**FREQUENTLY ASKED QUESTIONS**

**UNIT 1:**

## Short answer questions:

1. Why VSB is used in TV communication?
2. Draw AM wave for the following cases
   i. Under modulation ii. Over modulation iii. When μ=1.
3. What is meant by Quadrature null effect?
4. Define complex and Pre envelopes with suitable examples.
5. How a Band pass signal is represented in terms of in phase and Quadrature phase components? Give suitable examples.
6. What is Hilbert transform? Problem on Hilbert transform.
7. What is the need for modulation or need for frequency translation?
8. What is meant by synchronous detection?
9. What is Modulation index? What is the significance of modulation index? And problems on effective modulation index.

## Long answer questions:

1. Describe Weaver's method of generation of SSB signal with the help of block diagram and suitable spectral diagrams.
2. explain the generation of SSB using the following methods
   i. Filter method.
   ii. Phase shift method.
3. Find the transmission efficiency of tone modulated signal when the modulation index is 0.25, 0.5, 0.75 and1.
4. The input to envelope detector is a tone (single tone) modulated signal is given as $v(t) = A_c(1 + m\cos w_m t)\cos w_c t$. Find the maximum value of time constant RC of the detector that can always follow the message envelope?
5. What is coherent detection? What is Quadrature null effect in DSBSC coherent detection? Suggest a method to overcet this problem?
6. A speech signal as in a telephone system, occupies a frequency range 300Hz - 3400Hz (considered as baseband up to 3400Hz). In a carrier system it is transmitted in the form of SSB signal. Calculate the bandwidth saving as compared to AM signal transmission and Also estimate the amount of power saving
7. Explain the principle of ring modulator or double balanced modulator?
8. Explain the working operation of Costas receiver with neat block diagram. (Very very important).
9. What are the different synchronization techniques involved in DSBSC receiver? Explain in detail.
10. i) Define Hilbert transform.

ii) Find Hilbert transform of impulse signal.

11. Derive the power relations for single tone Amplitude Modulated wave.
12. Explain how Balanced Modulator generates a DSBSC signal.
13. The modulating signal $x(t)=2\cos(2000\pi t) + \sin(4000\pi t)$ is applied to a DSB modulator operating with a carrier frequency of 100 kHz. Sketch the power spectral density of the Modulator output.
14. Compare and Contrast AM, DSBSC, SSBSC, VSBSC modulation schemes?
    (In terms of the following parameters)

| parameter | AM (conventional) | DSBSC | SSBSC | VSBSC |
|---|---|---|---|---|
| Mathematical expression | | | | |
| Band width | | | | |
| Frequency spectrum | | | | |
| Transmission efficiency | | | | |
| % power saving | | | | |
| Generation schemes(names) | | | | |
| Demodulation schemes(names) | | | | |
| applications | | | | |
| Advantages & Disadvantages | | | | |

**Additional questions:**

## UNIT 1
## ASSIGNMENT1 (CO1) 2015-2016

1. a. Compare and contrast single tone Amplitude Modulation with single tone DSBSC 5M.
   b. If message signal $m(t) = 5\,cos\omega_m t\ where\ \omega_m = 200\pi$ and carrier signal is given as $c(t) = 250\cos 10000\pi t$ then
      i. Draw the Amplitude spectrum of Amplitude Modulated signal.
      ii. Draw the frequency spectrum of DSBSC modulated signal. And compare the bandwidths of the two modulated signals. 10M.
2. a. Explain the working operation of Envelope detector in AM. 6M.
   b. find the modulation index and transmission efficiency of an Amplitude Modulated signal $S_{AM}(t) = 50\ (1 + 0.2\sin 100\pi t + 0.4\cos 200\pi t)\cos 10000\pi t$ 4M.
3. Explain the working procedure of coherent detector for DSBSC in detail 5M.

## UNIT 1
## ASSIGNMENT1 (CO1) 2016-2017

1. a. What is coherent detection? What is Quadrature null effect in DSBSC coherent detection? Suggest a method to offset this problem? 5M.

   b. Explain the generation of SSB using the following method. 5M.
      i. Filter method.
      ii. Phase shift method.

2. a. How a Band pass signal is represented in terms of in phase and Quadrature phase components? Give suitable examples. 5M.

   b. Derive the power relations for single tone Amplitude Modulated wave. 5M.

3. a. i) Define Hilbert transform. 2M.
   ii) Show that the frequency spectrum of pre envelope of a real signal is one sided (either positive frequencies or negative frequencies). 3M.

   b. Explain the working operation of square law modulator and show that the relation f > 3 B is a valid restriction in the generation process of AM signal, where f is the center frequency of Band pass filter and B is the band width of message signal.

**TUTORIAL TEST 1 (CO1)**

1. The input to envelope detector of a tone (single tone) modulated signal is given as $(t) = A_c\ (1 + m\ cosw_m T)cosw_c t$ . Find the maximum value of time constant RC of the detector that can always follow the message envelope?

2. i. Find the modulation index and transmission efficiency of Amplitude Modulated signal $S_{AM}(t) = 50\ (1 + 0.2 \sin 100\pi t + 0.4 \cos 200\pi t) \cos 10000\pi t$.

ii. The modulating signal x (t) =2cos (2000πt) + sin (4000πt) is applied to a DSB modulator operating with a carrier frequency of 100 kHz. Sketch the power spectral density of the Modulator output.

3. i. Find the transmission efficiency of tone modulated signal when the modulation index is 0.25, 0.5, 0.75 and1.

ii. A speech signal, as in a telephone system, occupies a frequency range 300 - 3400Hz (considered as baseband up to 3400Hz). In a carrier system it is transmitted in the form of SSB signal. Calculate the bandwidth saving as compared to AM signal transmission.

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# Additional: Unit1-Quiz1

1. Find the modulation index if the amplitude of message signal is one third of the amplitude of carrier signal ----------.
2. The diagonal clipping in Amplitude Demodulation (using envelope detector) can be avoided if RC time-constant of the envelope detector satisfies the following condition, (here W is message bandwidth and ω is carrier frequency both in rad/sec) ( a )
   a. RC<1/W b. RC>1/W c. RC<1/ω d. RC>1/ω.
3. Given AM signal is $X_{AM}(t) = 10\,(1 + 0.5 \sin 2\pi f_m\, t\,) \cos 2\pi f_c\, t$ ,then The average side band power given for the above AM signal is ( )
   a. 25W b. 12.5W c.6.25W d.3.125W.
4. Given AM signal is $X_{AM}(t) = 100\,(1 + 0.85 \cos 2\pi f_m\, t\,) \cos 2\pi f_c\, t$ ,then The total power required for the above AM signal is ( )
   a. 25W b. 12.5W c.6.806KW d. None of the above.
5. Consider the AM signal $A_c cosw_c t + 2\, cosw_c t \cos w_m t$ for the demodulation of the signal using envelope detector the minimum value of $A_c$ should be ( a ).
   a. 2 b. 1 c. 0.5 d. 0.
6. Given AM signal is $S_{AM}(t) = 100\,(1 + 0.2 \cos 2\pi f_m\, t + 0.5 \sin 2\pi f_m\, t\,) \cos 2\pi f_c\, t$
   i. The total power required for the above AM signal is ( )
      a. 25W b. 6.45KW c.6.806KW d. None of the above.
   ii. Modulation index is ( )
      a. 0.53 b. 1 c. 0.2 d. None of the above.
   iii. The carrier power is ( )
      a. 5KW b.6KW c. 7KW d.100W
   iv. Total current flowing through the transmitter if carrier current is 5A ( ).
      a. 5mA b. 5.33A c. none of these d. 25A.
7. If the band width of message signal is 5KHz and the carrier frequency is 200KHz then upper sideband frequencies are ( c )
   a. 205KHz,190KHz c.205KHz,-205KHz
   b. 205 KHz,-195 KHz d. None of the above.
8. If the highest frequency of message signal is 5KHz and the carrier frequency is 200KHz then lower sideband frequencies are( c )
   a. 205KHz,195KHz b.205KHz,-205KHz
   c. 195 KHz,195 KHz d. None of the above.
9. If the bandwidth of message signal is 500Hz then the bandwidth of Amplitude Modulated signal is ( )
   a. 500Hz b. 1000Hz c.2KHz d. None of the above.
10. If the message $m(t) = 10 \cos 200\pi t$ and carrier signal is $c(t) = 25 \cos 10000\pi t$ then draw the amplitude spectrum of AM signal---------- .

## Additional imp questions in Unit1:

**Short Answer questions:**

1. What is modulation? Explain the need for modulation?
2. Why AM is referred to as Linear Modulation scheme?
3. With a neat diagram explain the frequency components of AM spectrum or draw the frequency spectrum of AM signal?
4. Define modulation and give the types of Modulation techniques?
5. Draw the frequency spectra of Conventional AM and Single-tone AM signals?
6. Give the Differences between High-level and low-level Modulation techniques?
7. Define Complex-envelope and Pre-envelope of a signal?
8. What is Hilbert transform and state any two properties of Hilbert transforms?
9. What do you mean by frequency spectrum of a signal?
10. Define DSBFC modulation or Amplitude Modulation?
11. Why DSBSC is scheme is developed? Or what are the disadvantages of Conventional AM?
12. What are the applications of AM?
13. What is the bandwidth of an AM signal? if the highest frequency of a message signal is 4KHz then find the Bandwidth required for an AM signal?
14. Differentiate un-modulated carrier with modulated carrier in AM
15. Define Modulation index of AM signal?
16. Draw the basic block diagram of an analog communication system
17. Give the significance of Transmitter in a Communication system?
18. Differentiate under modulation, over modulation and perfect modulation?
19. Draw the AM wave when modulation index is
    i. less than unity ii. Equals to unity iii. Greater than unity
20. Define Transmission efficiency of an AM signal?
21. Define Band width of a signal
22. Compare Pulse modulation techniques with Continuous Modulation techniques?
23. What is meant by demodulation?
24. What are the applications of Hilbert Transform/
25. Write the expressions for Hilbert and inverse Hilbert transform of a signal?

### Equations and frequency spectra:

26. Write the mathematical expression for Conventional AM signal, explain each term clearly and draw its Frequency spectrum?
27. Write the mathematical expression for single-tone AM signal, explain each term clearly and draw its Frequency spectrum?
28. Write the mathematical expression for DSBSC signal, explain each term clearly and draw its Frequency spectrum??

29. Write the mathematical expression for Single-tone DSBSC signal, explain each term clearly and draw its Frequency spectrum??
30. Write the mathematical expression for SSBSC signal, explain each term clearly and draw its Frequency spectrum??
31. Write the mathematical expression for single-tone SSBSC signal, explain each term clearly and draw its Frequency spectrum?
32. Write the mathematical expression for VSBSC signal, explain each term clearly and draw its Frequency spectrum?
33. What is the effective modulation index If two or more signals are used simultaneously to generate AM signal?
34. Write the expression for Modulation index if the Multi-tone modulation used to generate AM signal?
35. What are the limitations of AM?
36. What is meant by coherent detection or synchronous detection?
37. What are the components of a synchronous detector of DSBSC or draw the Block diagram of coherent detector of DSBSC signal?
38. What are the two detection techniques of AM signal or demodulation techniques of AM?
39. What are two Demodulation techniques of DSBSC signal?
40. Name the two Demodulation techniques of SSBSC signal?
41. How to Demodulate a VSBSC signal?
42. Draw the circuit diagrams of Square-law Demodulator. Using square-law demodulator what is the necessary condition to recover distortion less demodulated signal?
43. Draw the circuit diagram of Envelope Detector, what is the necessary condition to recover distortion less demodulated signal using envelope detector?
44. What are the applications of VSB and SSB?
45. What are the advantages of VSB over SSB?
46. How a band pass signal is represented in its In-phase and Quadrature-phase components?
47. What is Quadrature Null Effect?
48. Why is VSB used in TV transmission?

## Long Answer questions:

1. Explain the generation of AM wave using Square-law Modulator. Obtain the expression for modulation index.
2. Explain generation of AM wave using Switching-law Modulator. Obtain the expression for modulation index.
3. With the neat block diagram explain the operation of Envelope detector. Discuss the choice of time constant of it.
4. Explain operation of Square-law Demodulator and derive the condition for modulation index for reception of distortion less signal at receiver.
5. Derive all the power relations and transmission efficiency of a single-tone AM signal.

6. What is modulation? Why is modulation used in Communication systems?
7. What do you understand of Modulation index? What is its significance?
8. Discuss a suitable method of generating a SSB signal. Describe a method of detecting such signal
9. Distinguish between DSB-AM, DSBSC and SSBSC system of modulation, sketch their waveforms
10. Derive an expression for single tone AM signal
11. With a neat block diagram explain the working demodulation process of DSBSC.
12. Compare SSB with DSB systems?
13. Describe Weaver's method of generation of SSB signals with the help of block diagram and suitable spectral diagrams.
14. Explain the working of suppressed carrier balanced modulator. State its advantages and applications.
15. Why a DSB-SC modulation scheme is not much used inspiteof the fact that it saves transmitter power as compared to AM?
16. Explain what is meant by vestigial sideband transmission. What are its special characteristics? And how can these are achieved in practice. Discuss the specific examples where VSB is used.
17. Show that if the output of a phase-shift modulator is an SSB signal, the difference of the signals at the summing junction produces the upper-sideband SSB signal.
18. Draw the diode detector circuit and explain its action.
19. Show, giving a mathematical proof, how a square-law device can be used to generate an AM signal. Give complete diagram of the signal inputting and outputting arrangements.
20. Explain the generation and demodulation of DSBSC.
21. A certain transmitter radiates 9kW with the carrier unmodulated and 10.125kW when the carrier is sinusoidally modulated. Calculate the modulation index. If another wave, corresponding to 40% modulation is transmitted simultaneously, determine the total radiated power.
23. Derive an expression for power transmitted form AM signal.