DEPARTMENT OF EEE

EC 2311 COMMUNICATION ENGINEERING

UNIT I ANALOG COMMUNICATION

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Armstrong method & Reactance modulations : FM & PM frequency.

PART A

1. Mention the disadvantages of SSB transmission? **(Nov 2010).**
2. The carrier frequency of an FM BC transmission is 100 MHZ and maximum frequency deviation is 75 KHZ. Find the bandwidth of the signal when the highest audio frequency modulating the carrier is 15 khz. **(Nov 2010).**
3. Explain AM wave with its expression. Draw its spectrum.
4. What are the significant advantages of SSB transmission?
5. Distinguish between AM and FM.
6. What is meant by diagonal clipping?
7. Distinguish between high level and low level modulations.
8. Write the expression for FM wave and explain. (Oct '96)
9. Define FM.
10. Distinguish between linear and square law modulators. (Apr '95, Oct '97)
11. Why Armstrong method of modulation is preferred than direct modulation?
12. State the demerits of square-law modulator. (Oct '96)
13. State the principle of reactance modulator. (Oct '96)
14. What is meant by indirect method of FM generation? (Oct '97)
15. How can FET be used as reactance modulator? (Apr '97)
16. Define carrier's bandwidth for transmission of FM or PM signal? (Apr '99)
17. Differentiate between linear & non linear modulators.(Apr-2k)
18. What is a Ring modulator? (Apr-2k)
19. Compare the direct & indirect method of FM (Apr-2k)
20. Compare envelope and synchronous detectors. (Apr '95, Oct '96)
21. Compare Foster-Seeley discriminator with slope detector. (Apr '96)

22. Explain envelope detector. (Oct '95),(Apr-2k)
23. What is the principle of synchronous detector? (Apr '96)
24. How FM wave is demodulated? (Apr '96)
25. How does Ratio detector differ from Foster-Seeley discriminator? (Apr -2k)
26. What are the drawbacks of slope detector? (Oct '96)
27. SSB is suitable for speech signals and not for video signals. Why?
28. What do you understand by capture effect in FM?
29. Compare noise performances of FM and AM systems.
30. A broadcast radio transmitter radiates 5 kW power when the modulation percentage is 60%. How much is the carrier power?
31. What are the main difference between AM Receiver and FM Receiver?
32. Distinguish between narrow band FM and Wideband FM.
33. Differentiate FM and PM modulation systems.
34. Define sensitivity, selectivity & fidelity of a radio receiver.
35. A 107.6 Mhz carrier signal is frequency modulated by a 7 Khz sine wave. The resultant FM Signal has a frequency deviation of 50Khz. Determine the modulation index of the FM wave.
36. Determine the modulation index of a FM system with a maximum frequency deviation of 75 KHz and maximum modulating frequency of 10 KHz.
37. For an AM System Vmax of the envelope is 30v and modulation index is 0.5. Determine amplitude of unmodulated carrier.
38. A carrier is frequency is frequency modulated with a sinusoidal signal of 2 KHz resulting in a maximum frequency deviation of 5 KHz. Find the approximate band width of the modulated signal.
39. For an AM System Vmin of the envelope is 10v and modulation index is 0.6. Determine amplitude of modulating signal. (peak change in amplitude of envelope).

40. When the modulating frequency in an FM system is 400Hz and the modulating voltage is 2.4v, the modulation index is 60. Calculate the maximum deviation. What is the modulating index when the modulating frequency is reduced to 250 Hz and the modulating voltage is simultaneously raised to 3.2v?
41. What are the advantages of FM over AM?
42. Mention the advantages of SSB transmission.

PART B

1. (i) Explain the principle of indirect method of frequency modulation with neat sketch.(8) (ii) A carrier wave of 10 MHZ is amplitude modulated to 50% level with a tone of 5000 hz . Sketch the waveform and amplitude distribution in time and frequency domain. Assume carrier amplitude as 10 volts. (8**) (Nov 2010).**
2. (i) Draw the block diagram for generation and demodulation of a VSB signal and explain the principle of operation. (10). (ii) With suitable sketch discuss about square law detector. (6) **(Nov 2010).**
3. Explain the need for modulation. (Apr '95, Apr '97)
4. Derive an expression for the amplitude modulated wave and explain each term with the help of frequency spectrum. (Oct '97, Oct '98)
5. Derive power relations in AM wave. Explain the spectrum of AM wave.
6. Compare AM with FM with special reference to spectrum, power requirements, sidebands and bandwidth required. (6)
7. Obtain the mathematical expressions for AM & FM modulated waves & draw the necessary waveforms in both cases. (Apr –2k)
8. Explain the coherent detection of DSB/SC and SSB/SC signals. (10)
9. Explain the theory of reactance modulator. (Oct '98, Apr '99,APR-2k)
10. Draw the circuit of balanced modulator and show the waveform at various points. (Apr '96, Oct '97, Oct '98, Apr '99 , Apr-2k).
11. With the aid of a block diagram, explain the principle of working of a communication receiver. (Apr '96, Oct '98,Apr-2k)
12. Explain the principle of coherent detection of AM signals. How it is superior to square law detection (April ’96)
13. Explain with neat diagram, the working of a balanced slope detector. (Oct '96)

14. Give the principle of Armstrong method of frequency modulation. State sources of distortion in this method.(oct '96)
15. Discuss with suitable block diagram the working of Phase modulated FM transmitter. (Apr '96)
16. With a block diagram, explain the working of AM super heterodyne radio receiver using a RF amplifier. (Oct '96)
17. Describe in brief a SSB pilot carrier transmitter with neat diagram . (Oct '96)
18. Draw the block diagram of a high level AM transmitter and explain the function of each block. (Oct '98)
19. Explain any two methods used for generating SSB/SC (10)
20. Explain Ring modulator for the generation of DSB/SC (8)
21. Discuss the method of demodulation of DSBSC signal using Costas loop.(8)
22. Explain in detail an Envelope detector (6)
23. What do you understand by carrier synchronization?(3)
24. What is SSB modulation? Explain the benefits of using SSB modulation. How would you differentiate between NBFM and WBFM.(4)
25. Describe FM demodulation using frequency discriminator in detail.(16)
26. Write a note on the following
    (i)FM threshold effect (8)
    (ii)FM threshold reduction (8)
27. What is the function of pre emphasis and de emphasis in FM? Draw the circuit diagram of pre emphasis and de-emphasis and explain its operation.(16)
28. Draw the circuit diagram of a ratio detector and explain its operation. How is amplitude limit obtained in this detector?
29. Describe Phase-locked looped demodulator. Explain the generation of FM wave using Varactor diode modulator. (6)
30. What are the advantages of SHR over TRF and Straight receivers? (4)
31. Explain the detection of FM waves using Foster –Seeley Discriminator.

UNIT II DIGITAL COMMUNICATION

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

PART A

1. What are the elements of digital communication system? **(Nov 2010).**
2. How does the phase of carrier vary for the message m(n)={1,0,1,1,0,1,…}? **(Nov 2010).**
3. State the advantages of DM over FM. (Oct '96)
4. What is meant by multiplexing? (Apr '97)
5. What is the expression for SNR and BW for PWM? (Apr '96)
6. What is meant by quantization? (Oct '97)
7. What is meant by PCM? (Oct '98)
8. State the Nyquist rate in sampling a signal for effective transmission and recovery through a channel. (Apr '99)
9. What do you understand by the term aliasing with respect to a sampled waveform? (Apr '99)
10. Distinguish between natural and flat-top sampling with respect to a PAM waveform. (Apr '99)
11. Distinguish between PDM and PPM. (Oct '95)
12. Why PTM requires timing synchronization? (Oct '95)
13. How PPM signals are generated? (Apr '95)
14. What are the advantages of SSB transmission?(Oct '95)
15. How PWM can be converted to PPM wave? (Apr '96)
16. Draw the circuit for the generation of PWM wave. (Oct '96)
17. How FM wave can be converted to PM wave? (Oct '96)
18. What are the distinct advantages of PSK? (Apr'95, Oct'95, Apr '96)
19. What is meant by FSK and PSK? (Oct '97, Oct,98)
20. What is the bandwidth required for transmission of an FSK signal? (Apr '99)
21. List out the advantages of digital data transmission over analog data transmission? (Apr 2001)
22. What is meant by binary ASK?
23. What is meant by binary DPSK? (ARL '98)
24. Define ASK and PSK.
25. What is the expression for SNR and BW for PWM? (Apr '96)

26. How PWM can be converted to PPM wave? (Apr '96, Apr '97, Oct '97)
27. Draw the circuit for the generation of PWM wave. (Oct '96)
28. How FM wave can be converted to PM wave? (Oct '96)
29. What is the difference between PSK and FSK?
30. What is coherent and non coherent detection?
31. What is matched filter?
32. What are the advantages of QPSK?
33. ASK is also known as_____
34. What is the percentage modulation in ASK system?
35. What is the main reason to employ PSK?
36. What is the channel bandwidth in ASK?
37. Draw the PSK signal for a binary input?(ARL'99)
38. Give the block diagram of band pass binary data transmission system model ?(OCT'98)
39. What is meant by coherent ASK? (OCT '98)
40. Find the number of bits required to sample audio signals with 128 quantization levels.
41. Define Quantization Error
42. State Shannon's limit for information capacity.
43. What are the advantages of QPSK?
44. Draw the PSK signal for a binary input?
45. What are the advantages of using DPCM over PCM?
46. What is slope overload protection? How is it overcome using ADM?
47. What are the differences between DM and PCM?

PART B

1. Explain working principle of ASK modulator and detector with neat diagram.(10) (ii)Draw ASK,FSK,PSK signal to transmit the data stream 1111000111.(6**)** **(Nov 2010).**
2. With a neat block diagram explain PAM modulation and demodulation process .Derive an expression for PAM wave and depth of modulation.(16**)** **(Nov 2010).**
3. State and explain sampling theorem. (Apr '95, Apr '97)
4. Give the principle of producing PAM. (Oct '97)
5. Explain the following pulse modulation systems with suitable diagrams: (i)PAM (ii) PPM (Oct '97, Oct '98)
6. Explain with a suitable diagram the generation of PPM signal and explain how these signals are modulated. (Oct '96)

7. Explain a method of demodulating PAM wave with a neat diagram. (Oct '98)
8. Illustrate the modulation techniques to transform digital data into analog signals. (Apr 2001)
9. Describe delta modulation and compare its performance with that of PCM (Apr 2001)
10. Describe a FSK modulation system. What is the advantage of this system over other types of keying? (April '99)
11. Describe a method to generate binary FSK /PSK signal. Explain the operation of FSK receiver with a block diagram (Oct '99/ April 2000)
12. Distinguish between ASK, PSK, FSK in terms of signaling techniques. (April'2000)
13. Describe about the objective of data communication systems .How networking has importance in data communication (April 2001).
14. Explain how error control is achieved in data communication systems (April 2001).

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL CODES (Qualitative only)

Primary communication – entropy, properties, BSC, BEC, source coding : Shannon Fanno coding, Huffman coding: noiseless coding theorem, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

PART A

1. An event has six possible outcomes with probabilities {1/2, 1/4,1/8,1/16,1/32,1/32}. Find the entropy of the system**. (Nov 2010).**
2. Find the hamming distance between the following code words C1={ 1 0 0 0 1 1 1} and C2= { 0 0 0 1 0 1 1}.**(Nov 2010).**
3. What are the properties of entropy?
4. Define conditional entropy.
5. Define joint entropy.
6. When will entropy function have its maximum value?
7. Define average length and coding efficiency.
8. Define self information. What is the unit?

9. Define source entropy and information rate.
10. What is meant by BSC? Give the channel capacity of BSC.
11. Draw the structure of BEC.
12. Give the factors which influence reliable transmission.
13. List out the advantages of error control coding.
14. What are the disadvantages of error control coding?
15. Give the types of error control codes.
16. Define block codes.
17. Define linear block codes.
18. List the types of block codes.
19. What are systematic codes? Give the structure of systematic block code.
20. Define generator matrix.
21. What is parity check matrix?
22. State closure property.
23. What is hamming distance in error control coding?
24. Define hamming weight and minimum distance.
25. What is hamming code?
26. Define syndrome.
27. Why cyclic codes are well suited for error detection?
28. Give any two properties for cyclic codes.
29. List other cyclic codes.
30. What is the need for convolution coding?
31. What is convolution coder?
32. What is trellis?
33. Give the graphical representation of convolution encoder.
34. Distinguish between block codes and convolution codes.
35. What is variable length code?
36. State Shannon's first theorem.
37. Distinguish between static and dynamic Huffman coding.
38. Give the drawbacks of Huffman coding.
39. What do you mean by memory less source?
40. Distinguish between self and mutual information.
41. Define redundancy of a coding scheme.
42. An event has six possible outcomes with probabilities p1=1/2,p2=1/4,p3=1/8,p4=1/16,p5=p6=1/32.Find the rate of information if there are 16 outcomes per second.

43. When a selection between two likely events is made ,what is the amount of information associated in bits?
44. X and y are two discrete random variables associated with the same experiment. What is the relation between H(x, y),H(x) and H(y)?
45. In a channel for each transmitted symbol there is only one received symbol. What is the name of this channel?
46. When is a channel known as lossless?
47. What is meant by channel capacity?
48. State Shanon Hartley's law.
49. Define coding efficiency.

PART B

1. Brief the properties of entropy. (4) (ii) Five symbols of the alphabet of DMS and their probabilities are given below. S={So,S1,S2,S3,S4} P(S)= {0.4,0.2,0.2,0.1,0.1}.Code the symbols using Huffman coding.(12) . **(Nov 2010).**
2. (i)Briefly discuss on various error control codes and explain in detail with one example for convolution code.(12)(ii) Draw the polar, unipolar, bipolar and Manchester NRZ line code format for an information { 1 0 1 1 0 0} (4) . **(Nov 2010).**
3. (i) Discuss the BSC and BEC with their channel diagram and transition matrix.(12) (ii) Consider that a source is transmitting equiprobable 1/0 at the rate of 10^3 bits/sec and the probability of error is $p_e = 1/16$. Determine the rate of transmission.. **(Nov 2010).**
4. Define entropy and discuss its properties.(5)
5. Write short notes on the types of entropy.(6)
6. Define mutual information and discuss its properties.(5)
7. Discuss the different conditional entropies.(6)
8. What is BSC? Derive the channel capacity of BSC.
9. Explain the Shannon-Fano mutual information coding algorithm.
10. Construct Shannon-Fano code for the given symbols {x1, x2….x6} with probabilities {0.3, 0.25, 0.2, 0.1, 0.1, and 0.05}.Also find the average codeword length and the entropy of the source.
11. A discrete memory less source emits five symbols with probabilities [0.4, 0.1, 0.2, 0.1, and 0.2].Find Shannon-Fano code and its average length.
12. Explain the Huffman coding algorithm and its limitations.

13. A discrete memory less source emits five symbols with probabilities [0.4, 0.1, 0.2, 0.1, and 0.2].Find Huffman code and its length by placing the combined symbol as high as possible.
14. Construct (7,4) linear block code for the hamming codes for the message vector
15. [1 1 1 1] whose parity matrix is [0 1 1; 1 0 1; 1 1 0; 1 1 1].
16. Explain the cyclic coder with neat sketch.
17. Explain convolution coder.
18. Draw the following for the given message sequence [1 0 1 1 1]
    a. trellis
    b. code tree
    c. state diagram

UNIT IV MULTIPLE ACCESS TECHNIQUES

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits) :

PART A

1. Mention the advantages of CDMA system. **(Nov 2010).**
2. What is meant by spread spectrum?
3. What are the applications of spread spectrum?
4. What is DS spread spectrum?
5. Define FH spread spectrum.
6. What is space division multiple access?

PART B

1. Discuss the various multiple access techniques used in wireless communication with their merits and demerits.(16**) (Nov 2010).**
2. Explain what is meant by FDMA.
3. Describe the general operating principles of a TDMA network. Show how the transmission bit rate is related to the input bit rate.

4. Explain the principle behind spectrum spreading and dispreading and how this is used to minimize interference in a CDMA system.
5. What are the most commonly used methods of MA. Explain them in detail.

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA

Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

PART A

1. Specify uplink and downlink frequency ranges for satellite communication**. (Nov 2010).**
2. State the advantages of fiber optic system. **(Nov 2010).**
3. What is geosynchronous satellite? **(Nov 2010).**
4. Name the two devices commonly used to detect light in fiber optic communication receivers.
5. List the disadvantages of fiber systems.
6. List any two advantages of optical fiber communication systems
7. Give any two disadvantages of the single-mode step index fibers
8. Name the two devices commonly used to generate light for fiber optic communications systems.
9. Give the advantages & disadvantages of geosynchronous orbits.
10. What are look angles? Define them.
11. Define numerical aperture.
12. Define critical angle.
13. Define pulse spreading or pulse-width dispersion.
14. What is the result of losses in optical fiber cables?
15. Define index profile.
16. What are the four types of lasers and mention their applications?
17. List the characteristics of Laser.
18. List the characteristics of light detectors.

19. What are the requirements of optical sources ?
20. What is the principle used for guiding light beam within the optical fiber?
21. Define effective isotropic radiated power.
22. Define acceptance angle or acceptance cone.
23. List the different types of optical fiber configurations..
24. Give the advantages and disadvantages of geosynchronous orbits.
25. List the characteristics of Laser.

PART B

1. (i) Compare optical fiber cable with RF cable.(6)(ii) Distinguish among single mode step index, multimode step index and multimode graded index optical fibers. (10**)(Nov 2010).**
2. Write short notes on (i) satellite subsystems(8) (ii) power line carrier systems (8**) (Nov 2010).**
3. Discuss briefly about satellite orbits.
4. Derive satellite system link equation.
5. Explain briefly about Geo stationary satellites.
6. A satellite transmitter operates at 4 GHz with transmitter power 0f 7W and an antenna gain of 40 db. The receiver has an antenna gain of 30db and path length is 40,000 Km. Calculate the signal strength at the receiver.
7. Explain the block diagram of an optical fiber communication link. (8)
8. Give the comparison of the three types of optical fibers.(8)
9. With neat sketch for the ray propagation into and down an optical fiber cable, derive an expression for the acceptance angle. (16)
10. Explain how the light beam propagates through fiber. What are the different types of optical link losses & discuss their adverse effects? (16)
11. Describe the operation of PIN diode and APD (8)
12. Explain the important characteristics of light detectors. (8)

13. Describe the operation of different types of LED. (16)
14. Briefly describe the functional characteristics of an uplink, a transponder and a downlink model for a satellite system. (16)
15. Derive the expressions for flux density and Friis transmission formula for satellite links. Explain how a satellite link is established and discuss the various factors to be considered while performing the link budget calculations for uplink case along with the system considerations. (16)
16. What are the benefits of satellite communication systems? How is the position/location of a satellite tracked from the earth station? Derive the satellite link equations and comment on it. (16)