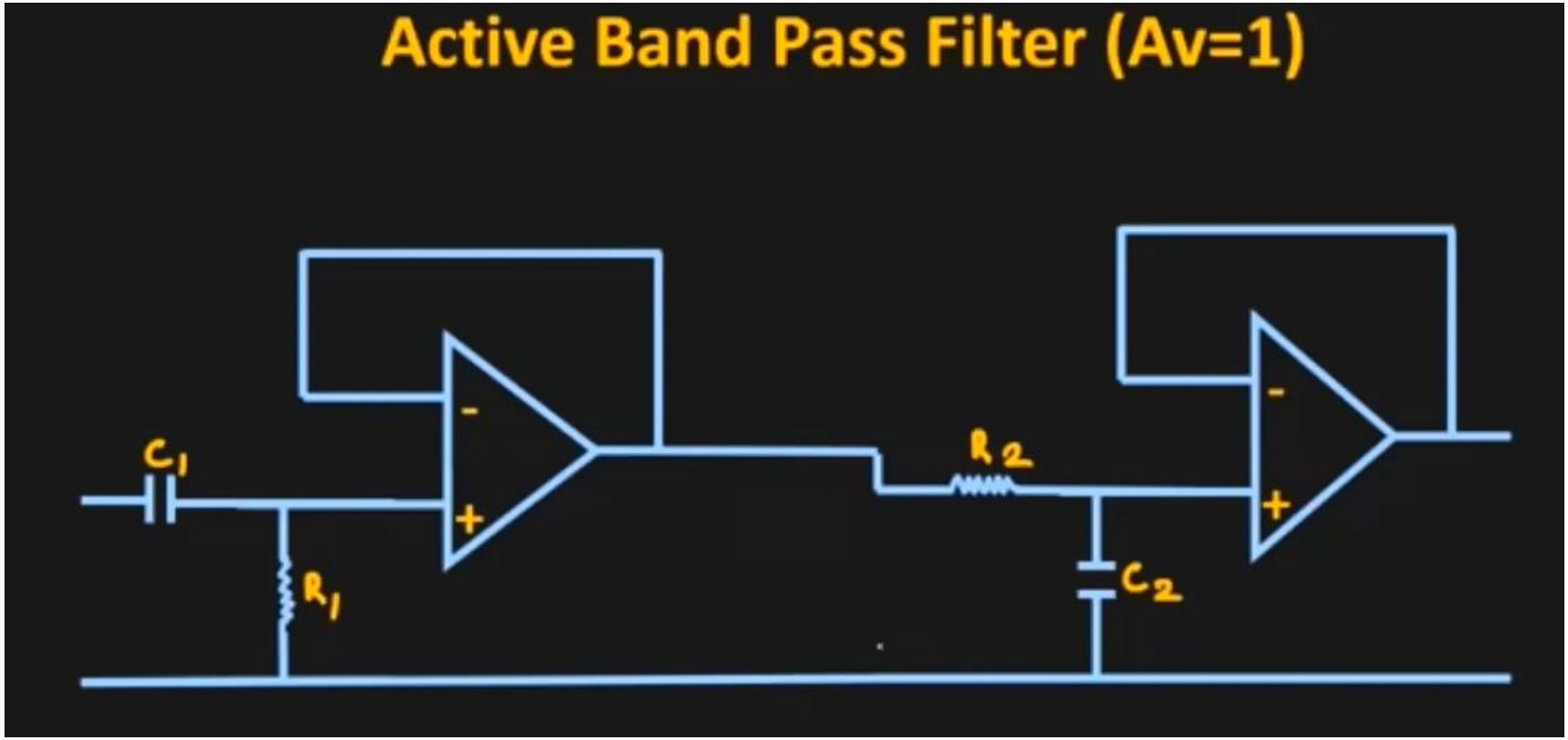
Example

Find the bandwidth of the given Filter

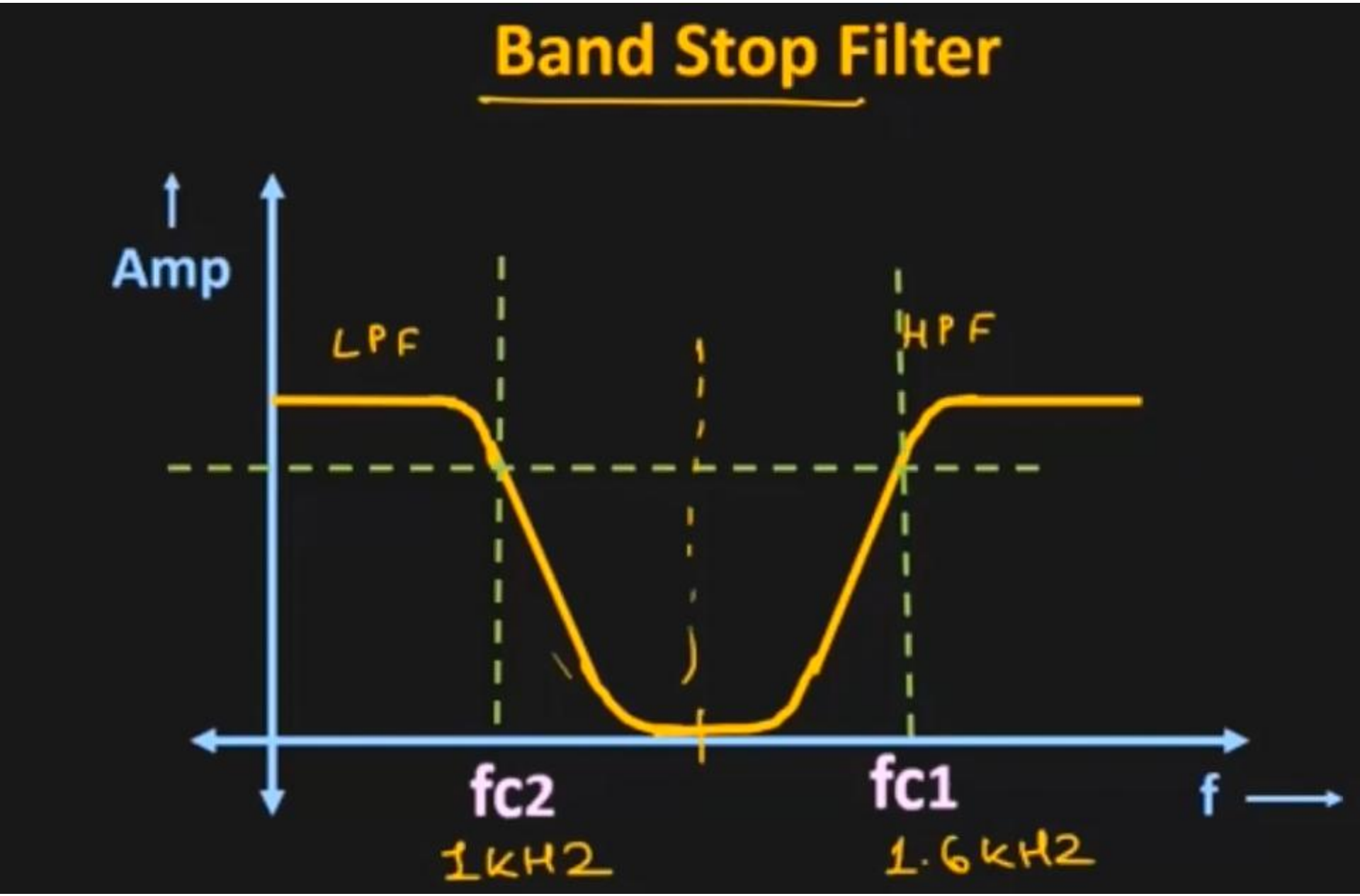



Band Pass Filter
Amp
Bandwidth
fc2 - fc1 =
= 106.1 - 10.61
= 95.5 kHz
-20 dB/decade
fc1
fc2
f

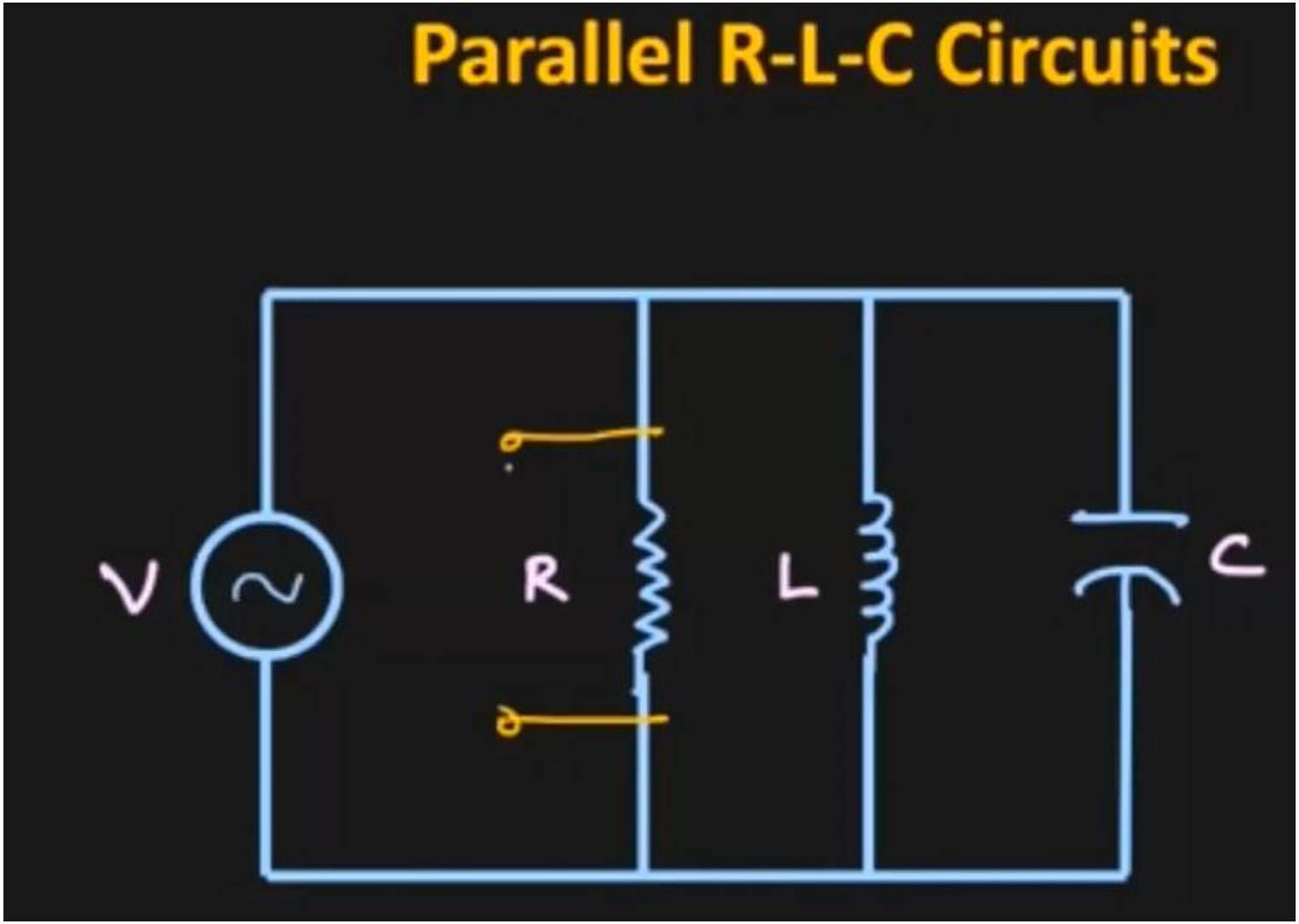

-
+
Vin
Vout = Vin
Av = 1
Op-amp as Voltage Follower

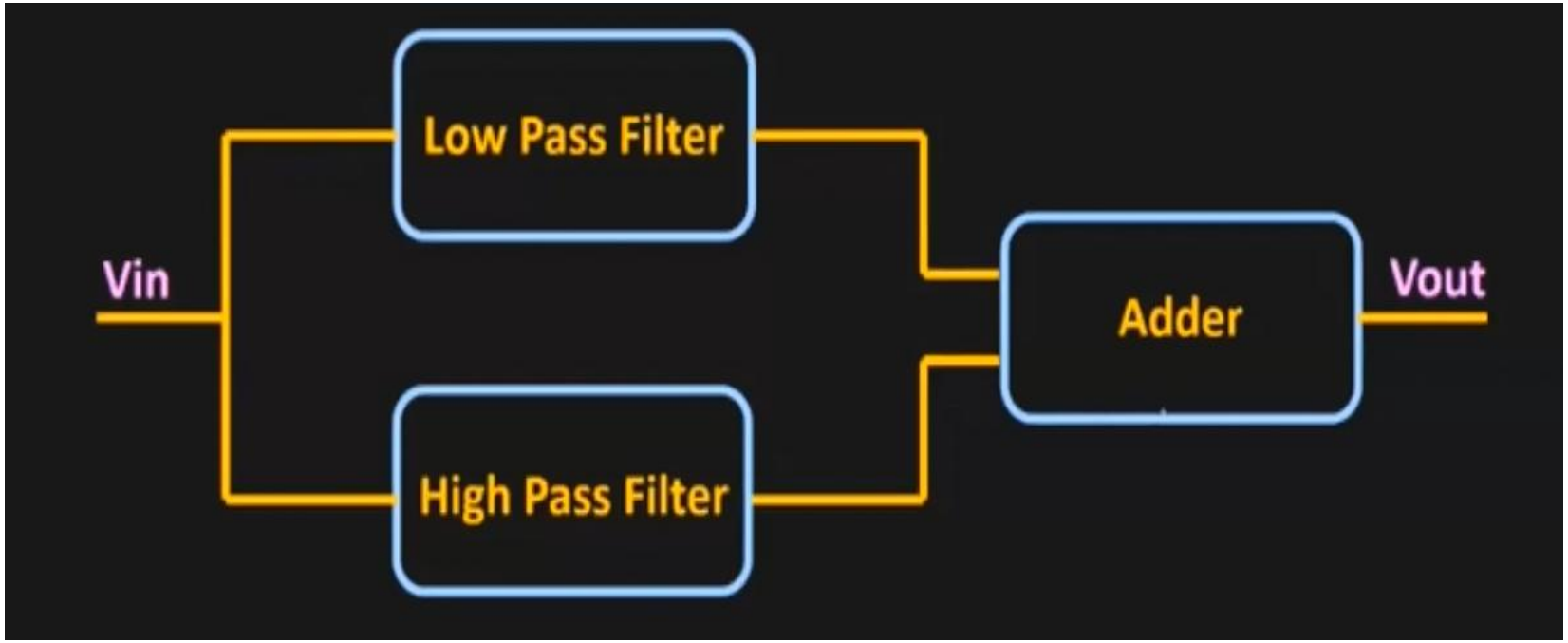

Active Band Pass Filter (Av=1)
C1
R1
R2
C2
-
+
-
+

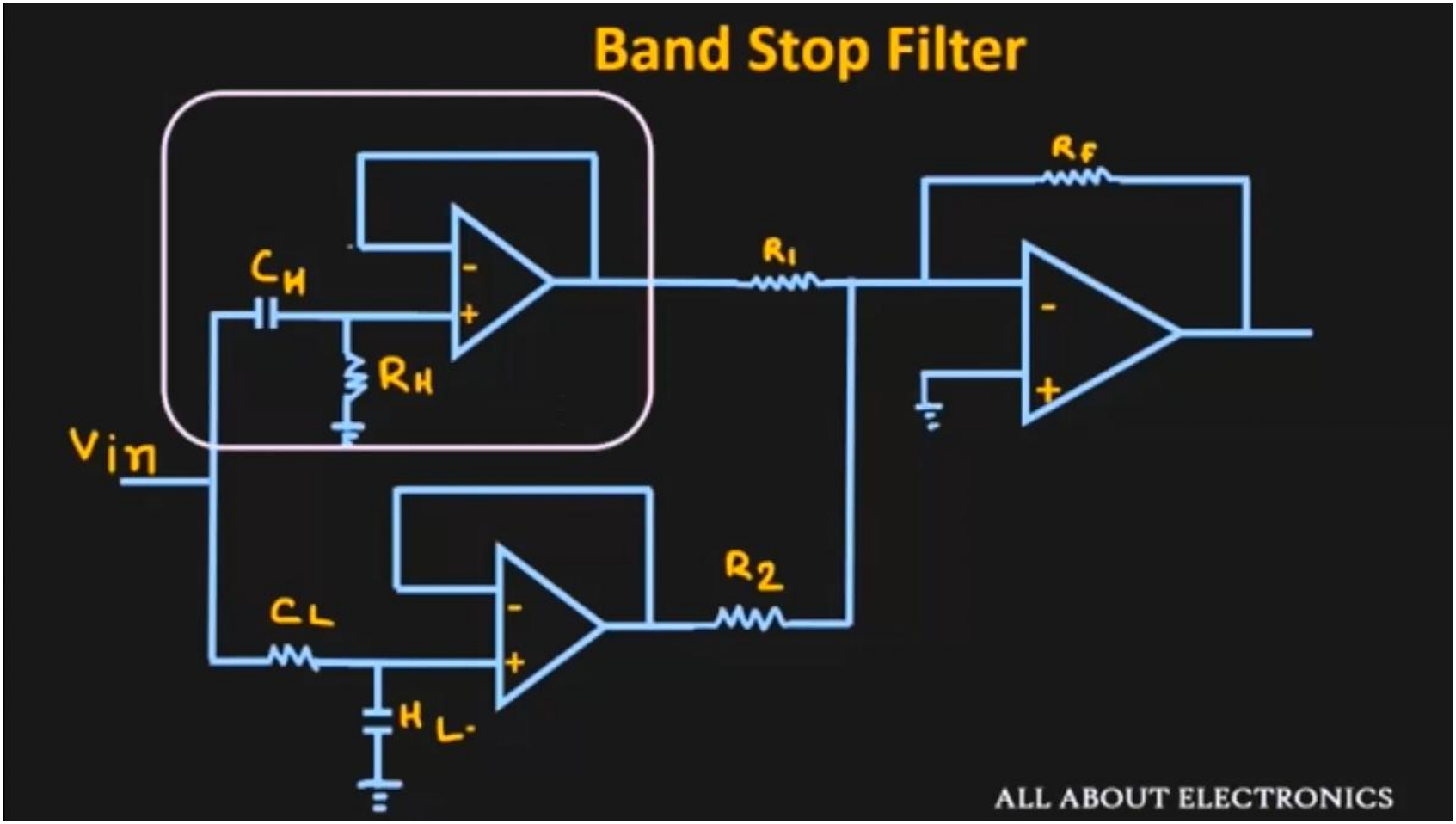
Band Stop Filter

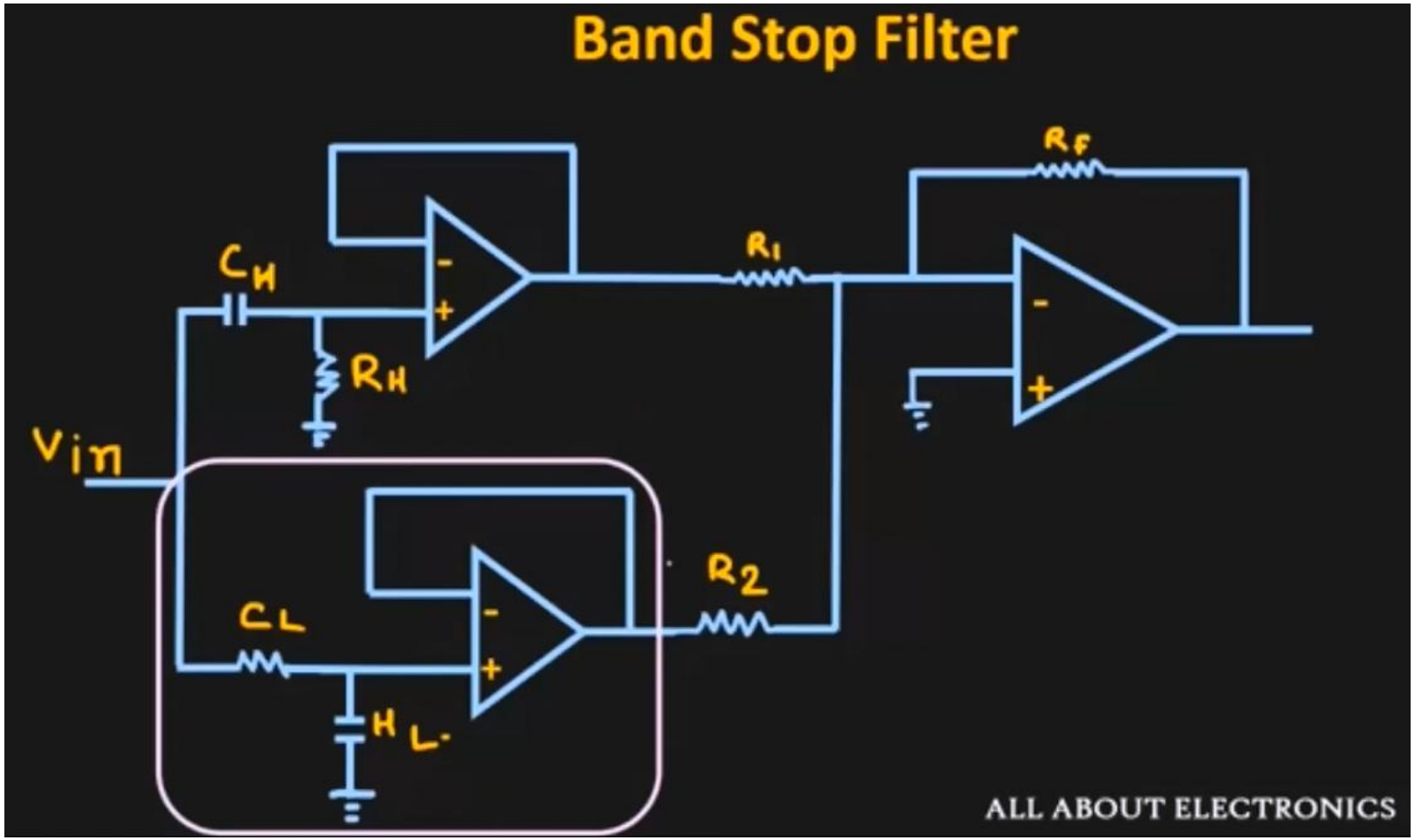


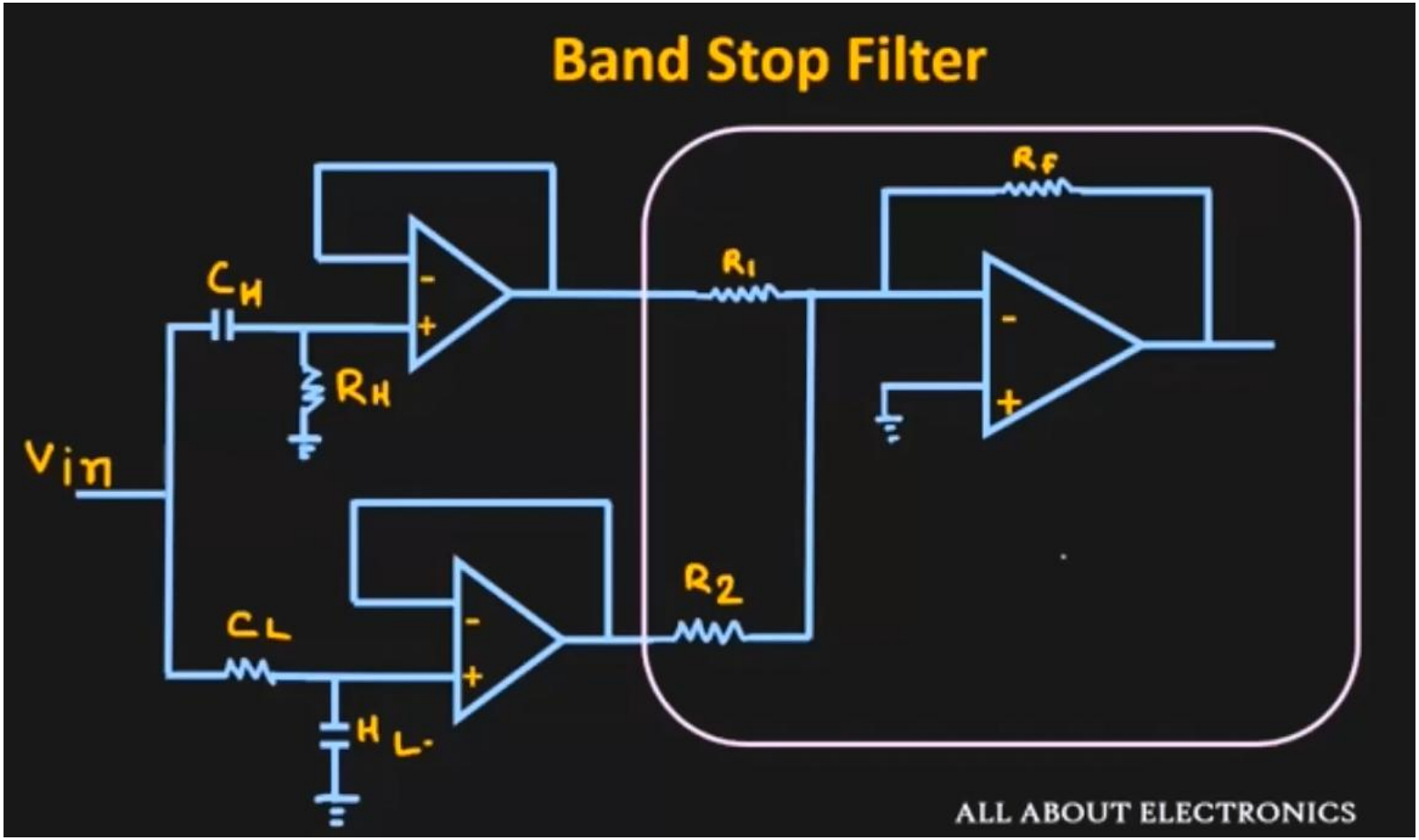
Parallel R-L-C Circuits




Low Pass Filter
Vin
Adder
Vout
High Pass Filter


Band Stop Filter
C_H
R_H
V_{in}
C_L
H_L
R_1
R_2
R_F
ALL ABOUT ELECTRONICS


Band Stop Filter
C_H
R_H
R_1
R_F
V_{in}
C_L
R_2
H_L
ALL ABOUT ELECTRONICS


Band Stop Filter
R_F
C_H
R_1
R_H
V_{in}
R_2
C_L
H_L
ALL ABOUT ELECTRONICS

For High pass Filter:

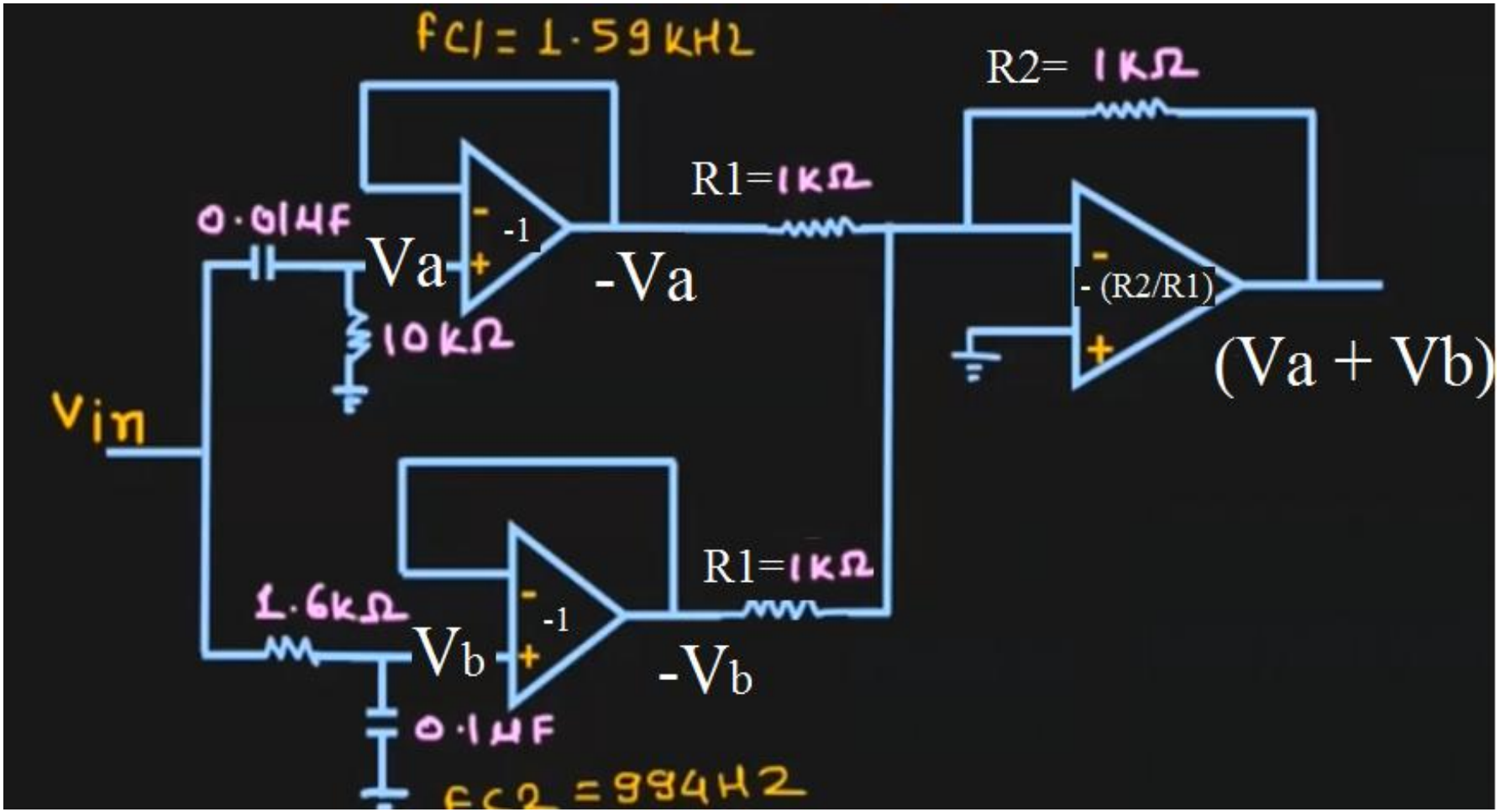
$$f_{C1} = \frac{1}{2\pi R C} = \frac{1}{2\pi \times (10K) \times (0.01\mu F)} = 1.59\ KHz$$

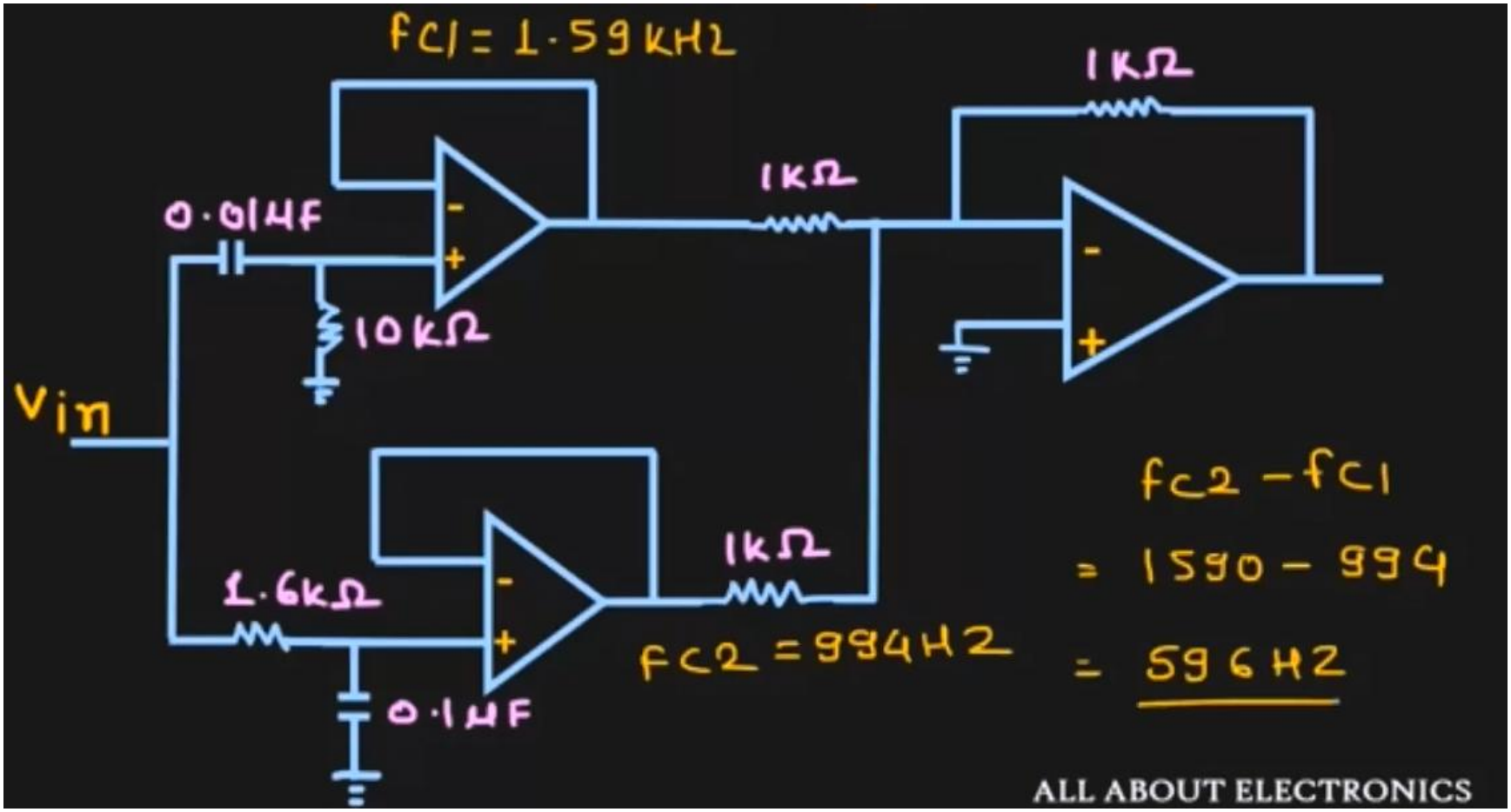
For High pass Filter:

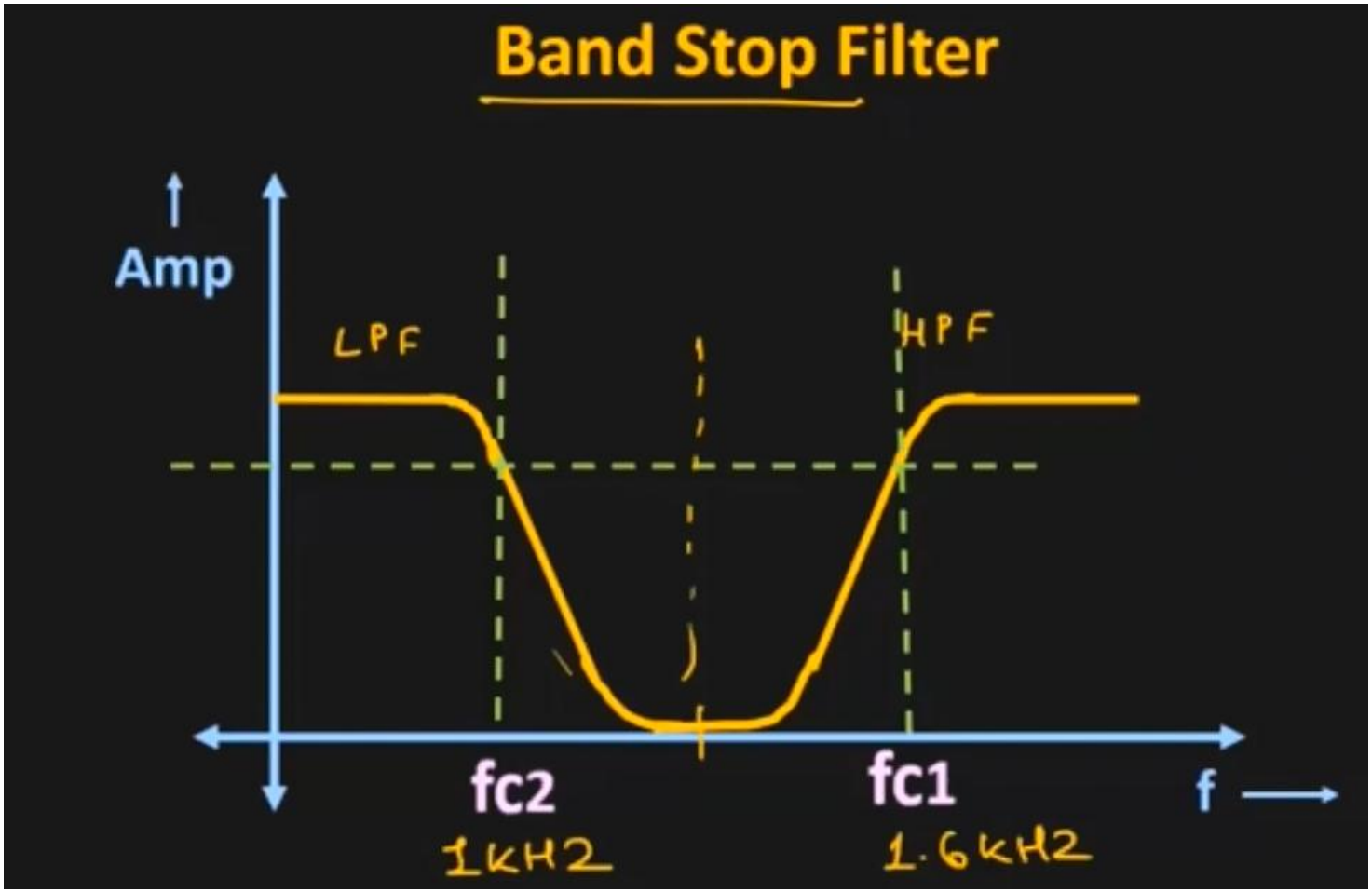
$$f_{C1} = \frac{1}{2\pi R C} = \frac{1}{2\pi \times (10K) \times (0.01\mu F)} = 1.59\ KHZ$$

For Low pass filter:

$$f_{C2} = \frac{1}{2\pi R C} = \frac{1}{2\pi \times (1.6K) \times (0.1\mu F)} = 994\ HZ$$


fc1 = 1.59 kHz
R2= 1kΩ
R1=1kΩ
0.01μF
Va
-1
-Va
10kΩ
- (R2/R1)
(Va + Vb)
Vin
R1=1kΩ
1.6kΩ
Vb
-1
-Vb
0.1μF
fc2 = 994Hz


fc1 = 1.59 kHz
1KΩ
0.01μF
1KΩ
10KΩ
Vin
1.6kΩ
1kΩ
fc2 = 994Hz
0.1μF
fc2 - fc1
= 1590 - 994
= 596Hz
ALL ABOUT ELECTRONICS


Band Stop Filter
Amp
LPF
HPF
fc2
1kH2
fc1
1.6kH2
f