

Institute of Road and Transport Technology, Erode
Department of Electronics and Communication Engineering
Class/Sem: 2nd Year Computer Science Engg-3rd Semester
Subject: Analog and Digital Communication (CSE)

Big Questions

Unit – 1 Fundamentals of Analog Communication

1. Illustrate time domain and frequency domain representation of standard AM with necessary mathematical representations and explanation for the conditions $|K_a m(t)|$ less than, equal to and greater than one, assuming both baseband and single tone sinusoid as a modulating signal. [POC, AU-2007]
2. A carrier of frequency 10^6 Hz and amplitude 3 volts is frequency modulated by a sinusoidal modulating signal frequency 500 Hz and of peak amplitude 1 Volt. The frequency deviation is 1 KHz. The level of the modulating waveform is changed to 5 V peak and the modulating frequency is changed to 2 KHz. Write the expression for the new modulated waveform. [POC, AU-2007]
3. An FM carrier is sinusoidally modulated. When does all the power lie in the sidebands (i.e. No power in the carrier)? [POC, AU-2007]
4. Describe the relationship between the instantaneous carrier phase and the modulating signal for PM. [POC, AU-2008]
5. Differentiate FM and PM. [POC, AU-2009]
6. Derive a relationship between total power and carrier power of AM. [POC, AU-2009]
7. Prove that after amplitude modulation the carrier power increases from P_c to $P_c[1+m_a^2/2]$, where m_a is the modulation index. [POC, AU-2010]
8. Derive the expression for modulation index of angle modulated waves. [POC, AU-2010]
9. Discuss in detail about bandwidth requirements for angle modulated waves. [POC, AU-2011].
10. An antenna transmits an AM signal having a total power content of 15 Kw. Determine the power being transmitted at the carrier frequency and at each of the sidebands when the percent of modulation is 85%. [POC, AU-2011]
11. Explain in detail about Frequency Modulation. [POC, AU-2011]
12. If the signal $v(t) = 20 \sin(6.28 \times 10^6 t + 10 \sin(6.283 \times 10^3 t))$ represents a phase-modulated signal, determine the following:
(1). The carrier frequency (2). The modulation index (3). The peak phase deviation. [POC, AU-2011]

13. For an FM modulator with a peak frequency deviation $\Delta f = 10 \text{ KHz}$, a modulating signal frequency $f_m = 10 \text{ KHz}$, $V_c = 10 \text{ volts}$ and a 500-KHz carrier, determine:
1. Actual minimum bandwidth
 2. Approximate minimum bandwidth using carson's rule.
 3. Plot the output frequency spectrum. [POC,AU-2011]
14. Explain in detail about frequency analysis of angle modulated waves and its bandwidth requirements. [POC,AU-2012]
15. Write short notes on AM envelope and its frequency spectrum. [POC,AU-2012]
16. Compare frequency modulation and amplitude modulation. [POC,AU-2012]
17. Explain about AM percent modulation, AM voltage distribution and power distribution with neat sketch. [POC,AU-2012]
18. For amplitude modulation prove the following statements:
- (i). Power of the carrier P_c is unaffected by the modulation process.
 - (ii). Total power in an AM envelope increases with modulation index.
 - (iii). Modulation index $m = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$ draw the modulated waveform and show V_{max} and V_{min} . [ADC, AU-2006].
19. Derive the AM wave equation for tone modulation and explain each term with the help of frequency spectrum and also obtain an expression for its power saving and efficiency. [ADC,AU-2007].
20. Derive an expression for a single tone FM signal and draw its frequency spectrum. [ADC,AU-2007].
21. Define FM and PM modulation. Write their equations. [ADC, AU-2008].
22. Suppose that the modulating signal $m(t)$ is a sinusoid of the form $m(t) = a \cos(2\pi f_m t)$, $f_m \ll f_c$. Determine the AM signal, upper and lower sidebands, Draw the spectrum. [ADC, AU-2008].
23. For an AM DSBFC with a peak unmodulated carrier voltage $V_c = 12\text{V}$, and modulation coefficient $m = 1$ with load resistance $R_L = 12\Omega$, determine the
- (1). Carrier power and the upper and lower side band power (P_c, P_{USB}, P_{LSB}).
 - (2). Total power of the modulated wave.
 - (3). Draw the power spectrum. [ADC, AU-2009].
24. Compare AM and FM. [ADC, AU-2010,AU-2012].
25. Derive the relation between total power of AM and carrier power. [ADC, AU-2010].
26. Explain how Carson's rule of bandwidth in FM is obtained. For an FM modulator with peak frequency deviation $\Delta f = 5 \text{ KHz}$, modulating frequency $f_m = 5 \text{ KHz}$, with amplitude of carrier 5V and frequency 500 KHz, determine the bandwidth using

Carson's rule. [ADC, AU-2011].

27. For an AM DSBFC wave a peak unmodulated carrier voltage $V_C = 10 V_P$, a load resistance $R_L = 10 \Omega$ and a modulation coefficient $m = 1$, determine:
- (1). Power of the carrier, upper and lower side bands
 - (2). Total power of the modulated wave
 - (3). Total side band power
 - (4). Draw the power spectrum. [ADC, AU-2011].
28. If the percentage of modulation is 100 %, how much percentage of the total power is present in the signal when DSB-SC is used. [ADC, AU-2012].
29. Define FM and PM modulation and write their equations. [ADC, AU-2012].
30. Derive the carrier power and transmitter power in AM in-terms of modulation index. [ADC, AU-2012].

Unit -2 Digital Communication

1. Draw the block diagram of FSK receiver and explain the operation. [ADC, AU-2006]
2. Explain the working of BPSK transmitter and receiver using balanced modulator. How M-ary encoding and modulation achieved in PSK? Draw a QPSK transmitter block diagram and explain the working principle. [ADC, AU-2006, AU-2007]
3. Derive an expression for baud rate in PSK and FSK systems. [ADC, AU-2008]
4. Explain the generation and detection of QPSK signals. [ADC, AU-2008]
5. Determine the baud rate and minimum bandwidth necessary to pass a 10 Kbps binary signal using amplitude shift keying. [ADC, AU-2008].
6. Explain quadrature amplitude modulation with the help of relevant diagrams. [ADC, AU-2008].
7. Draw the block diagram of FSK transmitter and receiver and explain the operation. How is the required bandwidth calculated for FSK? [ADC, AU-2009], [POC, AU-2011, AU-2012].
8. Draw the block diagram of QPSK transmitter and receiver and explain the operation. Also draw its phasor diagram and compare QPSK with simple BPSK in terms of bandwidth requirements. [ADC, AU-2009].
9. Determine the bandwidth efficiency for BPSK, QPSK and BFSK if bit rate is 64 Kb/sec. [ADC, AU-2010].
10. Draw the data signal, carrier signal and BPSK signal for the data 1 1 0 1 0 1. [ADC, AU-2010].
11. Draw the block diagram of a QPSK transmitter and explain. Derive the bandwidth requirement of a QPSK system. [ADC, AU-2010], [POC, AU-2011].
12. With neat diagram explain the generation of a DPSK signal and the method of recovering the data from the DPSK signal. [ADC, AU-2011].
13. Describe the procedure of coherent detection procedure of M-ary PSK with the help of block diagram. [ADC, AU-2012].
14. Determine the bandwidth efficiency of QPSK and compare it with other m-ary PSK transmitter. [ADC, AU-2012].
15. Explain the process of generating and detecting DPSK signal with the help of block diagram and given binary data sequence '0 0 1 0 0 1 0 0 1 1' assuming starting reference bit is "one". [POC, AU-2007].

16. Explain the relationship between
 - (1). The minimum bandwidth required for an FSK system and the bit rate and
 - (2). The mark and space frequencies. [POC, AU-2008].
17. Explain how transmission and reception of FSK signals is done. [POC, AU-2008].
18. Compare BPSK and BFSK with respect to bandwidth efficiency and power. [POC, AU-2009].
19. Explain in detail about Costas loop carrier recovery with neat sketch. [POC, AU-2011].

Unit 3 Digital Transmission

1. Derive the SNR ratio for uniform quantizer. [ADC,AU-2006]
2. Draw the block diagram of delta modulator and explain the operations. What are its advantages over PCM?[ADC, AU-2006,AU-2007][POC,AU-2011]
3. What causes ISI in the detection process of a baseband digital system? Explain the effects of ISI. How ISI can be reduced?[ADC, AU-2006,AU-2012]
4. Explain in detail, how PCM signals are generated and decoded?[ADC,AU-2007]
5. Explain ISI for NRZ input signal.[ADC,AU-2008]
6. What is the need for companding? Explain analog and digital companding.[ADC, AU-2009].
7. Draw the block diagram of adaptive delta modulator and explain its operation. How is this ADM better than DM?[ADC,AU-2009,AU-2011]
8. What is ISI? Explain how ISI can be measured using eye pattern method. [ADC,AU-2009]
9. Explain Delta modulation PCM receiver. Describe slope overload distortion and granular noise.[ADC,AU-2010]
10. In a binary PCM system, the output signal to quantization noise ratio is to be a minimum of 40 dB. Determine the number of required levels and find the corresponding output signal to quantization noise ratio.[ADC,AU-2010]
11. (i). Define Sampling theorem. (ii). Explain Adaptive delta modulation. [ADC,AU-2010]
12. Draw the eye diagram and explain its importance in data transmission. [ADC,AU-2011]
13. Explain the basic principle of differential PCM with relevant diagram. [ADC,AU-2011]
14. Discuss linear delta modulation using block diagram and derive expression for S/N ratio.[ADC,AU-2012].
15. A binary channel with bit rate = 36,000 bits/sec is available for PCM voice transmission. Find number of bits per sample, number of quantization levels and sampling frequency assuming highest frequency component of voice signal is 3.2 KHz.[ADC, Au-2012].
16. List out the information provided by eye pattern about the system performance. [ADC,AU-2007]

17. Consider a sinusoidal signal given by $S(t) = 3 \cos(1000 \pi t)$. Find the signal-to-quantization noise ratio when the signal is quantized using 10 bit PCM. Also find the minimum number of bits needed to achieve a signal-to-noise ratio of at least 40dB. [POC,AU-2007]
18. What is the necessity of non-uniform quantization and explain companding? [POC, AU-2010]
19. Derive the expression for signal-to-quantization noise ratio for PCM system that employs linear quantization technique, assuming the input to the system is sinusoidal input signal. [POC,AU-2010]
20. Compare PCM,DM,ADM and DPCM. [POC,AU-2010]
21. What are the drawbacks in delta modulation and how they are overcome in adaptive delta modulation? Explain it with neat diagram. [POC,AU-2011]
22. Define pulse modulation and explain about PCM circuit in detail. [POC,AU-2012]
23. Write a short notes on pulse transmission and intersymbol interference. [POC,AU-2012].

Unit 4 Data Communications

Unit 5 Spread Spectrum and Multiple Access Techniques

1. Draw the block diagram of a simple PN Sequence generator using shift register and obtain the output sequence. For this output sequence verify the properties of the PN Sequence. [ADC,AU-2006][POC,AU-2011].
2. Explain the process of Time Division Multiplexing and compare with FDM and Code Division Multiplexing.[ADC,AU-2007].
3. Give the advantages associated with spreading a signal spectrum. [ADC,AU-2008,AU-2012].
4. Describe the structure of feedback shift register for generating PN sequences. [ADC,AU-2008,AU-2012].
5. Explain FH-CDMA acquisition and tracking with neat sketches.[ADC,AU-2008].
6. Compare TDMA,FDMA and CDMA multiple access techniques.[ADC,AU-2008][POC,AU-2009].
7. What are the properties of PN sequence random numbers? Draw the direct sequence spread spectrum system which employs BPSK and explain the operation.[POC,AU-2007,AU-2009,AU-2010][ADC,AU-2009,AU-2010].
8. What are fast frequency hopping and slow frequency hopping? Explain both with suitable diagrams.[ADC,AU-2009][POC,AU-2007,AU-2008,AU-2010].
9. Describe the properties of maximum length sequences.[ADC,AU-2010].
10. Explain fast and slow frequency hopping techniques in spread spectrum. [ADC,AU-2011].
11. Explain the concept of synchronization and tracking of frequency hopping spread spectrum signals.[ADC,AU-2012].
12. Mention merits and demerits of time division multiplexing.[ADC,AU-2012].
13. Describe any one method of source coding the speech signal for transmitting through wireless communication link.[ADC,AU-2012].
14. Explain a speech transmission technique that retains the quality of speech and employs a reduced transmission rate.[POC,AU-2008].
15. Describe coherent based DSSS with suitable block diagram.[POC,AU-2008].
16. Describe the impairments of wireless communication networks.[POC,AU-2009].
17. Differentiate slow frequency and fast frequency hopping.[POC,AU-2010].

18. In a DS/BPSK system the feedback register used to generate PN sequence has the length of $m = 15$. The system is required to have an average probability of symbol error less than 10^{-5} . Calculate processing gain and Jamming margin for the system. [POC,AU-2010].
19. Give a brief account on wireless communication. [POC,AU-2011].
20. Explain CDMA system with its features. List out various problems in CDMA system. [POC,AU-2011].
21. Explain in detail about multiple access techniques in wireless communication with neat diagram. [POC,AU-2012].
22. Generate PN sequence of length 7 using flip-flops. [POC,AU-2012]