

EXPERT DIPLOMA IN PROTOCOL DEVELOPMENT COURSE CONTENT

MODULE 1 : UMTS (3G) AND GSM (2G) BASIC

- 2G and 3G Network Architecture - CS & PS domain.
- RAT- FDMA, TDMA, CDMA, WCDMA, DFDMA, SCFDMA.
- SDU,PDU,UMTS N/W Architecture
- UMTS Protocol Architecture
- UMTS Channel
- Spreading code ,Spreading factor and scrambling code
- UMTS Layers basic concept

MODULE 2 : LTE STANDARDIZATION (3GPP)

- What is 3GPP?
- 3GPP release and process
- LTE Standardization Phase
- LTE Specification and 3GPP Structure

MODULE 3 : LTE SYSTEM ARCHITECTURE

- EUTRAN, EPC, SAE &EPC Architecture.
- Logical Elements and their Interfaces
- Roaming Architecture configuration
- LTE Architecture with legacy 3GPP interworking with an interface and their protocols.
- LTE identifier - UE Identifier, MME Identifier, TAI Architecture
- Roaming in non 3GPP interworking architecture of LTE with non 3GPP network.
- Interfaces and protocol in non 3GPP interworking systems.
- Roaming in non 3GPP interworking configuration.
- Interworking with CDMA 2000 access network.
- Protocol and interfaces with CDMA 2000 HPRD network.
- Interworking with CDMA 2000 1XRTT
- LTE identities – UE identities ,MME identities, TAI architecture

MODULE 4 : LTE PROTOCOL STACK ARCHITECTURE AND CHANNELS

- Control plane and User plane
- L1,L2,L3 Architecture
- Logical channel, Transport channel, Physical channel
- Control Information (CI), Channel Mapping
- Uu - Control/User plane
- S1 - Control/User plane

- X2 - User/Control plane
- S6a - Control plane
- S3/S4/S5/S8/S10/S11- C plane/U plane
- LTE bearer - Default and Dedicated

MODULE 5 : PHYSICAL LAYER

- EUTRA Air interface capability
- FDD Bands
- TDD Bands
- FDD and TDD Frame Architecture
- TDD UL/DL Configuration
- LTE UE categories
- Resource grid and Resource block
- OFDMA, SCFDMA, MIMO
- Physical UL and DL Signaling
- Physical UL and DL Control Information
- Physical channels
- PRACH structure
- UE Power on procedure
- Resource allocation type 0,1,2
- DCI format and PUSCH HOPING

MODULE 6: PHYSICAL LAYER PROCEDURES

- HARQ Procedure, Timing Advance, Power control, Random Access procedure.
- Physical layer measurement, UE measurement, enodeB measurement, Physical layer parameter configuration.
- Channel feedback reporting
- Half duplex operation

MODULE 7 : RLC LAYER

- RLC Architecture and function - TM, AM, UM
- Framing and reordering
- ARQ operation, Window operation
- RLC PDU Format
- SDU Discard and RLC Re-establishment

MODULE 8 : MAC LAYER AND PROCEDURES

- MAC Architecture and function
- MAC PDU format, LCID, LCGID, MAC-CE
- MAC Procedures
 - a) Dynamic and SPS Scheduling
 - b) SR, BSR, and PHR

- c) Logical channel prioritization
- d) DRx
- e) HARQ and TTI bundling
- f) Measurement gap
- g) RACH Procedure - Contention and Non-contention

MODULE 9 : PDCP LAYER AND PROCEDURE

- PDCP function and architecture
- Header compression and security
- Data transfer, PDCP PDU format

MODULE 10 : RRC AND NAS LAYER

- RRC states and state transition, SRB & DRB PLMN and cell Selection
- Cell Reselection and access verification
- RRC Layer Architecture and function
- RRC procedures -
 - a) RCC connection establishment
 - b) RCC connection release
 - c) System information
 - d) RCC connection re-establishment
 - e) Paging
 - f) RCC connection re-configuration
 - g) Measurement Procedure

MODULE 11 : NAS LAYER - EPS MOBILITY MANAGEMENT PROCEDURE

- NAS state - EMM and ESM
- NAS Authentication procedure
- Security mode control procedure
- Attach procedure
- Detach procedure, TAU procedure
- Service request and extended service request procedure
- Paging procedure
- Authentication procedure
- Security mode control procedure
- Identification procedure

MODULE 12: NAS - EPS SESSION MANAGEMENT PROCEDURE

- Dedicated EPS bearer context activation
- EPS bearer context activation
- EPS bearer context deactivation
- UE requested PDN connectivity
- UE request PDN disconnect

- UE requested bearer resource allocation
- UE request bearer resource modification

MODULE 13 : UE MOBILITY AND HANDOVER

- RCC connected mode mobility
 - a) Intra LTE Handover within MME pool area
 - b) Intra LTE Handover Inter MME pool area
 - c) Inter RAT Handover - release with read direction
- RCC Idle mode mobility
- Cell Reselection
- UE measurement
- Network measurement
- Measurement reporting

MODULE 14 : CSFB

- CSFB system architecture Voice domain preference and UE usage setting CSFB call flow -
 - a) Mobile registration
 - b) Mobile originating call
 - c) Mobile terminating call

MODULE 15 : SMS IN CSFB

MODULE 16 : SRVCC

- SRVCC network architecture
- Attach registration and call setup
- SRVCC handover from LTE to 3GPP UTRAN – GERAN

MODULE 17 : SIP

- Basic SIP and SIP call with proxy server
- SIP message transfer
- SIP client and server
- SIP request message
- URI and URL schemes used by SIP
- Message bodies
- SIP response message
- SIP response header fields
- Message body header fields
- SIP security
- SIP call flow

MODULE 18 : VOLTE(IMS)

- VOLTE system architecture
- VOLTE radio functionalities

- VOLTE EPC functionalities
- IMS identification
- VOLTE end to end signaling
- VOLTE call flow
- VOLTE emergency call
- VOLTE messaging
- VOLTE handover and roaming
- Service centralization and call continuity
- VOLTE SMS

MODULE 19 : VOLTE – ARCHITECTURE AND FUNCTIONALITY

- VOLTE system architecture
- EPS – Mobility and session management
- EPS session management and QoS
- IMS fundamentals and IMS Entities
- IMS network architecture
- IMS protocol architecture
- SIP , SDP ,and diameter protocol

MODULE 20: IMS NETWORK FUNCTIONAL ARCHITECTURE

- EPS functional architecture
- IMS functional architecture
- Database functional architecture
- IMS charging functional architecture
 - PCC function
 - Application of EPC ,IMS , and PCC
 - Bearers

MODULE 21 : IMS IDENTIFICATION

- IP multimedia service identity module
- Private and public user identity
- Identification of users device
- Identification of network entity

MODULE 22 : VOLTE END TO END SIGNALLING

- Registration signalling procedure
- De registration signalling procedure
- VOLTE originating session
- VOLTE termination session
- Emergency call
- VOLTE call released by calling party
- VOLTE call released by called party

MODULE 23: ViLTE SERVICE AND PROCEDURES

- VOLTE and ViLTE service procedures
- Audio flow
- Video flow
- Measuring IP video quality
- ViLTE procedures
- ViLTE registration
- Video call establishment
- Video call originator terminates
- Video call terminator terminates
- Change of video parameter
- Video call - user stops video
- Video call accepted as voice only

MODULE 25 : VOLTE CALL FLOW ADVANCED

- Redirect VOLTE call to voice mail after called party is busy.
- Redirect VOLTE call not answered to voice mail.
- Originator cancels the call before ringing.
- Originator cancels the call after ringing.
- Loss of SIP signalling
- Loss of PD connectivity
- Voice call waiting, second party hold.

MODULE 26 : VOLTE HANDOVER AND CALL FLOW

- Interconnection with CS network
- Interconnection with IMS network
- Interconnection session establishment with CS network
- PS – PS intersystem handover
- Functional architecture of roaming
 - Roaming EPS network
 - Roaming IMS network
 - Roaming procedures
- SRVCC function and procedure

MODULE 27 : VOLTE SHORT MESSAGE SERVICE

- Message structure
- SM – TL Layer
- SM – RL Layer
- SM – CL Layer
- SMS over SGsAP architecture
- SMS over SGsAP procedure

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- SMS over SIP architecture
- SMS over SIP procedure

MODULE 28 : 3GPP SPECIFICATION , PROJECT AND TOOLS

- **3GPP –**
 - Re 99, Re, 5, R4 See 8, Re 9, Re, 10.
 - 26 Series- Codec.
 - 25 Series- Access Startum
 - 24 Series- NAS
 - 21 Series- Requirement Management.
 - 30 Series-Program Management
- **PROJECT -**
 - Describe the real time project in Layer1, layer 2, layer 3 of next generation telecom technologies on wireless protocol stack development from scratch to end which covers the series of PDLC services from Design and Development to Sustenance and Support, and also extends agilely to Platform Modernization and Application Management.
 - Prime bit’s team of highly experienced software architects and engineers will teach you how to collect the Requirements, analyze it and define the module interface to develop the complete product.
 - Describes how to work with a variety of development and test environments, utilizing a huge range of tools and technologies that should very familiar with Agile, and Waterfall development methodologies.
 - Discuss how to use 3GPP in your project development and how to decode the information elements and compile the messages.
 - Discuss how to track and fix the bug by using debugging and bug tracking tool.
 - Will discuss the system integration and how to release the different version of product.
- **TESTING TOOLS -**
 - Debugging tools: GDB
 - Bug Tracking tool: JIRA and BugZilla
 - Version tool: CVS ,SVN
 - Software configuration management : clear case
 - Compiler: GCC and ASN.1
 - Protocol Analyzer and network Simulator.
 - Chipset and Log capture tool: Broadcom, Intel and QUALCOMM.
 - 3GPP Specification

MODULE 29: ADVANCED C & UNIX PROGRAMMING

This course provides a thorough practical exposure to the C programming language, the workhorse of the UNIX operating system. The first two weeks will cover basic syntax and grammar which covers Basic

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C, Loops, Function, Array, Pointer, and Structure and expose students to practical programming techniques. The remaining lectures will focus on more advanced concepts, such as dynamic memory allocation, memory management Data Structure, concurrency and synchronization, UNIX signals and process control, library development and usage. Daily programming assignments and weekly laboratory exercises are required. Knowledge of C is highly marketable for full-time positions in software and embedded systems development.