What is a Filter?

- Many electronic systems require that certain bands of frequencies be passed/used and others attenuated/rejected. A device which does this operation is called a **Filter**

- It is made up of resistors and capacitors
Types of Filters

- Passive and Active Filters
- Low Pass and High Pass
- Band Pass and Band Reject
- Butter worth, Chebyshev, Salen Key, Bessel

Passive versus Active Filters

- Passive filter is a filter without active components such as transistors and op-amps.
- The output signal is not greater than input signal.
- No need of power supply.

- Active filter is one which incorporates transistors and op-amps.
- The output signal is greater than input signal due to gain.
- Needs power supply.
• In passive filters, the corner frequency changes due to load resistor.

• In active filters, the response is not affected by the load resistor.

High pass Filter
• A high pass filter is a circuit which passes all the frequencies above a certain frequency.

Low pass Filter
• A low pass filter is a circuit which passes all the frequencies below a certain frequency.
Band Pass Filters
• A filter which passes certain band of frequencies.

Band Stop Filters
• A filter which attenuates certain band of frequencies.

The corner frequency $F_c = \frac{1}{2\pi \sqrt{R_1 R_2 C_1 C_2}}$
FIGURE 1.9 Classification of Filters by Shape of Response Curves

<table>
<thead>
<tr>
<th>Name of Filter Type</th>
<th>Distinguishing Characteristic</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Butterworth</td>
<td>Maximally flat amplitude response</td>
<td>Most popular general-purpose filter</td>
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<tr>
<td>Chebyshev</td>
<td>Equal-amplitude ripples in passband</td>
<td>Attenuation slope steeper than in Butterworth</td>
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<tr>
<td>Inverse Chebyshev</td>
<td>Equal-amplitude ripples in stopband</td>
<td>No passband ripple; zeros of transmission in stopband</td>
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<tr>
<td>Complete Chebyshev (also called</td>
<td>Equal-amplitude ripples in both passband and stopband</td>
<td>Zeros of transmission in stopband</td>
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<td>Cauer, elliptic function, elliptic</td>
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<td>integral, or Zolotarev)</td>
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<tr>
<td>Legendre</td>
<td>No passband ripple, but steeper attenuation slope than in Butterworth</td>
<td>Not maximally flat</td>
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<tr>
<td>Bessel (also called Thomson)</td>
<td>Phase characteristic nearly linear in pass region, giving maximally flat group delay</td>
<td>Good for pulse circuits because ringing and overshoot minimized; poor attenuation slope</td>
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