

L_All_Vocatinal_Ed_Communications

Sector: Communications

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VOCATIONAL EDUCATIONAL QUALIFICATION FRAMEWORK
(Sector - Telecommunications - Specialization – Mobile Communication)
NVEQF/TEL/MC

S.No.	Certificate Level	Vocational Hours
1.	Level-I	200 hrs
2.	Level-II	250 hrs
3.	Level-III	350 hrs
4.	Level-IV	350 hrs
5.	Level-V	500 hrs
6.	Level-VI	550 hrs
7.	Level-VII	750 hrs

Certificate Level- I

I Module 1- Basics Of Electricity Components

Basics of Electrical Engineering

- OHM's Law: Electric current –conductors – insulators Semi-Conductors-Electric potential-Resistance-Ohm's Law-Resistances in Series and parallel simple problem.
- Work-power-Energy: Definitions of work, power & energy simple problems on power & energy-problems on energy consumption and monthly Billing – DC, AC power.
- OJT / LAB WORK
- Measurement of power of an Appliance / Circuit.
- Determining the Fusing Current of a fuse.
- Calibration of Energy Meter
- Practical use of soldering implements and materials

II Module 2- Basics Mobile Repairing Techniques

- Practical on Identification & Testing of SMD Resistors
- Identification & Testing of SMD coils
- Identification & Testing of SMD Capacitor
- Study of Diodes /Rectifiers
- Identification & Testing of SMD Transistors and Diodes
- Soldering of BGA components on Mobile trainer PCB's.
- Dismantling and Assembling of Mobile phones with locks/slide.
- Troubleshooting for Network
- Study of Audio section and its troubleshooting tips.
- Tracing of charging section.
- Troubleshooting dead phones.
- Study of DCT4 Models like Color display, Camera or FM models.
- Installation of UFS 3 dongle and flash files.
- Installing DTH antennas and cabling
- Soft skills

Certificate Level- II

Module 1- Mobile Repairing

Mobile Repairing

- Basic Electronics.
- Introduction of Mobile Components
- Practical on Electronic Components & Testing.
- Soldering with iron.
- Multimeter, CRO, Bread Board.
- Multimeter, CRO, Bread Board.
- How to use (SMD)
- PCB, General Purpose PCB.
- Checking Of Parts (Speaker, Buzzer, Earphone, PFO).

(B) Mobile Communication

- Introduction of Mobile Communication.
- Introduction to Mobile Phones.
- Cellular Mobile Telephone Service.
- Service Information of Mobile Phone.
- (Base Band Module, Base Band)
- Identification Of different IC's
- Supply Voltage Regulator, Powering UP & Down the Phone.
- Receiver, Transmitter, Headset Detection.
- Memory, SRAM, EEPROM, FLASH.
- Display Circuit / Monitor.
- Comparison with computer.
- Batteries and charger.
- SIM Card.
- Network Section(PFO, FDK, Antenna, Antenna Switch).
- Chip level and BGA training.
- GSM Codes.
- Block Diagram of different phones.
- Ball IC Practice.
- How to fix the Ball IC.
- Checking of PCB Prints.
- Introduction of different categories of mobile phones.
- SMD Rework Station Practice on Working Phones.
- Parts Replacing & Checking.

Module 2- Mobile Trouble Shooting

(A) Trouble Shooting

- Fault finding Procedure.
- SIM Card Faults.
- Network Problem.
- Charging and Battery Problems.

- Power ON/OFF Problems.
- General Faults.
- Display Problems.
- Software Problems.
- Keyboard Problems.
- Motherboard Tracing & Trouble shooting.

(B) Mobile Software and Trouble Shooting

- Use of Logo Manager.
- Identification of Dongle Switch and Interface Cable.
- Identify how to connect different type of Interface
- Cable with different mobiles.
- Unlock.
- Flashing.
- Blue tooth.
- Loading Games.
- Video clips.
- Blacklisting Software.
- Remote Software.
- UFS3.

Certificate Level- III

Module 1- Smart Phone Repair

- (A) Smart Phone Repair
- Block Diagram of Apple and Blackberry Phone
 - Replacing Touching Screen in Smartphone
 - Troubleshooting Network section in Smartphone
 - Troubleshooting Audio Section in Apple /Blackberry Phone
 - Troubleshooting Charging Section in Apple/ Blackberry
 - Troubleshooting Power on failure in Smart phones
 - Demonstration of Micro UFS installation & Flashing concept
 - Demonstration of S.E. Tool installation & Flashing concept
 - Demonstration of Infinity installation & Flashing concept
 - Installing I-Tunes & updating firmware of Apple Phone
 - Jailbrak Apple phone
 - Installing Desktop Manager and updating firmware BB
 - Using Mxkey for Blackberry (MEP unlocking)
 - Using Mxkey for HTC unlocking
 - Basics of PC Hardware & installing Device Driver
 - Internet Browsing and WinZip/WinRar
 - Downloading – Games, Mp3
 - Smartphone Repair Case

Module 2- Tablet PC Repair

- (A) Tablet PC Repair Techniques
- Features and ports in Tablet
 - Tablet PC Assembling –Disassembling
 - Understanding component on motherboard of Tablet
 - Understanding Circuit diagram of power section
 - Voltage measurement in Tablet pc
 - Troubleshooting power on failure in Tablet
 - Replacing Touch panel on Tablet
 - Troubleshooting No audio
 - Installing O.S. in Tablet
 - Troubleshooting Tablet Repair Case

Certificate Level- IV

Module 1- Optical Fiber Communication

- Basics of Optical fiber communication:-Introduction: Block diagram of optical fiber communication system, Advantages of optical fiber communication
- Optical fiber waveguides: structure of optical wave guide, light propagation in optical fiber using ray theory, acceptance angle, numerical aperture.

Module 2- Telephone Exchange Switching Theory

(A) Introduction to Exchanges

- Development of Electronics Exchange, Telecom Network Model, Electronics Exchange facilities, Working principle of Exchange, Software of Exchange, Redundancy Method Telephony:
- Explain the working principle of Telephone Transmitter; explain the working principle of Telephone
- Receiver, Describe the different tones used in Telephone Exchanges with Waveforms (Showing frequency and intervals).
- Explain the working of Electronic Private Automatic Branch Exchange(EPABX).
- Block diagram of Intercom and explain function of each block, Mention the specifications of Typical Intercom, Mention typical faults at each stage and their rectification, understand the difference between Landline Telephone, cordless telephone and cell phone.

(B) Telecom Switching

- Electromechanical Exchanges- Strowger & Crossbar, Switching Concept- Circuit & Packet Switching,
- Telecom Digital Switching-Time/Space/Hybrid.

(C) Traffic Engineering:-

- Concept of Telephone Traffic, Traffic load measurement, Traffic model, GoS & Erlang formula

(D) Long Distance Switching Plans:-

- Charging plans, PSTN switching plans, Transmission plans, National numbering plans, Synchronization plan, Signaling plan

Module 3- DSL

(A) Digital Subscriber Line

- Broadband Technology, Introduction to Analog Modem, Types of DSL, Asymmetric Digital Subscriber line- Principle & Benefits, ADSL Components-DSLAM, BBRAS, ISP, ADSL Network plan, Modem Protocol & Standard, Dial up modems, Digital Modems

- (B) Lab/OJT
- Configuring the ADSL
 - Installation of Modem with PC

Certificate Level- V

Module 1-Telecom Basics & Earthing System

- Introduction to Telecom Site- Cell Site Overview, Use of Surge Arrestor & Aviation Lamp, Various telecom tower types, designs, height determining of the GSM and the MW antenna
- Concept of Earthing Systems Earthing Fundamentals at wireless cell sites including DG Set and Active, Passive elements, Earth Resistance, Objectives of Earthing, Equipotential bonding, Principles of Earth Resistance Testing
- All the Electrical Activities which are being done on the Wireless Cell Sites including wiring, DG sets operations, Battery Bank, SMPS, PIU, functions and working.
- OJT/LAB Work
- Measurement of Antenna Height using Altimeter.
- Measurement of Earth Resistivity using Earth Resistance meter.
- Installation of different types of Earthing Systems.
- Installation of surge arrester.

Module 2-Telecom Power Supply

Roles & Responsibilities: - Awareness towards Site responsibilities, AC & DC power supply theory, Electrical unit (Watt, VA, KWH), Domestic Electric Circuit, Industrial Electric circuit, Telecom Power supply.

Installation of Electrical Equipments:-PIU, SMPS, Battery Bank, ACDB,DCDB, Inverter, AC installation, Internal Grounding, DG Automation, External Grounding Procedure.

Transmission media types, need,benefits and configuration. Transmission planning.

Tools Description- Multimeter, clamp meter, voltmeter, Galvanometer, Ammeter, Rheostat, Resistance meter.

Safety parameters- Safety while working on electrical instrument, foot & leg protection, electrically conductive & protective shoes, safety precaution while working on high voltage, electrical safety parameters, Device sensitive to static, Safety to RF radiation, Ionizing & Non- Ionizing radiation, Biological effect caused by RF radiation.

OJT/LAB Work

- Installation of Power Interface Unit.
- Installation of Switched Mode Power Supply.
- Installation of Battery Bank.
- Installation of DG Set.

Module 3-Telecom Fundamentals- Active & Passive Infrastructure

- Active & Passive Infrastructure- Description of Active & Passive Infrastructure, Antenna Basics, Sector & Microwave antenna installation, connectors, cable routing, role of jumpers.
- Installing NEC Paso link Microwave Transmitter/Receiver, MUX configuring at cell sites.
- Indoor installation- Need of Grounding, Internal Grounding Board, External Grounding Board.
- Basic Installation Tools- Allen Key set, pliers, crimping tools, file flat/round, Krone tool, soldering iron,
- spanner set, tie cutter, screw driver, multimeter, magnetic compass, ropes & pulley.
- Safety Parameters- Safety while working on towers and antenna installation, fall protection system, use of ladder, Hand & arm protection, Fall prevention and anchorage, personal protective equipment.

OJT/LAB Work

- Installation of Sector Antenna.
- Installation of Microwave antenna.
- Methods of feeder cable routing.
- Installation of Internal & External Grounding Board.
- Demonstration of use of Basic Installation tools.
- Tower climbing activity and safety kit use.
- Experiment to demonstrate the Site Cascading and MUX configuration.

Certificate Level- VI

Module 1- Antenna Theory & Installation

- Awareness towards Job responsibilities
- Polarization- Horizontal, Vertical, Circular, Cross-polarized.
- Antenna Alignment, Antenna Tilting and orientation, Connectors (RF/IF), Waveform pattern at antenna.
- Circuit explanation of PIU, SMPS, Battery bank, DG.
- Basic Tools:- Use of Magnetic Compass in antenna alignment, Site master use in measuring VSWR & Power, Power meter, Use of OTDR in measuring Fiber break and faults.
- Safety parameter while working with LASER, high voltage, RF & microwave radiation.
- OJT/LAB work
- To measure the VSWR using Site master.
- To find the Distance to Fault in Feeder cable using Site Master.
- To find the cable loss and cable break in Optical fiber using OTDR.
- To splice the Optical fiber using Fusion Arc Splicer.

Module 2-Modulation & Multiple Access Technique Introduction

- Introduction to communication system Analog to Analog Modulation
- Amplitude Modulation
- Frequency Modulation Analog to Digital Modulation
- Types of Pulse modulation,
- PAM (Single polarity, double polarity)
- PWM: Generation & demodulation of PWM,
- PPM: Generation and demodulation of PPM
- PCM: Generation & demodulation of PCM Digital to Digital Modulation
- RZ, NRZ, AMI, HDB3
- Manchester, Differential Manchester
- CMI Digital to Analog Modulation
- ASK, FSK, PSK
- QPSK, QAM, GMSK
- Bit rate & Baud rate Noise
- Noise in Analog communication System,
- Noise in DSB& SSB System Noise in AM System,
- Noise in Angle Modulation System,
- Threshold effect in Angle Modulation System,
- Pre-emphasis & de-emphasis
- Distortion
- Attenuation
- Transmission Units(db,Neper,dbm,dbmO,dbmi) Multiplexing & Multiple Access Technique
- Need of Multiplexing
- Time & Frequency Division Multiplexing
- Multiple Access Types
- Comparisons between Multiple Access Techniques

OJT / Lab Work

- Amplitude Shift Keying
- Frequency Shift Keying
- Phase Shift Keying
- Quadrature Phase Shift Keying
- Differential Phase Shift Keying
- Minimum Shift Keying
- Amplitude Modulation and Demodulation
- Frequency Modulation and Demodulation
- Pre Emphasis – De Emphasis Circuits
- Verification of Sampling Theorem
- PAM and Reconstruction
- PWM and PPM :Generation and Reconstruction
- Effect of Noise on the Communication Channel

Module 3- Data Communication Data Communication

- Components of Data Communication
- Protocol & Standard
- OSI models
- Functions of the layers
- Data Link Control- Line Discipline, Flow Control, Error Control
- Automatic Repeat Request
- Data Link Protocol- HDLC, LAPB, LAP-D, PPP
- Network Layer Protocol- Ethernet Standard, CDMA/CD, Fast Ethernet, Token ring, FDDI
- Packet Switching- X.25, Triple X protocol, Frame relay, ATM IP Address
- IPv4 & IPv6 address network
- Public & Private IP Address
- Sub netting
- IP Address Translation
- Address Mask

Module 4- Wireless Communication- 2G GSM

- GSM Background, GSM history, Frequency Band Allocation, GSM Network Architecture
- Frequency Reuse, GSM Network Components, Channel Coding and Decoding, GSM Channels, Mobile Originated & Mobile Terminated Call flow
- Base Station Identities: BTS Function, Interleaving and ciphering, Burst formation, Burst types, Interfaces in GSM
- Location Update (Normal, IMSI detach @ Attach, Periodic), Cell Selection/reselection, Frequency Hopping, Link Budget, Signaling Scenario. GPRS
- Need of GPRS, Benefits of GPRS, GPRS Architecture
- Mobile Classes, GPRS protocols stack
- PDP Context Activation, GPRS Attach, GPRS Cell Selection/reselection. EDGE
- GPRS/EDGE/GSM comparisons, EDGE features, Routing Area updates
- Role of GSNs, Modulation Coding Schemes, Packet Handling

- EDGE link control function, additional EDGE parameters. CODE DIVISION MULTIPLE ACCESS
- Introduction to IS 95, Spread spectrum, Principle
- Types of Spread Spectrum technology, Privacy, Forward & Reverse Links, Hand off
- CDMA channels, Rake Receiver, CDMA power control, Comparison between GSM and CDMA.

Module 5:- Installation & Commissioning

Lab/OJT I & C of BTS

- Nokia Ultra/Flexi EDGE- Product Overview, Installation Options (Stack, Wall, Pole, Cabinet), System Module, Sector Module, Transport Sub Module, DTRX, Power Modules, Infrastructure Space & Clearance, Site Delivery report, Cabling between the modules.
- ERICSSON 2000/6000
- Alcatel Lucent- Hardware Description
- ZTE- ZXSDR 8800/8900, BBU 8200, RSU 40/60, R8840/60.
- Commissioning Software.

Certificate Level- VII

Module 1- Wireless Communication- 3G/4G

3G/UMTS

- Evolution of 3G, UMTS spectrum, UMTS services & Benefits, Network Architecture, Core Network, UTRAN, User Equipment. WCDMA
- GSM vs. CDMA vs. WCDMA, WCDMA Wireless Principle- Spreading Technology, OVSF codes, Scrambling codes
- Cell Search procedure, Channel Coding, Convolution & Turbo coding, Interleaving
- WCDMA channels Physical, Logical & control channel • WCDMA key Technologies- Power control, Handover control, Admission Control, Load Control
- Code Resource Allocation, Rake Receiver
- 3G coverage & capacity planning, 3G TEMS Drive test, 3G Link Budget.

HSDPA

- HSDPA Theory, Channels used in HSDPA, Key Technology-AMC & HARQ, Quick Scheduling, HSDPA Road Map, HSUPA, HSPA.LTE
- LTE Architecture, Message flow, Channels & protocols
- WiMAX.

Module 2- Installation & Commissioning(NodeB & eNodeB)

Lab Work

I & C- Node B Nokia Siemens Network

- Product Overview- FMFA, FSM D, FSES, FSIA, FPKA
- System Module, Transmission Module, Triple RF Module, Cabling between Modules
- Radio Remote Head Installation, BTS Installation concept- Outdoor/Indoor ZTE Node B
- BBU installation
- RRU installation
- OVP- ILP/OLP NSN eNodeB- Multi Radio
- Migration to Multi Radio
- ESMB/ESMC, FRGP Commissioning of ZTE Node B & Nokia Siemens Multi Radio

Module 3- Operation & Maintenance

Site Maintenance

- Maintenance of the active & passive infrastructure, Tower maintenance activity, Preventive & Corrective maintenance. Operation & Maintenance
- Introduction & Need of O&M, Operation of Network, Operation Activities, Maintenance, Classification of Faults, Faults recognition, Faults information, Faults Isolation, Faults Localization, Concept of NMC & OMC, O & M philosophy, Fault management. Concept of TNM,KLM mapping

Module 4- On Site Training

On Site Training for 200 hrs with focus on hardware Installation & Commissioning

Module 5- Drive Test 2G/3G

DRIVE TEST- 2G

- Set up of DT, Objective of DT, KPI data, Extraction of Relevant Information
- Cell Edge Probability, Cell Area Probability, Rx Quality Measurement, Neighbor Cell Details, Layer 2 & 3 messages
- DT Applications, Operating Windows, Optimization, TEMS Working, TEMS Parameter 2G, Log File Analysis.

Drive Test-3G

- TEMS Windows and their functioning, Parameters, Testing Scenarios
- Antenna Tilting and its effects, Effect of Parameter Change on network quality
- Optimization, KPI, Actions for various Problems.