2.

Unit-4

Barkhausen criterion:

$V_o = A \cdot V_i$ — (1)

feedback

$V_f = -\beta V_o$ — (2) (Inverting Amplifier)

-ve sign indicates 180° phase shift

Subst (1) in (2)

$V_f = -\beta \cdot A \cdot V_i$

For the oscillator, feedback should drive the amplifier

hence $V_f = V_i$

$V_i = -\beta \cdot A \cdot V_i$

$\boxed{-A\beta = 1}$ ← This is called Barkhausen criterion.

$A\beta = -1 + j0$

Equating magnitude of both sides,

$|A\beta| = |-1 + j0|$

$|A\beta| = 1$.

Phase of V_f must be same as V_i.

Barkhausen criteria states that,

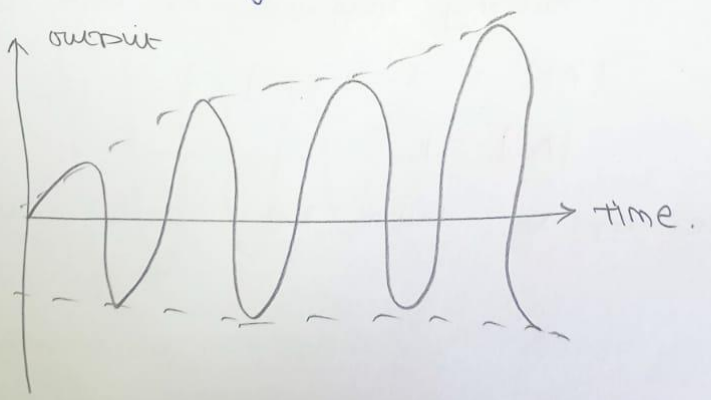
1) The total phase shift around a loop is 0° (or) 360°. or an integral multiple of 2π radians.

2) The magnitude of the product of the open loop gain of amplifier (A) and the feedback factor β is unity $|A\beta| = 1$

Satisfying the above 2 conditions, the circuit works as an oscillator producing sustained oscillations of constant frequency and amplitude.

a) $|A\beta| > 1$.

When total phase shift 0° (or) 360° & $|A\beta| > 1$. output oscillates and growing type. Amplitude goes on increasing.

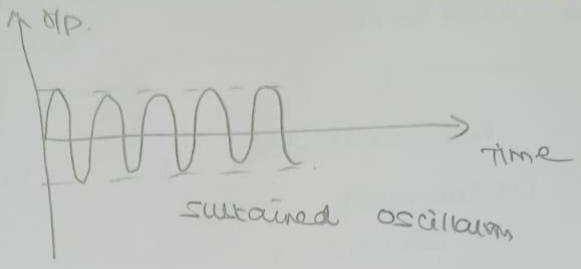


a) Growing type of oscillation.

b) $|AB| = 1$.

Phase shift 0° (or) 360° & $|AB| = 1$.

Oscillations with constant frequency and amplitude are called sustained oscillations.

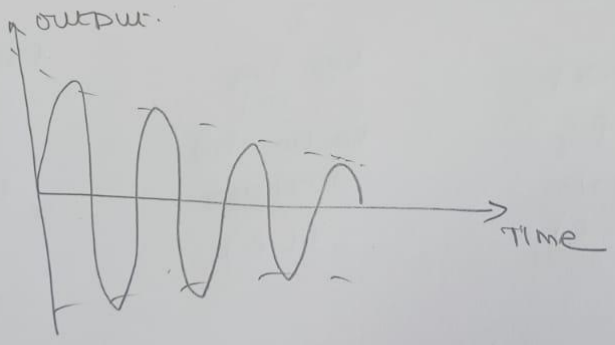


sustained oscillations

c) $|AB| < 1$.

When phase shift 0° (or) 360° & $|AB| < 1$.

Oscillations are decaying type. Amplitude decreases exponentially and finally cease. Circuit worked as amplifier without oscillations.



Exponentially decreasing oscillations.

Starting Voltage ?

Movement of free electrons generate a voltage called noise voltage, across the resistance. Such noise voltages are amplified.

classification of oscillator :