1

Q.1.a) Explain the function of AFC loop in FM.

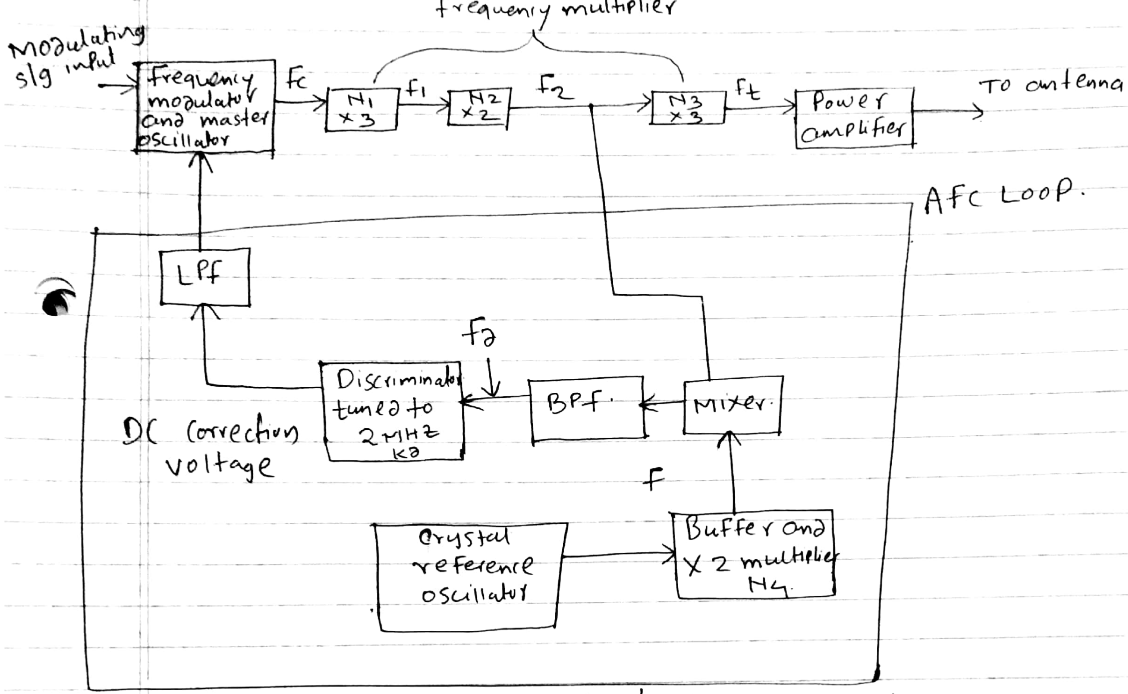


Fig:- Crosby direct FM transmitter.

→ The Purpose of the AFC loop is to achieve near-crystal Stability of the transmit carrier frequency without using a crystal in the carrier oscillator.

Q1 b) What do you mean by double Spotting?

→ This is a well-know phenomenon, which manifests itself by the picking up of the same shortwave station at two nearby points on the receiver dial. It is caused by poor front-end selectivity, i.e. inadequate image-frequency rejection. That is to say, the front end of the receiver does not select diffrent adjacent Signals very well, but the IF Stage takes care of eliminating almost all of them.

Q1 c) What is quantization? Explain types of quantization.

→ Quantization is a Process of approximation or rounding off.

Two types of quantization
1. Uniform Quantization
2. Non-Uniform Quantization.

Q1 d) why IF is selected as 455 KHZ in AM?

→ 1. If the intermediate frequency is too high, poor selectivity and poor adjacent-channel rejection result ~~reso~~ unless sharp cutoff (e.g. crystal or mechanical) filters are used in the IF stages.

2. A high value of intermediate frequency increases tracking difficulties.

3. As the IF is lowered, image-frequency rejection becomes poorer.

4. A very low IF can make the selectivity too sharp, cutting off the sidebands. This problem aries because the Q must be low when the IF is low, unless crystal or mechanical filters are used, and therefore the gain per stage is low. A designer is more likely to raise the Q than to increase the number of IF amplifiers.

5. If the IF is very low, the frequency stability of the local oscillator must be made correspondingly higher because any frequency drift is now a

larger proportion of the IF than of a high IF

(6) The IF must not fall within the tunning range of the receiver, or else instability will occurs and heterodyne whistles will be heard, making it impossible to tune to the frequency band immediately adjacent to the IF.

Q1 (e) Define Noise figure and Noise factor.

→ Noise factor = $\frac{S_{ni}}{S_{no}}$

S_{ni} - is the input signal to Noise ratio.
S_{no} - is the output signal to Noise ratio.

Noise figure = 10 log (Noise factor).

Q2 (a) Draw the block diagram of phase cancellation SSB generator and explain how carrier and unwanted sideband are suppressed?

→ Block Diagram — 5 Marks
Explanation — 5 Marks

Q.2 b) $f_c = 5\ MHz$ $P_c = 80\ kW$.

$f_{m1} = 600\ Hz$ $f_{m2} = 2\ kHz$.

① $m_1 = m_2 = 0.6$

$m_t = \sqrt{m_1^2 + m_2^2} = \sqrt{(0.6)^2 + (0.6)^2} = 0.8485$

$\boxed{m_t = 0.8485}$

② $P_t = P_c\left(1 + \frac{m_t^2}{2}\right)$

$= 80 \times 10^3 \left(1 + \frac{(0.8485)^2}{2}\right)$

$\boxed{P_t = 108.79\ kW}$

③ $f_c = 5\ MHz$

for Signal 1

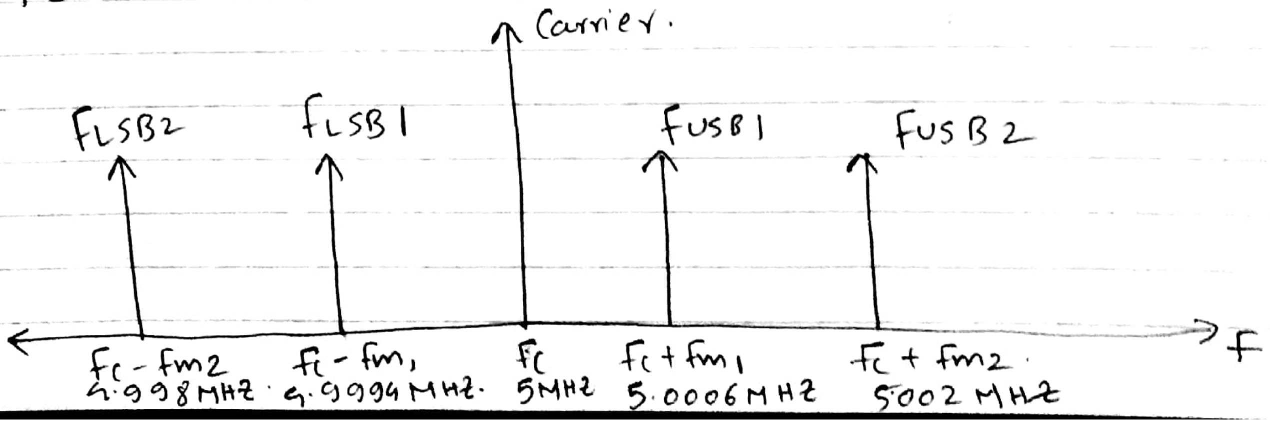
$f_{USB1} = f_c + f_{m1} = 5\ MHz + 600\ Hz = 5.0006\ MHz$

$f_{LSB1} = f_c - f_{m1} = 5\ MHz - 600\ Hz = 4.9994\ MHz$

for Signal 2

$f_{USB2} = f_c + f_{m2} = 5\ MHz + 2\ MHz = 5.002\ MHz$.

$f_{LSB2} = f_c - f_{m2} = 5\ MHz - 2\ MHz = 4.998\ MHz$.



4) % Power Saving $= \dfrac{P_c\left[1+\dfrac{m_t^2}{4}\right]}{\left(1+\dfrac{m_t^2}{2}\right)P_c} = 86.76\%\omega.$

Q3.a) Explain the operation of foster Seeley discriminator with the help of circuit diagram and phasor diagram.

→ Circuit Diagram :- 4 Marks.
Phasor Diagram :- 3 Marks
Explanation :- 3 Marks.

Q 3. b) Explain the Principle and generation of indirect method of FM generation.

→ Block Diagram :- 4 Marks.
Principle :- 3 Marks.
Advantage :- 3 Marks

Q 4. a) What are the drawbacks of delta modulation? Explain the method to overcome these drawbacks.

→ Drawbacks of delta modulation : 3 Marks
Block Diagram of Adaptive Delta modulation 3 Marks
Waveform of Adaptive Delta modulation :- 2 Marks
Explanation :- 2 Marks.

Q.4 . (b) State and Prove Sampling theorem for band limited Signal.

→ Statement :- 3 Marks.
Derivation :- 5 Marks.
waveform :- 2 Marks.

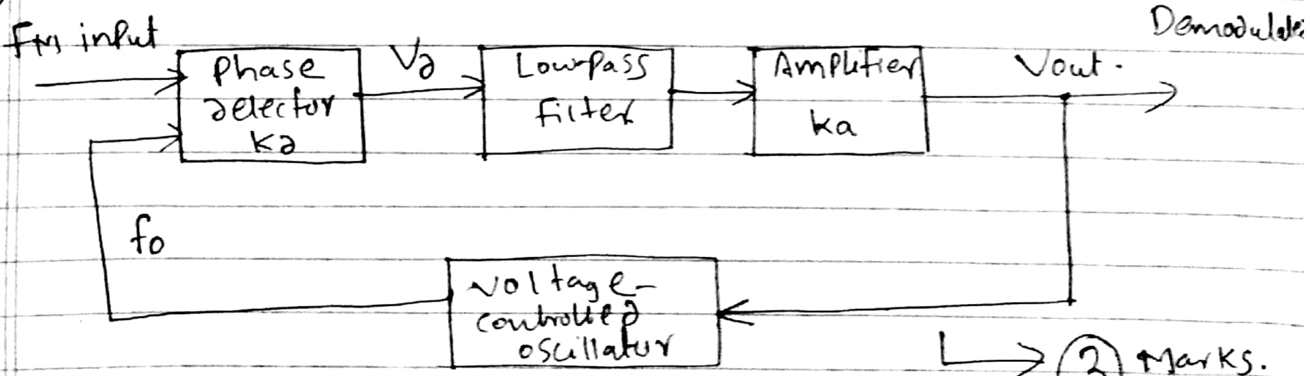
Q.5 a) Explain Super heterodyne radio receiver in details with block diagram.

→ Block Diagram :- 4 Marks.
waveform :- 3 Marks.
Explanation :- 3 Marks.

Q5 b) Explain the principle and working of transistor direct PM modulator.

→ Circuit Diagram :- 4 Marks.
principle :- 3 Marks.
working :- 3 Marks.

Q.6. a). PLL FM Demodulator.



→ 3 Marks.

~~25~~

Explanation - 3 Marks.

Q.6 b) μ - law and A - law Companding.

→ μ law - In the United States and Japan, μ-law Companding is used. The Compression characteristics for μ-law is

$$V_{out} = \frac{V_{max} \ln(1 + \mu V_{in}/V_{max})}{\ln(1+\mu)}$$

V_{max} = maximum uncompressed analog input amplitude (volts)
V_{in} = amplitude of the input Signal at a Particular instant of time (volts)
μ = Parameter used to define the amount of Compression (unitless)
V_{out} = Compressed output amplitude (volts).

→ A-law - In Europe, the ITU-T has established A-law Companding to be used to approximate true logarithmic Companding.

$$V_{out} = V_{max} \frac{A V_{in}/V_{max}}{1 + \ln A} \qquad 0 \leq \frac{V_{in}}{V_{max}} \leq \frac{1}{A}$$

$$= \frac{1 + \ln(A V_{in}/V_{max})}{1 + \ln A} \qquad \frac{1}{A} \leq \frac{V_{in}}{V_{max}} \leq 1$$

Q.6 c) Vestigial Sideband w.r.t broadcast television.

→ Block Diagram – 2 Marks
waveform – 2 Marks.
Explanation – 1 Marks.

d) Frequency division Multiplexing.

→ Block Diagram :- 3 Marks.
Explanation :- 2 Marks.

e) Pre emphasis and De-emphasis Circuit.

→ Pre-emphasis :- Circuit Diagram - 1.5 Marks.
De-emphasis :- Circuit Diagram - 1.5 Marks.
Pre-emphasis and De-emphasis Curves - 2 Marks.

f) Aliasing error and aperature effect :

→ Aliasing error :- Diagram with Explanation 2.5 M.
aperature effect :- Diagram with Explanation 2.5 M.