

## PAF: Media encoding

### Online course specification

**Target audience:**

This course is designed for those who require an introduction to the fundamental technical concepts that underpin modern telecommunications. The course is suitable for those joining the industry in a technical role especially those in an apprenticeship.

**Course aim:**

To introduce the role and principles of encoding and compression of speech and video in a digital communications system.

**Course level:** Introductory

*An explanation of PTT course levels is given at the end of this document*

**Pre-requisites:**

An understanding of the basic properties of analogue and digital signals. It is recommended that the PTT course “Analogue and digital signals is studied before attempting this course.

**Course structure:**

The course consists of the following four modules:

1. Role of encoding and compression
2. Analogue to digital encoding
3. Low rate encoding
4. Video encoding

**Module 1:** Role of encoding and compression

Module aim: Describe the role, benefits, constraints, and applications of digital encoding and compression.

After completing this module, a trainee will be able to:

- describe the advantages of encoding speech and video signals before transmission.
- explain the role of access networks and core networks in a telecommunications system, with reference to the physical media and multiplexing techniques used in each.
- describe the characteristics of a local loop connection from telephone to exchange.
- state the relationship between the bandwidth occupied by an analogue signal and the bit rate of the encoded signal.
- explain the reasons for restricting the bandwidth of a telephone call connection.
- describe where in a telephone system encoding and decoding takes place in a public switched telephone network (PSTN).
- explain that modern telecommunications systems carry encoded speech and video over packet-switched networks.
- give examples of the use of voice over IP (VoIP) including public telephony services, Internet services, 4<sup>th</sup> generation mobile systems, and over business networks.
- describe the role of digital compression in reducing the bit rate requirements for the transmission of speech and video, giving examples of its use.
- explain that increasing distortion limits the degree of compression that can be achieved.

## **Module 2: Analogue to digital encoding**

Module aim: To describe the application and operation of a PCM A/D encoder.

After completing this module, a trainee will be able to:

- explain the principles and operation of Pulse Code Modulation (PCM) encoders.
- define "Quantisation Distortion" (QD) and explain the relationship between the number of bits employed for each sample and the amount of QD produced by the encoding/decoding process.
- explain that the Nyquist rule determines the minimum acceptable sampling rate.
- describe the characteristics, advantages and applications of non-linear A-law and  $\mu$ -law PCM encoders.
- explain the need for conversion of the code sent between different types of encoder/decoder in communications systems.
- describe three ways of minimising the bit rate produced by an encoder and compare the advantages and limitations of each method.

## **Module 3: Low rate encoding**

Module aim: Describe the bandwidth requirements of speech and music and the low rate encoding techniques used for their transmission.

After completing this module, a trainee will be able to:

- indicate the bandwidth allocated to speech and music on various media
- including CD, radio broadcasts, and telephony. –
- explain the relationship between the bandwidth requirement and perceived quality of a digitally encoded speech or music channel and the sampling rate and the number of bits per sample.
- explain the basic principles and list applications of ADPCM, sub-band encoders, and hybrid vocoders.
- give examples of the use of encoders that provide a bandwidth of 7 kHz for speech.
- explain how encoders can use the characteristics of human hearing to reduce the amount of digitally encoded information that has to be transmitted to represent a music channel.
- state that multiple encoding/decoding processes accumulate quantisation distortion.
- list examples of the types of encoder used for telephony, digital broadcasting and music downloads.

## **Module 4: Video encoding**

Module aim: To describe the techniques used to digitally encode images and video, and the application of those techniques in modern communications systems.

After completing this module, a trainee will be able to:

- explain the concept of pixels in relation to digitally representing the information in an image.
- describe how the resolution of an image is defined and explain its significance in relation to perceived quality.
- list the factors that determine the bit rate required to stream a video.
- compare lossy and lossless compression.
- explain the basic principles of JPEG image compression
- explain the principles of MPEG video compression.
- list and compare the bit rate requirements of various media services including video conferencing, video streaming, standard quality broadcast television and high definition television.

## **Course access requirements:**

To access the course, a computer running a browser such as Google Chrome, Safari etc is required. The computer should have Internet access. A screen resolution of at least 1024x768 is necessary.

**Learning facilities:**

This online course employs interactive simulations, hypertext links to an online glossary and multiple-choice question sessions to fully involve the trainee in the learning experience. Each module provides revision links to previously studied, relevant topics. A record of progress and level of achievement is recorded for each trainee. Once studied as a structured, assessed course, the content can be browsed for revision or reference.

**PTT course levels:**

PTT online courses are categorised by one of three levels according to the depth of treatment they provide:

**1. Introductory:**

PTT Introductory courses are designed for those with no previous experience or knowledge of telecommunications. These courses provide an overview of telecommunications or discuss the fundamentals of electronic communications. The study of general science at secondary (high) school is a typical pre-requisite for PTT Introductory courses.

PTT Introductory courses are suitable for those joining the telecommunications sector particularly those in an apprenticeship programme.

**2. Intermediate:**

PTT Intermediate courses are designed for technicians and engineers requiring an understanding of a certain aspect of telecommunications. Those planning to study an Intermediate course should have an understanding of the basic principles of electronic communications.

The depth of treatment provided by Intermediate courses is typically equivalent to level 3 of a UK national vocational qualification (NVQ). PTT Intermediate courses can be used to support the attainment of a Communications Technology NVQ at level 3.

**3. Advanced:**

PTT Advanced courses are designed for those who require an in-depth treatment of a certain aspect of telecommunications. Such courses are suitable for system designers as well as those who will be responsible for the maintenance of the system described in the course.

Those planning to study a PTT Advanced course should have a background in telecommunications, and an understanding of telecommunications fundamentals and the principles of the type of telecommunications system described in the course.

PTT  
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