

## MASTERED 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

### 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

### 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
- UE Power on procedure

## **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.

## **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

## **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

## **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 : 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 16: 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 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.