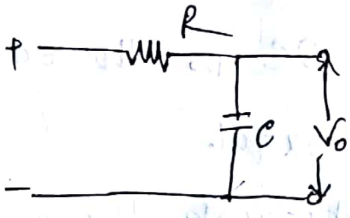
Subject :

Date :

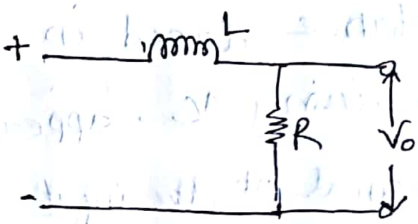
Filter: A circuit that can remove unwanted portions ~~a g~~ of a signal at its input.

- Capacitor : Allow AC ; Block DC
- Inductor : Allow DC ; Block AC

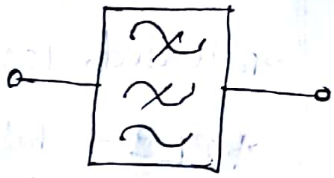
Low pass: A filter circuit which allows a set of frequencies that are below a specified value can be termed as a low pass filter.



RC

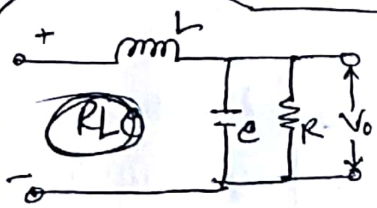


RL



Symbol of LPF

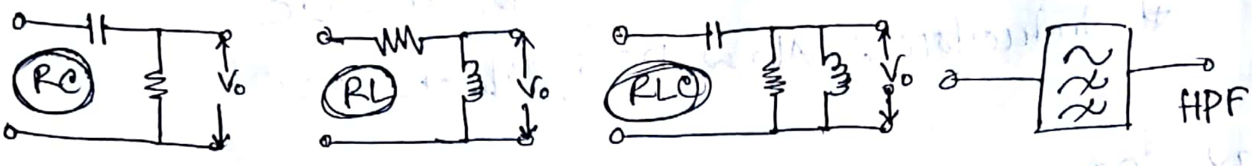
- RC = as the capacitor is placed in shunt, the AC it allow is grounded. This by passes all the high frequency components while allows DC at the output.
- RL : as the inductor is placed in series, the DC is allowed to the output. The inductor blocks AC which is not allowed at the output.



RL

- L : ~~Block AC~~, allow DC
- The output is again passed through the capacitor in shunt, which grounds are remaining AC component if any present in the signal. Allow DC at output.

<u>High Pass filter:</u> A filter circuit which allows a set of frequencies that are above a specified value can be termed as a high pass filter.

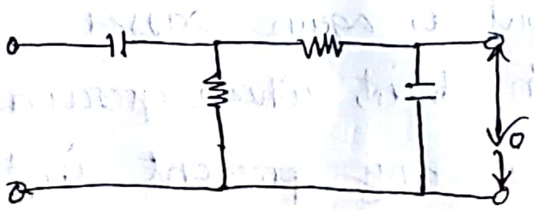


★ RC = as the capacitor is placed in series. it block DC components and allows AC to output. ~~HP~~ high frequency appear at the output accross the resistor.

★ RL = Inductance placed in series, DC is allowed to grounded, remaining AC, appear at the output.

★ RLC = the signal at the input goes through the capacitor which blocks DC, Allows AC. The output again passed through the inductor in shunt, which grounds the remaining DC components, If any present in the signal. This is the better high pass than both of them.

<u>Band Pass filter:</u> a filter circuit which allows a set of frequencies that are between two specified values can be termed as band pass.

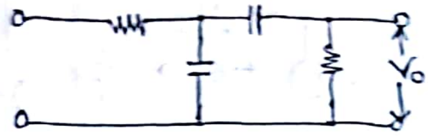


BPF symbol.

Subject :

Date :

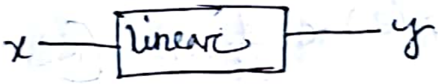
Band Reject filter: a filter circuit that blocks a set of frequencies that are between two specific values can be called as BRF.



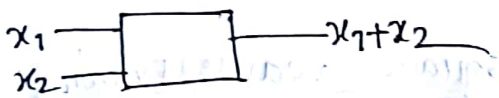
symbol of BRF

Characteristics of linear wave shaping:

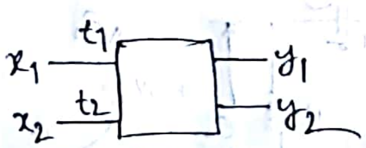
1. **Homogeneity:** If x be input then y be output corresponding of x. If input be $2x$ then output must by $2y$.



2. **Additivity:** If x_1 and x_2 be input then output be ~~x+y~~ x_1+x_2



3. **Shift Invariance:** If x_1 be input at time t_1 and output be y_1 then x_2 be input at time t_2 then y_2 be output.



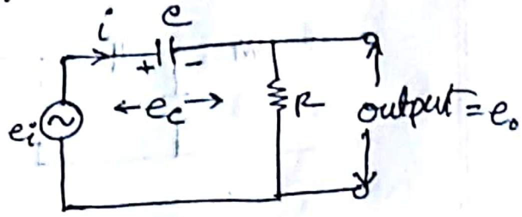
4. It can hold the waveform to a particular d.c. level.
5. It also generate one waveform to another.
6. It limits the voltage level of the waveform of some presenting value.
7. It cuts-offs the positive and negative portion of output.

Subject :

Date :

Differentiating circuit: a circuit in which output voltage is directly proportional to the derivative of the input is known as a differentiating circuit.

$$\text{output} \propto \frac{d}{dt}(\text{input})$$



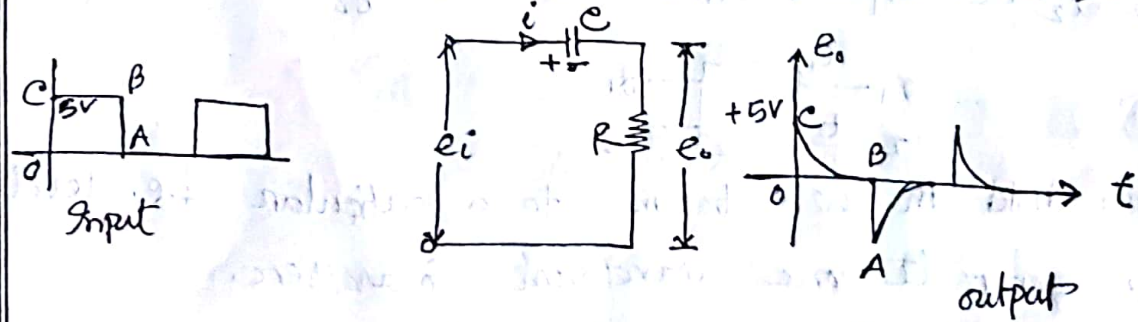
The output across R will be the derivative of the input.
To achieve good differentiating there must be -

1. time constant must be very smaller.
2. the value of X_C should be 10 or more time larger.

output,
$$e_0 = iR = RC \frac{d}{dt}(e_i) \propto \frac{d}{dt}(e_i) \quad [RC = \text{constant}]$$

output waveform: output waveform of this circuit depends upon the time constant and shape of input.

i) **When input is a square wave:** During OC part of input wave, its amplitude changes abruptly and hence the differentiated wave will be a sharp narrow pulse shown as -



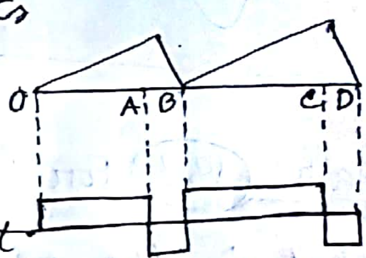
Since time constant RC of the circuit is very small w.r.t. time period of input wave and $X_C >> R$, the capacitor will become fully charged during the early part

Subject : | Date :

of each half cycle of input wave. During the remainder part of the half cycle, the output of the ~~circle~~ circuit will be zero because the capacitor voltage neutralises the input voltage and there can be no current flow through R.

Make القرآن

(ii) **When input is a triangular wave:** when the input fed to a differentiating circuit is a triangular wave, the output will be a rectangular wave as shown.



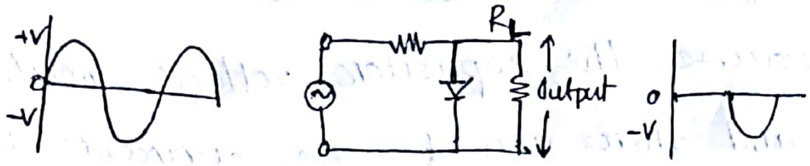
During period OA of the input wave, its amplitude changes at a constant rate and therefore, the differentiated wave has a constant value for each constant rate of change.

(iii) **When input is a sine wave:** A sine wave input becomes a cosine wave and a cosine wave input becomes an inverted sine wave at the output.

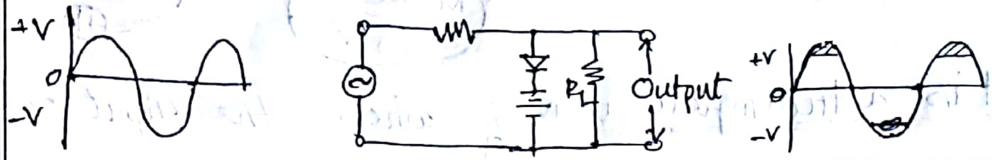
Subject :

Date :

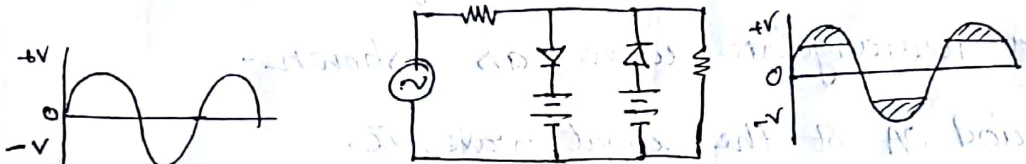
Clipper & Clamper:



Positive clipper

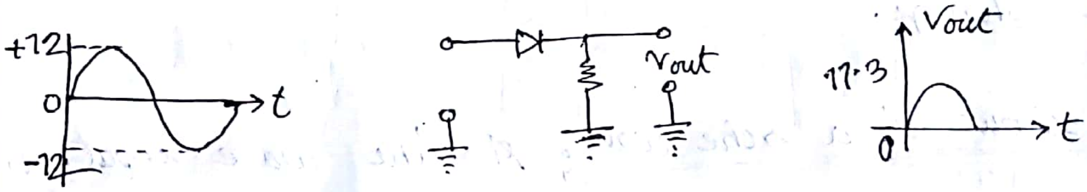


biased



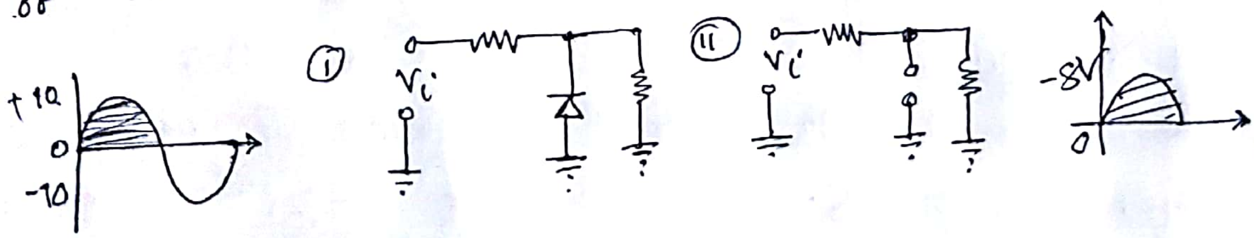
combination

Maths: (18.7) For the negative series clipper shown in fig. 18-28 what is the peack output voltage from the circuit?



$$V_{out(peak)} = V_{in(peak)} - 0.7 = 12 - 0.7 = 11.3\ V$$

(18.8) negative shunt clipper (i) has a peak input voltage of +10V. What is the peak output voltage from circuit?



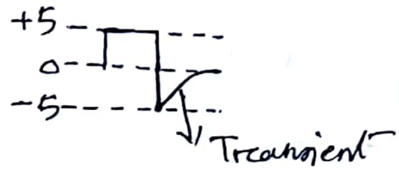
Subject :

Date :

$V_{out(peak)}$ = Peak voltage across R_L $= \frac{R_L}{R+R_L} V_{in} = \frac{4}{1+4} \times 10 = 8$

Application of clipper:

1. Changing the shape of a waveform;
2. Circuit transient protection: a transient is a sudden current or voltage rise that has an extremely short duration



3. Used as half wave rectifier in power supply;
4. Used as voltage limiters and amplitude selectors;
5. It clips either positive or negative cycle;
6. Used for separation of synchronizing signal;
7. Used for the generation of new wave forms or shapping the existing, waveforms.

Appication of clamper:

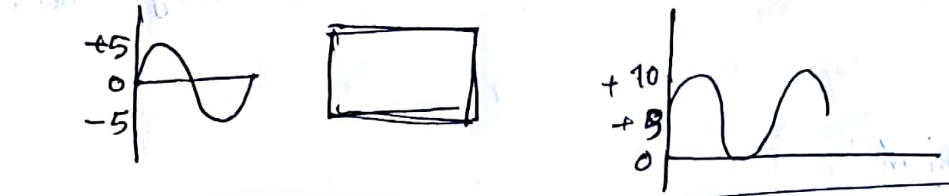
1. They clamp the wave forms to a fixed DC potential.
2. Used in test equipment, sonar and radar systems;
3. Used for protection of the amplifier;
4. Used as a base line stabilizer to define section of the luminance signals to present level.
5. Used for removing distorsions.

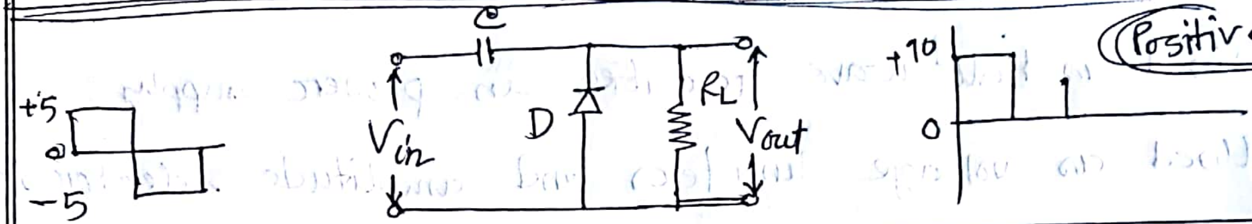
Subject: Date:

6. Used as voltage or voltage multipliers.

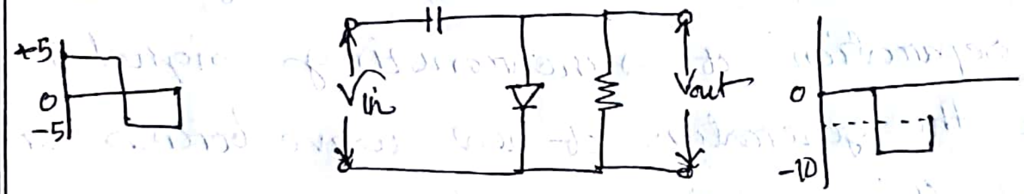
7. Used for improving the overdrive recovery time.

Clamping circuit: A circuit that places either the positive or negative peak of a signal at a desired d.c. level is known as clamping circuit.





Positive clamper



Negative clamper

Examples: 18.19

$5 - V_c + 2 = 0 \quad \Rightarrow V_c = 7V$

$-5 - 7 + V_{out} = 0 \quad \Rightarrow V_{out} = -12V$

18.20