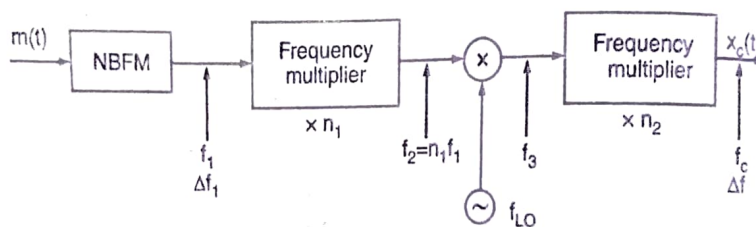




Important Instructions:

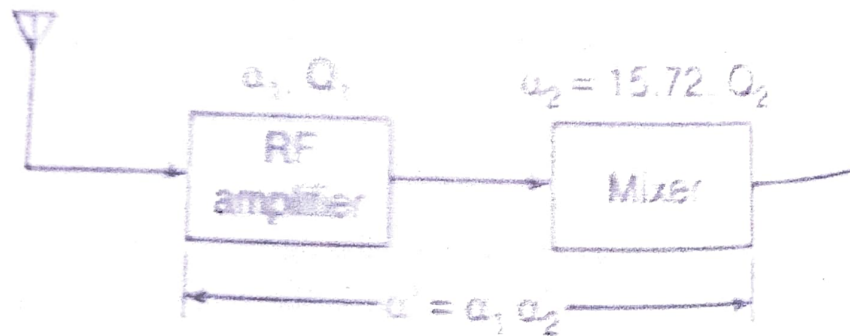
- This is a closed book, closed notes examination.
- This question paper comprises a total of 12 questions, and each question is worth 5 marks.

1. The bandwidth of TV video plus audio signal is 5MHz. If this signal is converted into a PCM bit stream with 1024 quantization levels, determine the number of bits/sec. of the resulting signal. Assume that the signal is sampled at the rate of 20% above the Nyquist rate.
2. Write the difference between PAM, PWM, and PPM with clear waveform diagrams.
3. A continuous-time signal is given below:
 $X(t) = 8 \cos 200 \pi t$
Determine
(A) Minimum sampling rate required to avoid aliasing.
(B) If the sampling frequency is 400Hz. What is the discrete time signal obtained after the sampling?
(C) If the sampling frequency is 150Hz. What is the discrete time signal obtained after the sampling?
4. Consider a sampled signal $y(t) = 5 \times 10^{-6} x(t) \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$; $x(t) = 10 \cos(8\pi \times 10^3 t)$; $T_s = 100 \mu s$. When $y(t)$ is passed through an ideal low pass filter with a cut-off frequency of 5KHz. Find the output of the filter.
5. A block diagram of the FM transmitter has been shown below. Calculate the maximum frequency deviation Δf of the output of the FM transmitter and the carrier frequency f_c if $f_1 = 200 \text{ KHz}$, $f_{LO} = 10.8 \text{ MHz}$, $\Delta f_1 = 25 \text{ Hz}$, $n_1 = 64$, and $n_2 = 48$.



6. Determine the permissible range in the maximum modulation index for
 - (i) Commercial FM which has 30Hz to 15KHz modulation frequencies; Given that maximum deviation in commercial FM is 75KHz.
 - (ii) Narrowband FM system which allows maximum deviation of 10KHz and 100Hz to 3KHz modulating frequencies.

7. A given AM broadcast station transmits a total power of 50kW when the carrier is modulated by a sinusoidal signal with a modulation index of 0.7071. Compute (i) the carrier power (ii) the transmission efficiency.
8. Derive an expression for the DSB-SC signal. Explain a methods to generate and detect it.
9. In order to make the image frequency rejection of the receiver shown below as good at 10MHz as it is at 950KHz (rejection ratio at this freq. Is 1.45). Given that $\alpha' = 130.5$; The Q of the Mixer is 90. Calculate:
 - (i) The loaded Q which an RF amplifier for this receiver would have and
 - (ii) The new intermediate frequency that would be needed (if an RF amplifier is not used).



10. What is Quantizer in PCM? Write the working principle and types of the Quantizers.
11. What is aliasing and how it can be reduced.
12. Explain the methods to detect the FM waves.