**Unit-III:** Wireless Transceivers

**Session -1** Comparison of analog and digital link

Introduction: Discussion by remembering keywords:

* Modulation
* Demodulation
* Coding
* decoding
* destination

**presentation:** Digital communication link

**show and tell :**wave.

* [*www.wiley.com/go/molisch*](http://www.wiley.com/go/molisch) *book*
* [http://www.ask.com/question/how-does-fsk-worken.wikipedia.org/wiki/File:Fsk.svg](http://www.ask.com/question/how-does-fsk-worken.wikipedia.org/wiki/File%3AFsk.svg)

**Conclusion:**Recall by keywords

1. Define modulation.

Modulation may be defined as the process by which some parameters of a highfrequency signal termed as carried, is varied in accordance with the signal to be transmitted.

2. What is demodulation?

Demodulation or detection is the process of recovering the original modulating signalfrom a modulated wave.

3. Write the advantages of digital over analog modulation?

(i) Greater noise immunity.(ii) Robustness to channel impairments

(iii) Easier multiplexing of various forms of information.(iv) Greater security.

4. What are the digital modulation techniques are available?

1. Amplitude shift keying (ASK)2. Frequency shift keying (FSK)3. Phase shift keying (PSK)

5. Write a short note on

(a) Amplitude shift keying (ASK)-If amplitude of the carrier is varied depending on the incoming digital signal, then itis called amplitude shift keying (ASK)

(b) Frequency shift keying (FSK)-If the frequency of the sinusoidal carrier varied depending on the incoming digitalsignal, then it is called frequency shift keying (FSK).

(c) Phase shift keying (PSK)-If phase of the carried is varied depending on the input digital signal, then it is calledphase shift keying (PSK)

**Session -2 BPSK,**QPSK–principle, constellation diagram generation, detection

 Introduction: activity: Show and tell

<http://wn.com/on_off_keying#/images>

<http://www.netbook.cs.purdue.edu/animations/Amplitude%20Shift%20Keying.html> for ask

waveforms of various modulated signals were shown. Students have to identify the type of techniques.

<http://www.radio-electronics.com/info/rf-technology-design/pm-phase-modulation/what-is-pm-tutorial.php>

<http://www.winlab.rutgers.edu/~narayan/Course/Wless/Lectures05/lect9.pdf> for qpsk

<http://www.youtube.com/watch?v=nHN7PbWVh1A>qpsk

Recap: Recall by keywords

Activity Description: We can divide the learners into four teams and instruct each team to prepare 5 questions on modulation and its types. After 5 minutes of preparation, each team will ask the other team the questions prepared.

**Conclusion:** Recall by keywords Questions

 1. Define baud rate.

Speed at which symbols (signals) are transmitted in a digital communications system.

Simply no. of symbols/second.

2. Define bit rate.

Speed at which data (Bits) is transmitted in a digital communication system. Simply

no. of bits/second.

3. What is QAM?

At high bit rates, a combination of ASK and PSK is employed in order to minimizethe errors in the received data. This method is known as “quadrature amplitude modulation”.

4. Define QPSK.

QPSK is a multilevel modulation in which four phase shifts are used for representingfour different symbols.

5. Define linear modulation?

In linear modulation techniques, the amplitude of the transmitted (carrier) signalvaries with the modulating digital signal.

6.Differentiate linear, non-linear modulation.

|  |  |
| --- | --- |
| linear modulation | nonlinear modulation |
| In the linear modulation the amplitude of the carrier is not constant, regardless of thevariation in the modulating signals | In the non linear modulation the amplitude of the carrier is constant, regardless of thevariation in the modulating signals.Non-linear modulations may have either linear or constant envelops depending onwhether or not the base band waveform is pulse shaped. |
| Merits:(i) Bandwidth efficient.(ii) Very attractive for use in wireless communication systems and(iii) Accommodate more and more users within a limited spectrum.  | (i) Power efficient class C amplifiers can be used without introducingDegradation in the spectrum occupancy of the transmitted signal.(ii) Low out of band radiation of the order of -60dB to -70 dB can beachieved.(iii) Limiter-discriminator detection can be used, which simplifies receiverdesign and provides high immunity against random FM noise andSignal fluctuations due to Rayleigh fading. |
| Demerits:poor power efficient examples of linear modulation are(i) Pulse shaped QPSK(ii) OQPSK(iii) \/4QPSK | (i) Constant envelope modulations, occupy a larger bandwidth than linearmodulation schemes.(ii) In situations where bandwidth efficiency is more important than powerefficiency, constant envelope modulation is not well-suited.Eg.,BPSK |

**Session -3 T**he principle of π/4 QPSK

1. Recap:

Activity by rising Questions

* Define Bit rate
* symbol rate
* Linear
* non-linear modulation
* Define QPSK.

**2.**Slides Presentation: π/4-Differential Quadrature-Phase Shift Keying

Generation and detection

* [**http://educypedia.karadimov.info/library/appD.pdf**](http://educypedia.karadimov.info/library/appD.pdf) **for oqpsk**
* [**http://www.williamson-labs.com/480\_com.htm**](http://www.williamson-labs.com/480_com.htm) **for animation**

**Conclusion:Quiz**

1. **Why we go for offset QPSK?**
2. **Few words about OQPSK.**
3. **Differentiate QPSK AND** π/4 QPSK
4. **List the advantages of OQPSK.**

**Session -4** principle and operation of Offset Quadrature-Phase Shift Keying

**Recap: Group Quiz**

Activity Description: We can divide the learners into two teams and instruct each team to prepare 5 questions on the Feedback and its types. After 5 minutes of preparation, each team will ask the other team the questions prepared.

**Content: Presentation by slides Generation of OQPSK**

<http://www.youtube.com/watch?v=AL3nGMhh-sM>

* [**http://www.radio-electronics.com/info/rf-technology-design/pm-phase-modulation/what-is-gmsk-gaussian-minimum-shift-keying-tutorial.php**](http://www.radio-electronics.com/info/rf-technology-design/pm-phase-modulation/what-is-gmsk-gaussian-minimum-shift-keying-tutorial.php)

**Conclusion:** Quiz-Buzz round

 Generation

* detection technique
* Error propagation
* Applications

**Session – 5** principle and operation of BFSK

**Introduction:** Questions

Presentation: Describe principle and operation of BFSK:

[**www.youtube.com/watch?v=ifgsouypc78feature=relmfu**](http://www.youtube.com/watch?v=ifgsouypc78feature=relmfu)

[**http://educypedia.karadimov.info/library/aa-iq.gif**](http://educypedia.karadimov.info/library/aa-iq.gif) **animation fsk**

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|  | Conclusion: Queriesby recall Generation* detection technique
* Error propagation

Applications of FSK technique Define M-ary FSK?.In M-ary system, M=2Ndifferent symbols are used and N-number of bits per symbol.Every symbol uses separate frequency for transmission. Such system is calledas M-ary FSKsystem. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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**Session -6** principle and operation ofMSK

* Introduction: **Minimum Shift Keying**

**Presentation**:

* Generation and detection of MSK

probability of error performance of MSK

* [**http://www.powershow.com/view/142bf3-N2VmM/Introduction\_to\_GMSK\_Gaussian\_Filtered\_Minimum\_Shift\_Keying\_powerpoint\_ppt\_presentation**](http://www.powershow.com/view/142bf3-N2VmM/Introduction_to_GMSK_Gaussian_Filtered_Minimum_Shift_Keying_powerpoint_ppt_presentation)**msk**
* [**http://educypedia.karadimov.info/library/lect\_mask.pdf**](http://educypedia.karadimov.info/library/lect_mask.pdf)**ask,msk**

**Conclusion :**Learner led presentation

1. Why MSK is called as fast FSK?

MSK is sometimes referred to as fast FSK, as the frequency spacing used for onlyhalf as much as that used in conventional noncoherent FSK.

2. Mention some merits of MSK.

(i) Constant envelope(ii) Spectral efficiency

(iii) Good BER performance(iv) Self-synchronizing capability

(v) MSK is a spectrally efficient modulation scheme and is particularly attractive foruse in mobile radio communications systems.

3. Write the expression for normalized power spectral density for MSK.

Thenormalized power spectral density for MSK is given by

4.. What is the need of Gaussian filter?

Gaussian filter is used before the modulator to reduce the transmitted bandwidth ofthe signal. It uses less bandwidth than conventional FSK.

5.Write the formula for bit error rate in GMSK.

The bit error probability for GMSK is given by Where, T is a constant related to BT.

6. Write the expression for probability of error of M-ary QAM?

The average probability of error in an AWGN channel for M-ary QAM, using

coherent detection is given by, \_ \_

7. Write the applications of MFSK and OFDM.

MFSK and OFDM modulation methods are used for high speed data connections aspart of the IEEE 802.11a standards activities to provide 54Mbps WLAN connections, as wellas for high speed line-of sight and non-line-of-sight microwave connections for MMDS(Multichannel multipoint distribution service) Operation.

* **Session -7 Gaussian Minimum Shift Keying**

Recap: Questionnaire Discussion about**Minimum Shift Keying**

**Presentation: Gaussian Minimum Shift Keying**

**Generation and detection of GMSK**

* [*www.wiley.com/go/molisch*](http://www.wiley.com/go/molisch) *book*
* [**http://www.radio-electronics.com/info/rf-technology-design/pm-phase-modulation/what-is-gmsk-gaussian-minimum-shift-keying-tutorial.php**](http://www.radio-electronics.com/info/rf-technology-design/pm-phase-modulation/what-is-gmsk-gaussian-minimum-shift-keying-tutorial.php)**GMSK**

Conclusion: Recall by questions

* generation
* detection
* Error probability
* **Session -8 Power spectrum and Error performance in fading channels**
* Introduction: QPSK, BFSK system error performance analysis

Presentation: slides

Error probability

Conclusion: Learner led presentation

**Session -9** MSK, GMSK system error performance analysis

Recap: Questions

Fading in Channel chart preparation

Presentation slides:

Conclusion: Questions and answers

1. **Distinguish between MSK,GMSK**



2.Write the properties of QPSK.



3.Compare QPSK,MSK,FSK

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