

## EXPERT DIPLOMA IN PROTOCOL TESTING 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 24 : 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 25 : 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 26 : VOLTE SHORT MESSAGE SERVICE

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

- SMS over SIP architecture
- SMS over SIP procedure

## MODULE 27 : 3GPP SPECIFICATION , PROJECT AND TOOLS

- **3GPP –**
  - a) 3G series for LTE layers
  - b) Analyse 3GPP log, LTE logs
  - c) Decoding 3GPP LTE messages and logs
  - d) ASN.1 compiler to describe 3GPP layer 3 message format
  - e) LTE protocol test lab setup and explanation
  - f) Conformance testing
  - g) Different types of testing certification
- **PROJECT -**
  - Our technical expert will guide the project by explaining how to
  - Develop test plans and test cases based on the marketing and design requirements for new features or update existing features.
  - Validate the design and test new features, functionalities thoroughly providing thorough coverage to features testing.
  - Conformance, IOT, regression, performance and stability testing.
  - Discover the bugs, file them using bug tracking tool, verify bugs after the fix and track the bug status.
  - Reproduce the customer reported bugs, verify the fix and convert it to test case.
  - Write test cases using TTCN 3, PYTHON or any other tool selected.
- **TESTING TOOLS -**
  - Bug Tracking tools
  - Version tools
  - Software configuration management
  - Protocol Analyzer and Network Simulator
  - Chipset and Log capture tool
  - 3GPP Testing Specification

## PYTHON PROGRAMMING COURSE CONTENT

### MODULE 1: BASICS OF PYTHON

- Introduction

#### *PYTHON OPERATORS*

- Arithmetic
- Relational
- Logical
- Assignment
- Bitwise Membership
- Identity operators.

#### *PYTHON CONDITIONAL STATEMENTS*

- If
- If - else
- If – elif

#### *PYTHON LOOPS*

- While
- For
- Range()
- Break and Continue
- Example problems

#### *PYTHON NUMBERS*

- Types in numbers
- Type conversions

#### *PYTHON STRINGS*

- Built-in functions
- Basic operators
- Slicing
- Example problems

#### *PYTHON LISTS*

- Array or list in python
- List slicing techniques
- Built-in functions

#### *PYTHON TUPLE*

- Tuple & Immutability
- Built-in functions



- Example problems

## ***PYTHON DICTIONARIES***

- Creation of dictionaries
- Built-in functions
- Example problems

## ***PYTHON FUNCTIONS***

- Advantages of functions
- Function definition using
- def statement.
- Calling function.
- passing parameters
- scope of the variables

## ***MODULES IN PYTHON***

- Importing modules
- creation of own modules
- standard modules - os / sys

## ***EXCEPTION HANDLING***

- Handling exceptions
- Try-except block
- Example problems

## ***FILE HANDLINGS***

- Files and directories
- Text files
- Binary files
- Text file processing
- Binary file processing

## **MODULE 2 : ADVANCED PYTHON**

### ***NETWORK PROGRAMMING:***

- In this, we will teach how we will send as well as receive data between devices by using TCP/IP and UDP protocols.
- Python supports many networking protocols through libraries such as a socket, SMTP etc and you can also write network programs directly by using TCP/IP or UDP sockets.

### ***TCP VS UDP / CLIENT VS SERVER - PYTHON EXAMPLES:***

- Python socket module makes it easy for you to write our own clients and server programs.

# Primebit Solution

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## ***MULTIPROCESSING IN PYTHON:***

Multiprocessing refers the ability of a system to support more than one processor at the same time. Applications in multiprocessing system are broken to smaller routines that run independently. The operation system allocates these threads to the processors improving performance of the system.

## ***FILE TRANSFER PROTOCOLS:***

In this, we will teach how can we transfer the files as well as receive the files between the devices.

## ***EMAILING:***

To transfer the emails, we will use SMTP library which is a built-in library in python. SMTP ( Simple Mail Transfer Protocol) is a protocol which enables you to send emails.