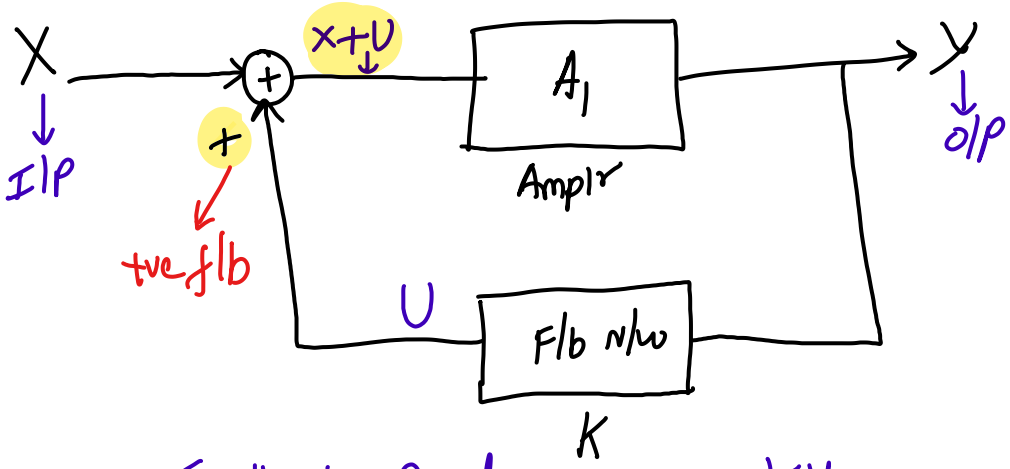
AEC lec 32 9/10/23

Concept of Positive feedback:



X & U are in phase

→ Feedback signal : $U = KY$

$\frac{Y}{X} = ?$

→ $Y = A_1(X+U)$

→ $Y = A_1(X+KY)$

→ $Y(1-KA_1) = A_1X$

→ $\boxed{\frac{Y}{X} = \frac{A_1}{1-KA_1}}$

Closed loop gain

A_1 – open loop gain

$\boxed{\frac{Y}{X} > A_1}$

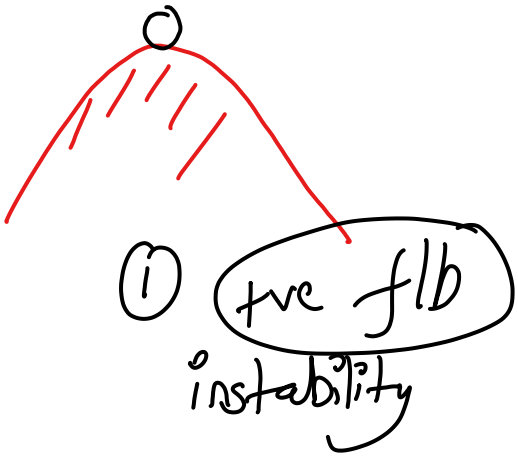
KA_1 : loop gain

+ve flb

→ If K ↑ses → A_1 being constant → $\frac{Y}{X}$ will ↑se

$KA_1 \to 1 \longrightarrow \boxed{\frac{Y}{X} \to \infty}$

→ v.high → instability



Oscillator Vs Amplifier

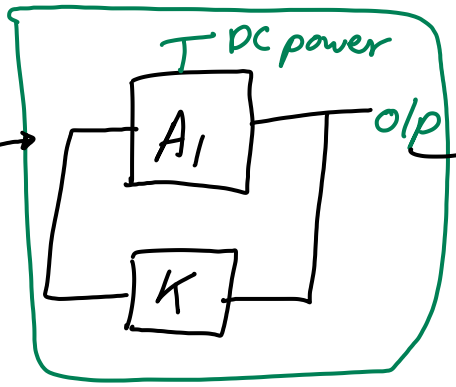
→ An oscillator is an amplr with +ve flb

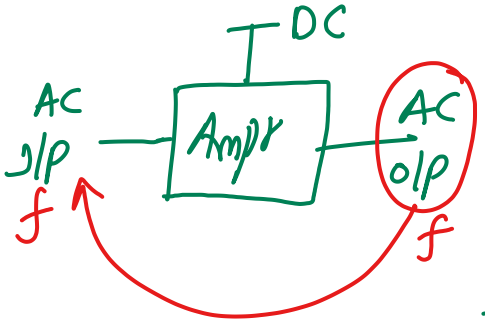
An oscillator provides a periodic, sinusoidal waveforms of adjustable amplitude of any desired frequency

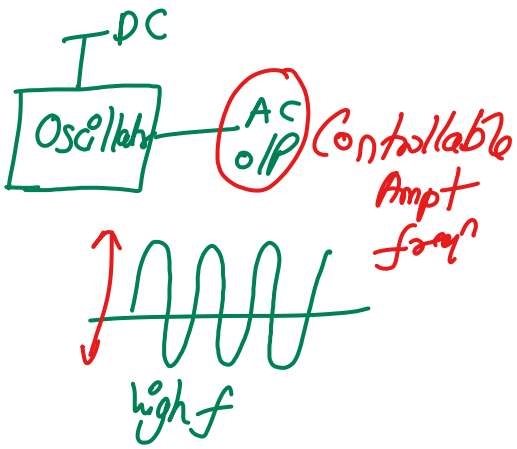
No external AC I/p

sustained oscillation

Oscillator.



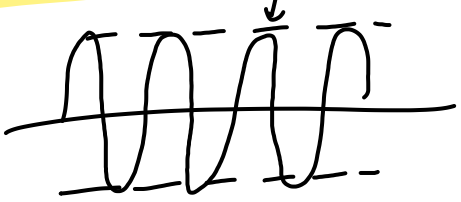


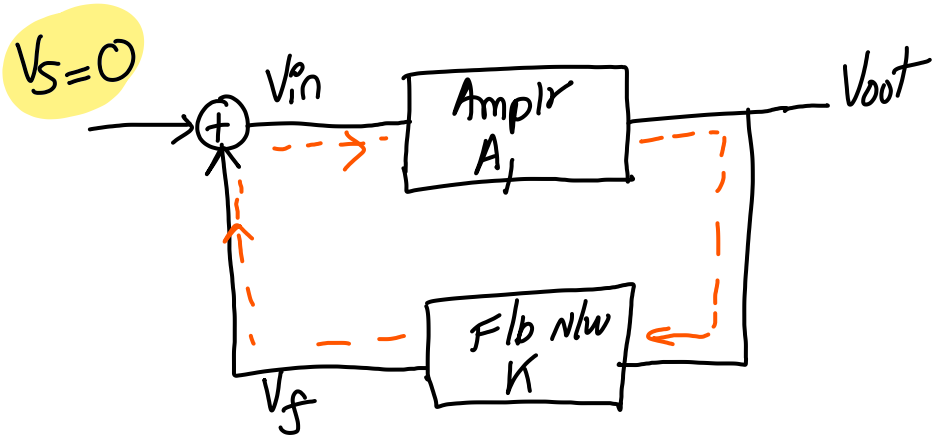


Principle of oscillations:

Oscillator: +ve flb does not guarantee oscillations.

An oscillator to produce sustained oscillation → it should obey "Barkhausen's Criterion"





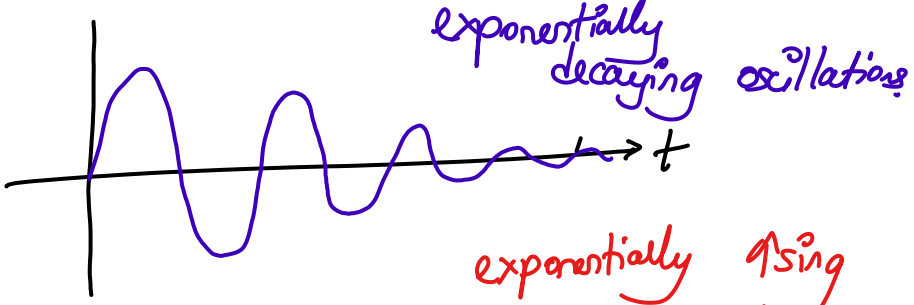
① $A_1K \geq 1$

② $\angle A_1K = 0$ or $360°$ or 2π radians

Phase shift

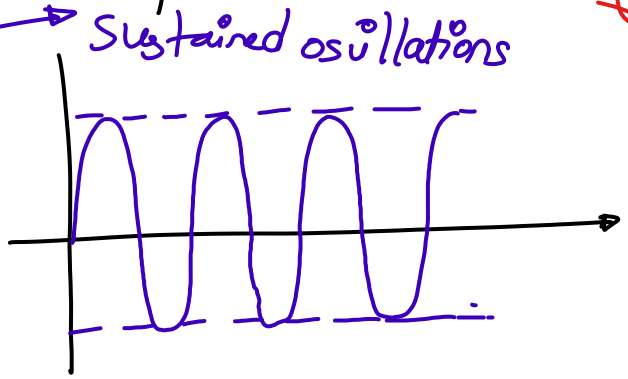
Effect of loop gain $|A_1K|$ on nature of oscillations?

① $|A_1K| < 1$

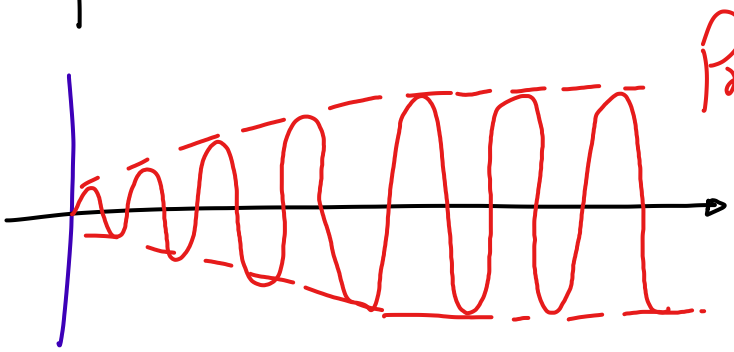


② $|A_1K| > 1$

③ $|A_1K| = 1$



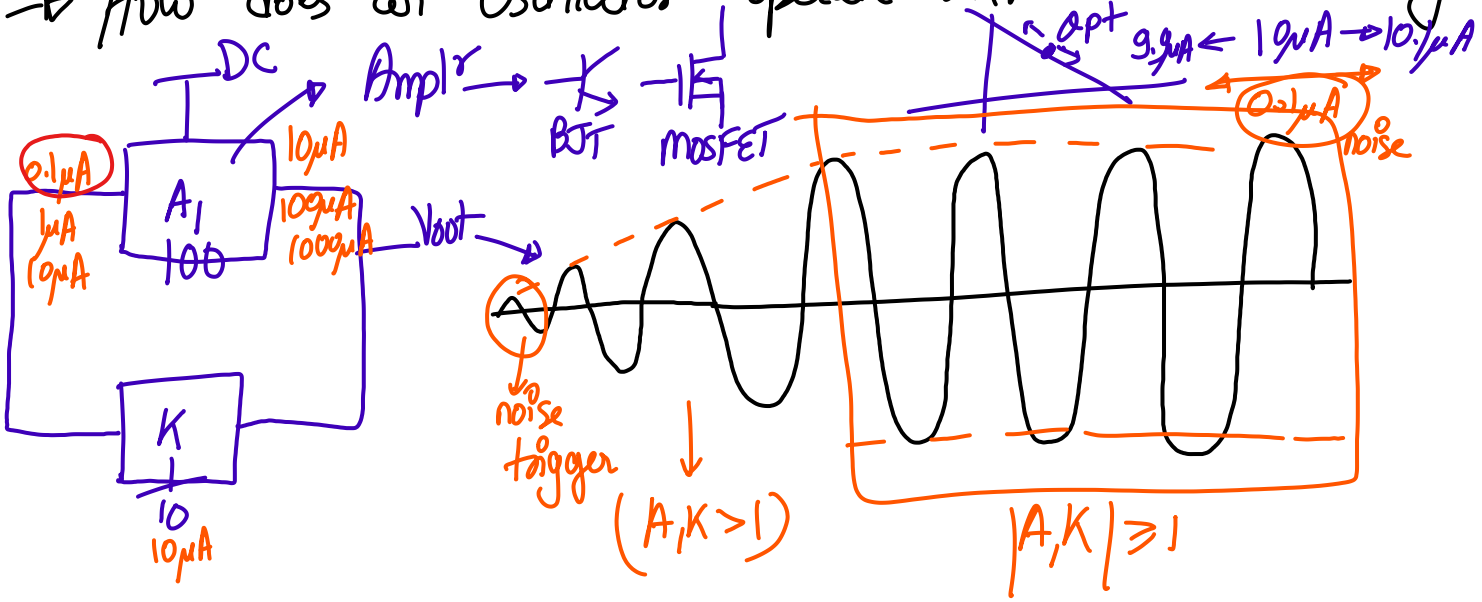
④ $|A_1K| \geq 1$

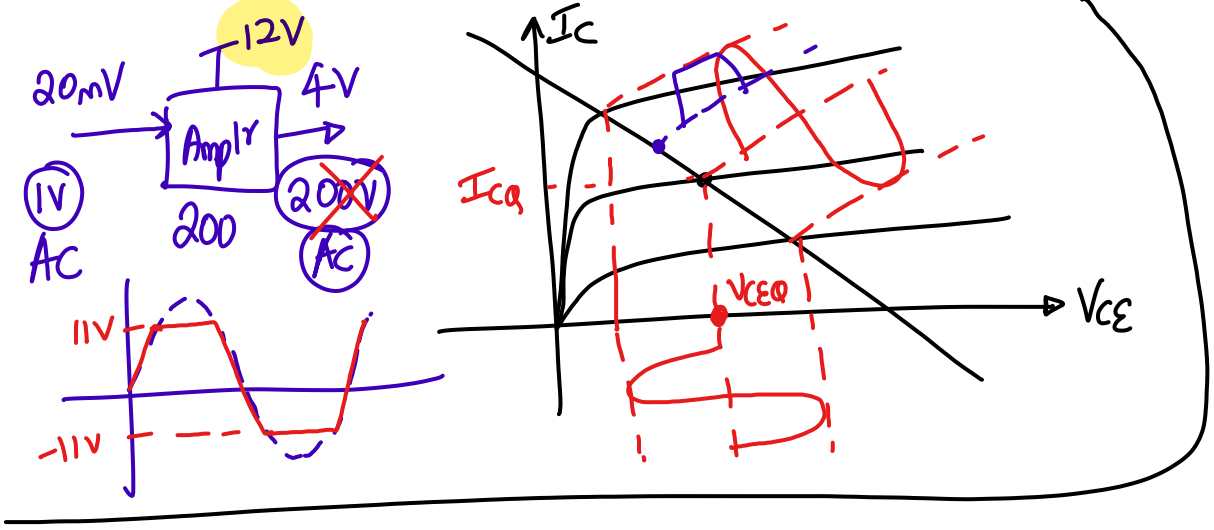


$|A_1K| \geq 1$? why → offset the non-linearities existing in the ckt (BJT, MOSFET)

+10%

→ How does an Oscillator operate without an AC ip sig.?





Classification of oscillators:-

Sinusoidal oscillators

Non-sinusoidal
- Multivibrators (Schmitt trigger)
- UJT relaxation oscillator

Not in syllabus

① low-frequency oscillator (Audio-freq^n)
↓
R, C elements
(20Hz-20KHz)
eg ① RC phase shift oscillator
② Wien-bridge oscillator

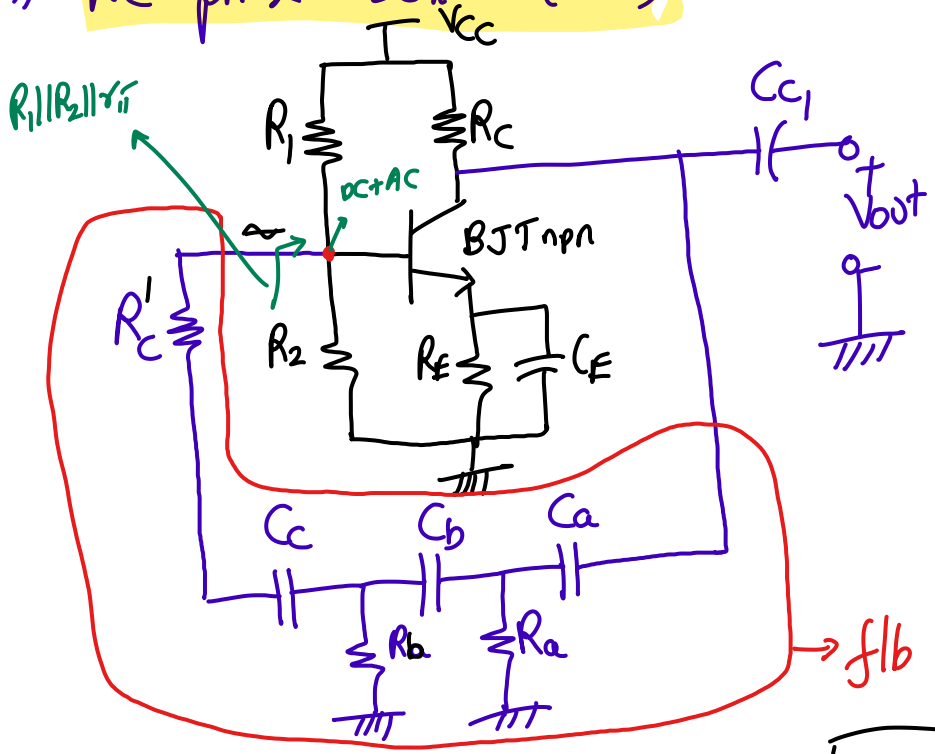
② high-frequency oscillator (RF oscillator)
↓
L, C elements
(> 20KHz - few MHz)
eg ① Hartley oscillator
② Colpitt's oscillator (Clapp's)

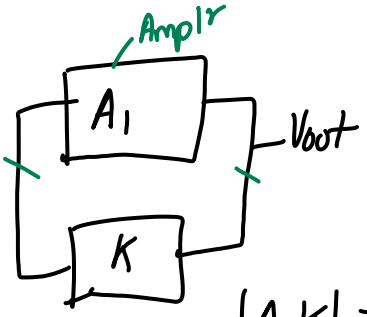
flb N/w

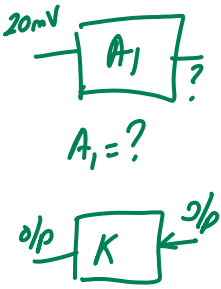
③ Crystal oscillator
✗
↳ Quartz crystal

10M
ckt diag^m = 3m
Principle of oscillation → 2m
Working : 3m
freq^n exp : 1m
Adv, Disadv : 1m

RC phase oscillator (BJT)

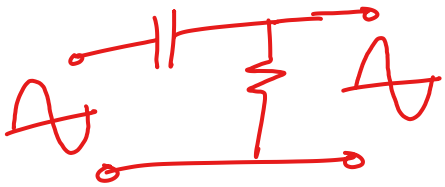






$|A_1K| \geq 1$

$\angle A_1K = 0$ or 360°

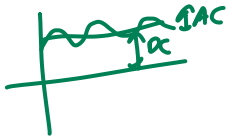


RC → 60°

3×RC → 60°×3 = 180° → flb n/w

CE Amplr → 180°

360° or 0° Phase shift

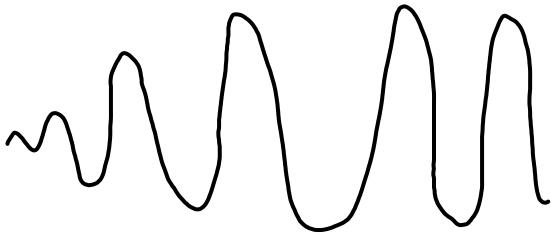


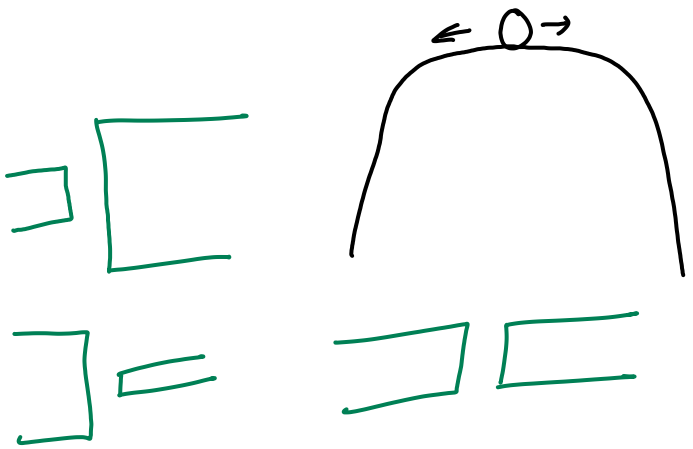
$$f_0 = \frac{1}{2\pi RC\sqrt{6+4K}}$$

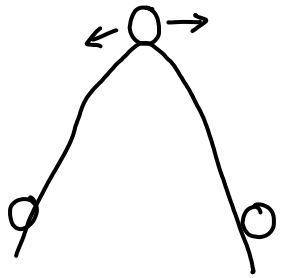
$K = \frac{R_c}{R}$ $\quad R'_c = R - R_{in}$

$R = R_a = R_b$

$C = C_a = C_b = C_c$





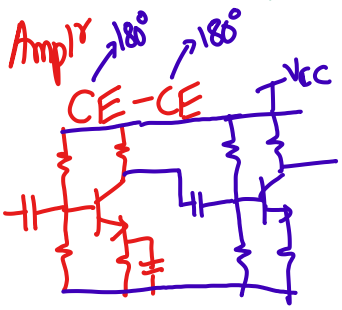


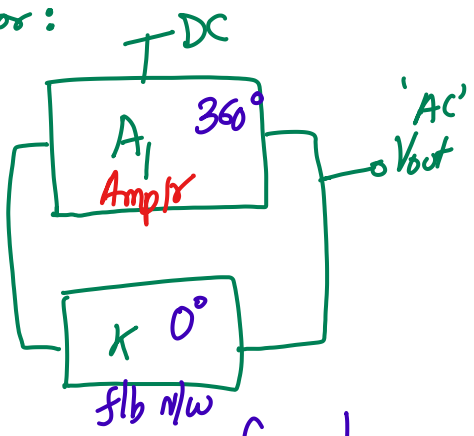
unstable

$A_1 = 45.514$ $\quad |A_1K| > 1$

$K = 0.067$ $\quad |A_1K| = 3.04$

Wien-bridge oscillator:





$$f_o = \frac{1}{2\pi RC}$$