

## **S-72.423 Telecommunication Systems**

### **List of short essay topics that are relevant for the exam**

#### **PSTN**

Define, what is meant by value added services. Mention at least 5 of them.  
Describe how operational and maintenance functions are categorized and realized in the PSTN; briefly explain the functions.  
List and explain the functions of Digital Circuit Multiplexing Equipment  
Briefly describe the historical development of inter-exchange signalling in PSTN.

#### **ISDN**

List the basic evolution steps from analogue PSTN to ISDN and beyond  
PSTN vs. ISDN user access  
Explain the Basic Rate Access user interface structure  
Explain the Primary Rate Access user interface structure  
Setup of an “old-fashioned” PSTN call (user signalling only)  
Setup of an ISDN call (digital user signalling only)  
Explain the role of LAPD (Q.921) in ISDN.

#### **SS7**

Channel-associated signalling (CAS) vs. Common channel signalling (CCS)  
Explain the basic idea of Channel-associated signalling (CAS)  
Explain the basic idea of Common channel signalling (CCS)  
List and explain the three basic types of Signalling Points in SS7  
Describe the meaning of DPC, OPC, SLS and CIC in an ISUP signalling message  
Explain the meaning of SLS and CIC in SS7 signalling messages  
Explain the meaning and reusability of Signalling Point Codes (SPC)  
Explain the basic functions of MTP (Message Transfer Part)  
Where and why is ISUP (ISDN User Part) used?  
Setup of a call using ISUP (ISDN User Part)  
Where and why is SCCP (Signalling Connection Control Part) used?  
What is Global Title Translation (GTT) and why is it used?

You should be able to explain the basic signalling steps and network element functions when setting up or disconnecting a circuit switched call.

#### **IN (Intelligent Network)**

Explain the basic Intelligent Network (IN) architecture  
Explain the meaning of service provider, subscriber and customer

Present and explain a typical call-related IN procedure

Give 3 examples how an SCP can affect the routing of a circuit switched call

List (and shortly explain) 4 typical IN services

## **ATM**

Explain the basic functions of the physical layer in an ATM network

What does pointer processing mean in SDH systems?

What does the concept “Virtual Container” mean in SDH systems?

How can the ATM cell borders be found in an ATM-over-SDH system?

Explain the basic functions of the ATM layer

Describe the different multiplexing options in an ATM transmission system

Explain the basic functions of the ATM Adaptation Layer (AAL)

Explain the difference between AAL (ATM Adaptation Layer) 2 and AAL 5

Describe the basic operation of AAL 2 (ATM Adaptation Layer 2)

Describe the basic operation of AAL 5 (ATM Adaptation Layer 5)

## **GSM & GPRS**

Explain the meaning of duplexing in a mobile radio system

Explain the duplexing methods used in GSM, DECT, TETRA and UMTS

Explain the meaning of handover in a cellular mobile system

Why is TRAU (Transcoding and Rate Adaptation Unit) used in GSM?

List the main network management tasks in GSM/GPRS

Explain why and how random access is used in a cellular mobile network

Explain how a user is authenticated in a GSM network (not PIN code ...)

What is the meaning of “Authentication vector”?

Explain the meaning of cell, location area and routing area in GSM/GPRS

Why and where are IMSI, TMSI and MSISDN numbers used in GSM?

Explain the meaning of PDP context

List and briefly describe the types of handover in GSM.

Describe the steps of Random access performed by a mobile station in GSM/GPRS.

You should be able to explain the basic GSM/GPRS network architecture and the main functions of basic GSM/GPRS network elements

You should be able to explain the main signalling events of a Mobile Originated Call (MOC), Mobile Terminated Call (MTC) or Location Updating procedure

You should be able to explain the basics of packet transmission in a GPRS network

## **TETRA & DECT**

Explain the difference between cellular mobile, PMR and cordless systems.

What does a PMR system like TETRA offer that GSM cannot offer?

Give a comparison between TETRA and GSM systems.

Describe shortly three typical DECT usage scenarios.  
Explain the Dynamic Channel Selection and Allocation concept in DECT.  
Handover possibilities in DECT.  
What is the main difference between GSM and TETRA in terms of authentication?  
List TETRA Teleservices.  
List TETRA Bearer Services for data transfer.  
Channel spacing in GSM is 200 kHz, how much is it in TETRA?

### **3G**

List the basic steps in the evolution of cellular mobile networks.  
Describe shortly the four UMTS QoS (Quality of Service) classes.  
What do the UMTS concepts Serving RNC and Drift RNC mean?  
Explain the meaning of soft handover.  
Describe the difference between macrodiversity and microdiversity combining.  
Describe (using a few sentences) the meaning of the following UMTS features and acronyms: FDD / TDD, UTRAN, Spreading factor, Processing gain, Soft handover, RRC, Outer loop power control, AMR, Admission control.

### **ADSL**

Why loaded loops are not suitable for DSL system?  
In rate adaptive DSL, the different sub-channels are allocated for their optimum rates during the channel activation phase, how?  
What is the type of data paths in DMT and what are their characteristics and applications?  
What is the function of the following in an ADSL system based on OFDM/DMT: Pilot signal, Interleaving, Guard interval between OFDM symbols, FFT and IFFT, Channel estimation, Draw a simplified block diagram of ADSL modem, List the initialization phases and the operations performed during each phase in ADSL T1.413 standards.

### **Internet part I**

Explain the basic Client-Server concept in an IP network.  
Where and why is ARP (Address Resolution Protocol) being used?  
What is the purpose of using ICMP (Internet Control Message Protocol)  
Where and why are the Transport layer protocols TCP, UDP and SCTP being used?  
What is the purpose of using SCTP (Stream Control Transmission Protocol)  
Explain the meaning of URL (Uniform Resource Locator).  
Explain the meaning of DNS (Domain Name System).  
Where and why is RTP (Real Time Protocol) being used?  
IP address vs. TCP/UDP port number.  
Explain the hierarchical IPv4 address structure.

How can the IPv4 address space be increased?  
What does NAT (Network Address Translation) mean?  
What does dynamic IP addressing mean?  
Why and where is dynamic IP addressing used?  
Explain the hierarchical structure of the Internet.  
Explain the differences between Internet routing protocols BGP, RIP and OSPF.  
List the advantages of using IPv6 instead of IPv4.  
Describe the TCP connection establishment.

## **Internet part II**

What is SIP (Session Initiation Protocol) used for?  
Explain the basic operation of SIP (Session Initiation Protocol)  
Explain the meaning of forking.  
Explain the differences between HTTP and SIP (Session Initiation Protocol)  
What is IMS (IP Multimedia Subsystem) used for?  
Explain why it is difficult to achieve QoS support in the Internet.  
Explain two different methods for achieving QoS support in the Internet  
What does RSVP (Resource ReSerVation Protocol) mean?  
What does DiffServ (Differentiated Services) mean?  
What does MPLS (MultiProtocol Label Switching) mean?  
How is MPLS (MultiProtocol Label Switching) used in an IP network?  
Explain the difference between terminal and personal mobility.  
Explain the basic Mobile IP architecture.