

# Mobile

learntelecoms interactive E-learning suite of courses:  
Mobile radio networks

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## Mobile

- is a suite of interactive, e-learning courses designed to run under Windows™ XP ,Vista or Windows 7.
  - provides training in the technical aspects of modern mobile radio systems.
  - consists of seven separate but integrated courses:
    - Introduction to mobile systems
    - The air interface
    - GSM mobile radio networks
    - GSM data services
    - UMTS (3G) mobile radio networks
    - LTE (4G) mobile radio networks
    - LTE mobile systems
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## Training delivery:

study on-line over the Internet or company intranet.

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## Each Mobile course:

- provides in-depth, authoritative technical training.
  - employs interactive simulations, hypertext links and question sessions to fully involve the trainee in the learning experience.
  - provides personalised training - each trainee can make his/her own notes and place bookmarks.
  - provides a record of progress and level of achievement for each trainee.
  - can be followed as a structured assessed course or browsed for revision or reference.
  - provides revision links to relevant screens in other modules.
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## Target audience:

- Those studying for a career in telecommunications and who require a detailed knowledge of modern mobile radio networks.
- technical staff involved in the operation, installation or maintenance of mobile radio networks.

# \_.Mobile

learntelecoms interactive E-learning suite of courses:  
Course MBA: Introduction to Mobile systems

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## **Pre-requisite:**

You will get the most out of this course if you already have a basic understanding of telecommunications systems. The PTT e-learning course StarTel A: “Telecoms fundamentals” provides the information you need.

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## **Course Aim:**

To introduce concepts which are used in most types of mobile systems, like handover and roaming, and cellular traffic handling. The course also reviews the various generations and types of mobile system and is a prerequisite for the later courses in the Mobile suite.

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## **Course objectives:**

At the end of this course, the trainee will be able to:

Explain degrees of mobility, differentiate between location and position and describe the effects of these concepts on system and service design.

Identify the basic components of a cellular system.

Explain the need for registration (authentication, authorisation and accounting) in mobile systems.

Explain the concepts of handover and roaming.

Describe cellular system traffic handling and explain how expansion may be provided.

Describe the characteristics and applications of digital radio systems (including DECT, PHS, TETRA, WiFi, WiMax, and Bluetooth) which differ from cellular systems such as GSM.

Describe the concept of generations of mobile systems, define the official terms “2G” “3G” and “4G” and describe ‘fractional G’ terms like 2.75G, 3.5G.

# \_.Mobile

learntelecoms interactive E-learning suite of courses:  
Course MBB: The air interface

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## **Pre-requisite:**

Before studying this course you should have a clear understanding of the structure of mobile networks, including the components of the core network. You should also be familiar with the terms authentication and authorisation. The PTT course MBA “Introduction to mobile systems” covers these topics.

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## **Course Aim:**

To describe the communications between a mobile user’s equipment and the fixed infrastructure provided by the mobile operator, that is, between a mobile and a base station.  
It is suggested this course is studied before attempting the later courses in this suite.

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## **Course objectives:**

At the end of this course, the trainee will be able to:

Define the air interface, and explain how a radio wave is affected by its environment.

Explain the terms loss, gain, cochannel and adjacent channel interference and delay.

Describe types of fading, their causes and methods used to reduce their effects.

Explain the characteristics of data traffic and their impact on mobile networks.

Describe methods of providing access to and from a basestation by many mobiles.

Describe frequency bands in use, frequency allocation methods and considerations affecting how frequency bands are used.

Describe the need for and methods of implementing secure communications over the air interface.

# \_.Mobile

learntelecoms interactive E-learning suite of courses:  
Course MBC: GSM mobile radio networks

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## **Pre-requisite:**

Understanding of basic principles of mobile telecommunications (it is suggested that courses MBA and MBB of the learntelecoms Mobile suite of courses are studied before attempting this course).

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## **Course Aim:**

After completing this course a trainee will be able to describe the structure, components and features of GSM (Global System Mobile) systems and the provision of telephony services using such systems.

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## **Course objectives:**

At the end of this course, the trainee will be able to:

Describe the architecture of GSM systems and their component parts.

Describe telephony services offered by GSM operators.

Explain how calls to and from the PSTN (Public Switched Telephone Network) are handled.

Explain GSM communications between a user's mobile and a mobile operator's fixed network.

Describe the GSM methods for keeping in touch with mobiles as they move with reference to handover, roaming and location updates.

Explain the TDMA multiframe structures used in GSM radio channels and the role of the various channels.

Describe the role of, and relationship between, the various protocols used in GSM systems.

Describe the application of MAP and ISUP signalling messages to location tracking, call establishment and handover.

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**Pre-requisites:**

Before studying this course you should have clear understanding of GSM networks used for telephony. The PTT online course MBC: 'GSM principles' covers this subject and we strongly recommend that you complete MBC before continuing with this course.

A background knowledge of data communications is also desirable. If you are new to data communications we suggest you study the PTT course TransNet A: 'Introduction to Wide Area Networks'.

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**Course Aim:**

After completing this course a trainee will be able to describe the provision and facilities of the various types of GSM mobile data service.

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**Course objectives:**

At the end of this course, the trainee will be able to:

Compare the basic GSM data transfer facility with that provided by HSCSD.

Describe the impact of all-IP architectures on GSM data services.

Describe the principles of operation of, and the facilities provided by, a Small Message Service (SMS).

Describe the components, operation and facilities of a General Packet Radio Service (GPRS).

Explain how mobility management (MM) in GPRS differs from MM in GSM with reference to the concept of Routing Areas.

Explain how data transfer rates for GSM systems can be increased by the use of different modulation techniques with reference to GMSK modulation in GSM and GPRS systems and the modulation techniques used by EDGE systems.

Compare the various means of accessing the Internet using mobile stations and explain the role and limitations of the Wireless Application Protocol (WAP).

# \_.Mobile

learntelecoms interactive E-learning suite of courses:  
Course MBE: UMTS (3G) mobile radio systems

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## **Pre-requisite:**

A good knowledge of GSM radio systems - It is recommended that courses MBC and MBD of the learntelecoms Mobile suite of courses are studied before attempting course MBE.

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## **Course Aim:**

To explain the principles of UMTS radio systems and describe in detail the the features, structure and operation of 3G mobile networks.

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## **Course objectives:**

At the end of this course, the trainee will be able to:

Explain the differences between UMTS and GSM in terms of modulation/multiple access method and packet mode (IP mode) integration.

List the main frequency bands used by UMTS systems and explain how frequency sharing in UMTS leads to more efficient use of frequency spectrum.

Explain the concept of WCDMA scrambling and channelisation codes and capacity limitations.

Explain the radio aspects of WCDMA, including multipath receiving, transmitter power control and radio channel structure and use.

Explain the physical and logical structures of UMTS networks and the evolution to IP (Internet Protocol) operation for all forms of traffic.

Show how user mobility is managed in UMTS and to discuss the various forms of handover.

Identify the mandatory and optional requirements for UMTS mobile equipments.

Describe security measures in UMTS systems, services enabled by UMTS security and 'lawful interception'.

Explain the benefits and operation of High Speed Packet Access (HSPA), and Evolved HSPA (HSPA+).

# \_.Mobile

learntelecoms interactive E-learning suite of courses:  
Course MOF: LTE (4G) mobile radio networks

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## **Pre-requisite:**

You will get the most out of this course if you already have an understanding of the principles of mobile communications. Therefore, familiarity with the material in the MBA and MBB courses in PTT's Mobile suite of e-learning courses is desirable. You should also have a detailed understanding of 3G mobile systems. It is recommended that the PTT e-learning course on "Third generation (3G UMTS) mobile systems" is studied before attempting this course.

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## **Course Aim:**

To introduce the features, structure and operation of LTE (Long Term Evolution) mobile systems.

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## **Course objectives:**

At the end of this course, the trainee will be able to:

Explain the need for mobile systems with capabilities beyond those of 3G and the work of 3GPP to standardise systems to meet those needs.

Explain the development of core network structures through HSPA+ to System Architecture Evolution (SAE).

Describe the role of the functional components of the Evolved Packet Core.

Explain LTE standards for the downlink and uplink of the air interface and why different technologies have been chosen.

Explain considerations applying to frequency allocations for LTE.

Describe processing used over the LTE radio access technology.

**Pre-requisite:**

You will get the most out of this course if you already have an understanding of the role and operation of the functional components of a UMTS (3G) system, and the principles of operation of the LTE radio access network and Evolved Packet Core. It is recommended that the PTT e-learning courses MBE 'UMTS (3G) mobile radio networks' and MOF: 'LTE (4G) mobile radio networks' are studied before attempting this course.

**Course Aim:**

To describe mobility in, and the provision of services over, LTE (4G) mobile systems. This course also discusses how the enhanced performance provided by an LTE Advanced system is achieved.

**Course objectives:**

At the end of this course, the trainee will be able to:

Describe the factors that determine the Quality of Service (QoS) requirements for a particular service and explain how a LTE Evolved Packet System delivers the required QoS with reference to EPS bearers.

Describe the role of the various Evolved Packet Core (EPC) interfaces and protocols.

Describe the procedures involved with mobility management including handover to other mobile systems such as GSM, UMTS, WiMAX and CDMA.

Describe and compare the various ways of providing a telephony and short message service over an LTE mobile system. Topics covered include CS Fallback, VOLGA and Voice over IMS.

Describe the benefits of LTE Advanced mobile systems and the techniques employed to provide their enhanced performance such as carrier aggregation, Enhanced MIMO and CoMP.