UNIT-V – FEEDBACK AMPLIFIERS AND OSCILLATORS

1.What are the types of Mutivibrators

The three types of mutivibrators are

1. bistable :It has tow stable states.
2. It has one stable state.
3. It has tow states both are quasi-stable.

2.What is intrinsic standoff ratio of a UJT

Intrinsic stand-off ratio of UJT indicates that the transistor internally divides the supply voitage and bias the emitter terminal.It is the ratio of the stand off voltage to the power supply voltage.

3. What is a clamper? Name it's types?

The ciricuit which is used to add a d.c lever as Per the requirements to the a.c output signal is called Clamper circuit. The two types are positive clamper and negativeClamper.

4. How is a Schmitt trigger different from a multivibrator?

A Schmitt trigger isa thres hold circuit which uses Positive feedback with loop gain greater than unity.The Schmitt trigger is a comparator which switches the output positive when the input passes upward.

5. Mention some applications of UJT

1. used in triggering of another device such as SCR.
2. AS a relaxation oscillator

6. Write the frequency equation of an Astable Multivibrator.

The frequency equation is T=0.69R,C, and T2=0.69R2c2

While T=T1+T2

F=1/T=1/0.69CR1C1+R2(2)

7. What is Schmitt trigger?

A Schmitt trigger is a threshond circuit which Uses positive feedback with loop gain greater than Unity.

8. What is a Multivibrator?

A multivibrator is an electronic circuit using two Amplifying transistor stages each with its output Connected to the input of the other by resistors and capacitors.

9. What is clipper?

The circuit which is used to clip off unwanted Portion of the waveform without distorting the remaining Part of the waveform is called clipper circuit.

10. Under what condition would a Schmitt trigger operate as an amplifier?

The resistance Rc1 must be enough smaller than Rc2 So that regeneration cannot take place and Schmitt Trigger operates as an amplifier.

UNIT- V

FEEDBACK AMPLIFIERS AND OSCILLATORS

1. Explain the voltage series – shunt feedback amplifier with an eg.

Circuit diagram

Series – shunt – feedback is connect with i/p as feedback is taken from o/p

$V_f = \beta V_o$ $A_i = \frac{V_o}{V_i}$ = gain of amplifier without feedback.

$V_o = V_i A$ $V_s = V_i + V_f$. $A_{Vf} = \frac{V_o}{V_s} = \frac{A}{1 \pm A\beta}$

Input impedance : voltage depended voltage source

$V_i = V_s - V_f = R_i I_c$ $Z_{if} = \frac{V_s}{I_i} = Z_i(1+\beta A)$

Output impedance : $V_o = IZ_o + AV_i$

$V_o(1+A\beta) = IZ_o$ $Z_{of} = \frac{V_o}{I_o} = \frac{Z_o}{1+A\beta}$

2) Explain the current sshunt – series feedback amplifier with eg.

Block diagram output current is taken as feedback parameter and is fed in parellel with input circint.

Current gain I_o/I_i feedback factor $\beta = I_f / I_o$

$A_F = \frac{A}{1+\beta A}$

Input impedance : $I_s = V_i/R_i\ (1+A\beta)$; $R_{if} = \frac{V_i}{I_s} = \frac{R_i}{1+A\beta}$

output impedance : $I_o = \frac{V_o}{R_o} - A\beta I_o$ $R_f = \frac{V_o}{I_o} = R_o(1+A\beta)$

Gain ↓, Stability ↑, Noise ↓, Distortion ↓

3. Describe the characteristics of Negative feedback.

When the feedback is in opposition to the i/p, the i/p signal reduced. – Negative feedback. $V_i = V_s - V_f$

$i_i = i_s - i_f$.

* reduces the gain of the amplifier
* Reduces the noise, distortion & instability
* increases bandwidth
* Used in Amplifiers.

$A_f = \frac{V_o}{V_s} = \frac{V_o}{V_i + V_f}$

$A_f = \frac{A}{1+A\beta}$

$|A_f| < |A|$, gain decreases.

4. Describe the characteristics of positive feedback.

When the feedback is in phase to the input, the i/p signal increases. – positive feedback / regenerative / direct.

→ $V_i = V_s + V_f$; → $i_i = i_s + i_f$

* increases the gain, noise, distortion,
* reduces the stability of an amplifier.
* Used in oscillators.

$V_f = \beta V_o$

$A_f = \frac{V_o}{V_s} = \frac{V_o}{V_i - V_f}$. $A_f = \frac{A}{1 - A\beta}$

$|A_f| > |A|$ - gain increases.

6) Comparison of positive & Negative feedback.

* Gain
* Noise
* Distortion
* Bandwidth
* Stability
* Input and output resistance changes
* Application.

6) Explain the principle of operation and derive the expression for wein bridge oscillator.

Wein bridge Oscillator - low frequencies in the range of 10Hz to 1 MHz.

- ✓ Blockdiagram
- ✓ Equivalent circuit

* Used in audio generator.
* Consists of two stage RC coupled amplifier
* O/p of amplifier → I/p of bridge.
* O/p voltage & I/p voltage = 0
* Not produce any phase shift.
* Continuous undamped oscillations are produced

⇒ Which uses both positive & negative feedbacks.

$$\frac{R_1}{R_2} = 2 + \sqrt{\left(\frac{R^2 - X_c^2}{RX_c}\right)} \Rightarrow \frac{R_1}{R_2} = 2.$$

$$\Rightarrow f = \frac{1}{2\pi RC} \Rightarrow V_1 = V_2 = \frac{1}{3} V_0. \Rightarrow |A_V| \geq 3$$

7) Explain the principle of operation and derive the expression for colpitts oscillator.

Colpitts Oscillator - Emitter tap is connected b/w C_1 & C_2.

- ✓ Block diagram
- ✓ Equivalent ckt

* Uses tapped capacitance
* O/p is taken out of the inductor by transformer coupling.
* C_b conveys feedback from C to B ckt.
* C_1 C_2 acts as alternating voltage divider.
* $Z_1 = \frac{-j}{\omega C_1}$ $Z_2 = -j/\omega C_2$ $Z_3 = j\omega L$.

$$\Rightarrow f = \frac{1}{2\pi}\sqrt{\frac{C_1 + C_2}{LC_1C_2}}$$

$\Rightarrow h_{fe} = \frac{C_2}{C_1}$ ⇒ the condition for maintanence of oscillations.

8) Derive the expression and characteristics of RC phase shift oscillator

RC phase shift oscillator – Using BJT

- Positive feedback required
- Frequency determining network introduce phase shift of 180°
- Obtain by 3 section – Each 60°
- Continuous damped oscillation produced.

→ Block diagram

→ Equivalent circuit

$\Rightarrow \frac{1}{h_{oe}} >> R_L$, effect neglected $\Rightarrow h_{re} << 1$, $h_{re} V_2$ – neglected.

$$\begin{vmatrix} R+R_L-jX_C & -R & h_{fe}R_L \\ -R & 2R-jX_C & -R \\ 0 & -R & 2R-jX_C \end{vmatrix} = 0. \Rightarrow f = \frac{1}{2\pi RC\sqrt{6+\frac{4R_L}{R}}}$$

$\Rightarrow h_{fe} = 23+29\frac{R}{R_L}+\frac{4R_L}{R}$ ⇒ Condition for sustained oscillation

$\Rightarrow f = \frac{1}{2\pi\sqrt{6}RC}$.

9) Derive the expression and characteristics of Hartley oscillator

Hartley oscillator – Resistor & capacitor C_E provide stabilized voltage divider bias.

- FDN – CAL
- feedback b/w i/p & o/p thro transformer action.
- RFC provides DC load for collector.
- C_C blocks DC. ⇒ O.C at zero frequency.
- FET → amplifying device.
- $Z_1 = j\omega L_1 + j\omega M$ $Z_2 = j\omega L_2 + j\omega M$ $Z_3 = -j/\omega C$

→ Equivalent ckt

→ Block diagram

$\Rightarrow f = \frac{1}{2\pi\sqrt{(L_1+L_2+2M)C}}$ $\Rightarrow h_{fe} = \frac{L_1+M}{L_2+M}$.

10) Explain the operation and advantages of crystal oscillators.

Crystal oscillator – frequency of LC depends on value of tank ckt.

* Values change with time, temperature etc.,
* piezo-electric crystal is used.
* Quartz, tourmaline, Rochelle salt.
* Series LCR ckt shunted by C_m.

⇒ Equivalent ckt

⇒ $f_s = \frac{1}{2\pi\sqrt{LC}}$ * parallel resonance, $f_p = \frac{1}{2\pi\sqrt{LC_T}}$

⇒ $C_T = \frac{CC_m}{C+C_m}$.

* positive feedback provided by capacitive voltage divider n/w.
* CE produces 180° phase shift.

Advantages :
* High frequency stability
* High Q-factor.
* Low cost
* Simple construction
* Highest oscillating frequencies.