Syllabus for Limited Internal Competitive Examination (LICE) for Promotion of Assistant Manager (Telecom) (E 2) to Deputy Manager (Telecom) (E 3)

PAPER 2- ADVANCED TECHNICAL PAPER (SPECIAL)
MAXIMUM MARKS – 100

(A candidate can select any one of the four subjects i.e. A, B, C, D)

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6. Data System
7. Miscellaneous

C. MOBILE COMMUNICATION SYSTEMS

1. Mobile Concept
2. Mobile Technology
3. Mobile Services
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D. COMPUTERS, COMPUTER NETWORKS, INTERNET & BROADBAND, APPLICATION PACKAGES AND WEB BASED SERVICES

1. Computer Fundamentals
2. Data Communication
3. Broadband and Data Services
4. Database Management
5. Software Applications & Web technologies
6. Miscellaneous

A. DIGITAL SWITCHING:

Section 1 (All questions are compulsory & carry equal marks) **50 Marks**

1. **Intelligent Network & Services:** Basic concepts of IN architecture and functions and role of SSP, SCP, SMP, IP etc, Description of various types of IN services and call flow. Access codes for various IN services.

2. **Signaling Systems:** Various signaling systems being used in the Company for local and trunk network such as E/M, R2 modified, CCS#7. Salient features and concepts of CCS#7 signaling including signaling point (SP), Signal Transfer Point (STP), Layered Structure with reference to OSI layer architecture, Description of MTP, ISUP, SCCP and TCAP3, Application of No 7 signaling in PSTN, ISDN, IN and mobile telephony; V5.2 interface for connecting different RSUs to the main exchanges.

3. **ISDN:** Overview of OSI layer, ISDN introduction and services, Customer Premises equipment, ISDN implementation strategies etc.

4. **Long Distance Switching:** Overview of national switching, numbering, charging, routing, transmission and signaling, synchronization plans etc.

5. **Battery & Power Plant:** Maintenance of Exchange Battery, Power Plant and Inverters, EA Sets, Fire Protection Systems, Air-conditioning Units, Earthing of Telecom Systems, Trunk IVRS etc.

6. **New Technologies:** NGN etc.

7. **Battery & Power Plant**

Section 2 (Attempt any one of the questions) **50 Marks**

1. **EWSD Switching System:** Overview of system architecture, Description of various functional units like DLU, LTG, SN, CP, MB, CCG, SYP, CCNC, Call Set up Procedure, CCS#7, EWSD operations, Maintenance, Emergency concepts etc. Application Program System (APS), Man-machine Communication, System Administration, Subs Administration, ISDN Administration,, V5.2 Routing, Charging, including IACHASTA, Traffic Administration, Network Administration, Physical Installation, APS Loading, commissioning, A/T, planning, Dimensioning, Documentation, Line& Trunk Testing, Concept of Telecom Assistance Centre, Charge Band Concept in CCS#7, Patch Implementation Procedure.

2. **5ESS (AT&T)-2000 Switching System:** Basic characteristics & functions of 5ESS switch, Description of SM, SM2000, CM & AM, RSM, Access Interface Unit (AIU), Call Set up procedures, Implementation of CCS#7 and ISDN in 5ESS, Routine Maintenance. Documentation Structure and use of Master Control Centre, Subscriber and PBX Data, Man-machine Interface, Reports and Alarm handling, Trunk and Line Maintenance, Routine Maintenance, System back-up, ODD recent change for trunks and line, 5ESS-2000 database, Analysis of system reports, initialization and recovery, Traffic measurement Reports, Installation and Commissioning Activities, Testing methods, A/T procedures.

3. **OCB-283 Switching System:** OCB-283 system overview, Description of various units like SMC, SMA, SMT, STS, SMX, SMM, token ring & CSN, Call set-up procedures, O&M, CCS#7, OCB-283 system software, operations, Man-machine commands, System administration, Subscriber Administration, Routing Administration, Charging & Billing Administration, Traffic Management, Network management, Planning & Dimensioning issues, Physical Installation, Commissioning activities, A/T procedures, maintenance procedures, patch implementation methods.

4. **AXE10 (Ericsson) Switching System:** System overview, Description of various subsystem viz. Central Processor Subsystem (CPS), Regional Processor Subsystem (RPS), Input-Output Group (IOG-11B), Subscriber Switching System (SSS), Group Switching Subsystem (GSS), Trunk & Signaling Subsystem (TSS), Common Channel Signaling Subsystem (CCS), SUS, TCS, CHS & OMS, Call handling, System Maintenance Philosophy, Software Organization, Documentation, I/O handling, Planning & Dimensioning, Installation, Testing, Construction Practice, Management of Exchange Data related to hundred groups, A-number & B-number analysis, routes, routing, charging, destination codes, installation test of GSS, SSS, TSS, CCS, RPS/EMS, Start up & test of IOG-11 B, Start up and test of APZ 212, Initial loading of APZ, User authority Management (Password management), Connection of ATS, Management of announcements, Operational

quality measurement, A/T Procedures, Use of testers, Subscriber Management, Maintenance of subscriber lines, trunks, hardware of SSS, GSS, RPS/EMS, IOG-11B & CPS, handling of detailed billing data, call meters, System re-starter, reload & back-up, Command & transaction logs, Traffic & Service measurements.

5. FETEX 150 (NEC) Switching System:

B. TRANSMISSION:

1. Optical Fiber Communication: **10 Marks**

Basic concepts of Optical communication, OF cable Characteristic & Design features (96 fiber cables) like Mono-mode and Multimode fibers, Cable construction, Repeater spacing with reference to typical loss Budget calculations, Survey & Cable Laying Procedure, Route Index Diagram, & factors governing their selection for use. Dispersion, Attenuation, Fault localization, Tests and testing instruments, functioning of testing/measuring instruments like OTDR, DTA, OCFL, Precision Power Meter etc, use of optical sources like LEDs lasers; optical decoders like pin diode & avalanche photo diodes; detectors; Requirements of various tools & apparatus like splicing machine, pulling machine & winch.PDH & SDH concept.

2. Optical Fiber Access Network System: **20 Marks**

GPON, FTTH, NOC, DLC, Fiber Distribution, Subscribers end equipment, Types of Faults and restoration:cable, OFSY.

3. Optical Fiber Transmission Network and System: **20 Marks**

SDH (STM-1/4/16 systems), SDH Multiplexing, Techniques, SDH Network Elements, & Topology, Network Survivability, SDH Measurements, faults, alarms, through NMS, LCT, Element Manager, Synchronization of SDH Networks & measurement of Synchronization, basic concepts and advantages of DWDM Systems, components like laser detector, transponders & optical amplifiers, DWDM testing, optical analyzer, A/T of OF Systems.

4. Microwave & UHF (Digital Radio Relay System): **10 Marks**

System design objectives, CCITT & CCIR standards, Planning & designing of multi-channel microwave system,, Choice of antennae, wave guide, ducting, fading, fade margin, path loss, multiple fading, Microwave devices, traveling wave tube (WT), Klystron, Semiconductor devices, engineering order wire supervisory, protection switching & remote controls, measurement of power & frequency, noise figure, group delay, Noise power ratio measurement, standing waves ratio measurement, amplitude & frequency response, Equalizers, Microwave site survey & selection, Tower height calculation, Critical Tower Height & Block Schematic of high capacity Microwave system, SACFA clearance, A/T of 6 Ghz & 2 Ghzsystems. Knowledge of Frequency band, capacities of Digital UHF systems, Hop distance.

Frequency Planning and coordination in selecting a digital radio bearer for the route; various types of modulation techniques for different capacity system; brief description & working of the modems; 34 & 140 Mbt/sec radio system including re-generators & functions of various units;

Factors determining the reliability of digital Radio System; Block schematic of a 120 channel digital UHF trans-receiver & functions of various units; Hierarchical digital multiplexing equipment (2, 8, 34, 140 Mbt/sec) & their4 working with the help of a block diagram; Measuring instruments & their applications.

5. Satellite: **10 Marks**

Overview of Satellite Communication, History & Evolution, Frequency bands used for Satellite Communication, C & Ku Bands, Geostationary Satellites & Satellite orbits, G/T Ratio, Antenna Characteristics, VSATs, IDRs, & DCME Data Rates. INSAT Satellite Systems-purpose & evolution, Space Segment, Altitude & orbit control, Earth Station Configuration & parameters, LNA & HPA – types & characteristics, Inter-modulation products & back off, relative comparison of SSPA & TWT power amplifier, elements of satellite link engineering, C/N & BER Bandwidth & power considerations, need for VSAT Communication, VSAT applications, MCPC, VSAT, HVNET, intermediate Data Rate & Digital Circuit Multiplexing Equipment.

6. Data System: **20 Marks**

Computer basics, Client Server architecture, Local Area Networking, Wide Area Networking, Internetworking, Router, Frame relay, I net and asynchronous Transfer Mode (ATM) etc. Circuit switching/Packet switching; Leased Lines & their management; Effect of internet on normal switching such as congestion, holding time, tariff, VoIP, Fax over Internet etc; HVNET, RABMN.

7. Miscellaneous: **10 Marks**

Knowledge on Earthing of Telecom systems, maintenance of Battery & Power plants, Fire protection Systems – types, use and maintenance schedule, basic maintenance of EA sets, air-conditioning units, PCM Principles and digital transmission concepts.

C. Mobile Communication & Systems:

1. Mobile Concept : **15 Marks**

Overview of GSM Architecture, Brief History of development of Mobile Communication, Description of GSM Architecture, Functions of various Network elements of GSM like BTS, BSC, MSC, VLR, HLR and OMC etc. Role of IMSL, TMEI, MSRN. GPRS/EDGE/IMT-2000: Brief description of GPRS Architecture & its Network Elements; Key features & objectives of IMT-2000; Migration Path from 2G to 3G, GSM to WCDMA, Future trends in Mobile Communication.

2. Mobile Technology: **30 Marks**

GSM Technology:(one of the following technologies: Nokia, Ericsson, Motorola, Alcatel, Nortel) Functionalities, Interconnection & Configuration of MSC, BSC, BTS, Abis & A link dimensioning, Engineering, Planning & Traffic Measurements, GSM Signaling Model, Um

Interface, Abis Interface, A Interface, Location Update, Handover, description of NSS measurement & statistics.

Security Features of GSM: Knowledge of Security arrangements in GSM Communication, Functions of A3, A5, A8 Algorithm, Kl, Ke keys, Authentication & Ciphering functions of GSM.

RF Channel Management: Conception of Cell layout & frequency planning, bands & specifications for GSM-900 system, Multiple Access Methods -FDMA, TDMA, Description of Air Interface like logical channels and traffic channels, Basic steps in Call Set up like connection request, IMSI attach and IMSI detach; Functions of Handovers & frequency Hopping during conversation.

CDMA Technology: Cellular Concepts: Multiple Access Techniques, Duplexing Method, frequency band used in CDMA, Channel List.

Spread Spectrum Communication: Its types; DSSS as used in CDMA cellular systems; codes used in CDMA & their functions, PN offset; Power control, SoR hand off, System Capacity, rake Receivers, Multi-path Advantage; Processing Gain & Spreading rates.

System Architecture: IS-95 A & CDMA 2000 1x standards & their features; system architecture, Network elements – BTS, BSC, MSC, HHTs & FWTs, PCF Functionality; elements of Packet Switch core network – PDSN, AAA server etc.

RF Channel Architecture: IS 95-A, Channel coding & Spreading rates; Modulation methods, functions of each channel, Call flow, HHT & FWT programming parameters, SID, NID, Channel number etc.

RF Planning: CDMA RF planning basics, various planning parameters – Eb/No, Ec/it FER, Frequency reuse factor, Sectorization gain, Voice activity factors, cell loading factor, cell breathing, cell capacity & coverage aspects, BTS coverage tests-VSWR Test, RF power measurement & spectrum Analyzers, A/T & billing.

Variants of CDMA:CDMA 2000 1xEVDo, WCDMA–features; CDMA-GSM comparison.

3. Mobile services: **15 Marks**

GSM Services: Description of GSM Services like Bearer services, Tele Services, Supplementary services, SMS, VAS like Mobile Messaging, Mobile internet, Mobile IN Services, configuration of Mobile Handset for use of VAS & GPRS & EDGE features.

4. Mobile Billing: **15 Marks**

GSM Billing Concept: Billing concept in GSM network for Pre-paid & post-paid systems; Role of Mediation of CDRs in Billing System; various services in Billing System; Activation of services & facilities in Subs. Mobile.

5. Miscellanous: **25 Marks**

Knowledge on Earthing of Telecom systems, maintenance of Battery & Power plants, Fire protection Systems – types, use and maintenance schedule, basic maintenance of EA sets, air-conditioning units.

D. COMPUTERS, COMPUTER NETWORKS, INTERNET & BROADBAND, APPLICATION PACKAGES AND WEB BASED SERVICES

1. Computer Fundamentals: **10 Marks**

Fundamentals of Personal computers, use of Windows Operating Systems, & introduction to software packages like MS Word, MS Excel, MS Power Point. Use of Internet for office work like e-mail, web browsing, etc. The features of Linux Operating System, Linux File System, Basic & advanced Commands, Graphical User Interface (KDE & GNOME), Open Office etc. Client Server architecture, Local Area Networking, Wide Area Networking, Internetworking, Router, Frame relay, I net and asynchronous Transfer Mode (ATM) etc.

2. Data Communication **40 Marks**

Internet Protocols, Network Components and Architecture, OSI Model & TCP/IP Model, Physical Layer Standards – V.35, V.24, G703, HSSI etc., Data Link Layer Protocols (DLC, HDLC, PPP etc.; PAP, CHAP, LANs & VLANs; Ethernet, Fast- Ethernet, & Gigabit Ethernet standards; CSMA-CD & switched Ethernet networks; Collision Domain & Broadcast Domain; Switched Ethernet Backbones).

Network Layer Protocols (IP, ARP, RARP, ICMP, IGMP, IP Addressing, VLSM, CIDR-Routers & routed networks, IP Routing Principles, Static Routings, Default routing & Dynamic routing; Dynamic Routing Protocols-RIP, OSPF, BGP etc.), Transport Layer Protocols: TCP, UDP, IP Addressing and Sub-netting, Network Operating System, Active Directory, DHCP, DNS, Client Configuration & User/Group Creation, Sharing of network Resources, Disk Quota, WLAN, Proxy server, Firewall; Network security issues, various types of attacks & their counter measures, various security products like Firewall, antivirus software, IDS, vulnerability assessment & Penetration testing.

MPLS: MPLS; Label Distribution Protocol (LDP), QoS in MPLS Networks, Traffic Engineering in MPLS Network, RSVP MPLS Based VPNs: Virtual Private networks (VPNs), MPLS based layer 3 VPNs, MPLS based layer 2 VPNs.

3. Broadband and Data Services: **10 Marks**

XDSL, DSLAM & ADSL Modems, BRAS, Tier 1 & Tier 2 switch, DMT Modulation technique, PPPoE, WiFi & WiMAX, VoIP, IPTV.

4. Database Management **20 Marks**

RDBMS Concepts, SQL, SQL Plus and PL/SQL. Oracle architectural components, managing an Oracle Instance, Creating a database Data Dictionary Contents & usage, maintaining the control file, Redo log files, managing Table-spaces & Data Files, Storage structure & relationships, Managing Undo data, managing tables, managing Indexes, maintaining Data integrity, Managing Password Security & resources, managing Users, privileges, Roles, Oracle recovery Manager.

5. Software Applications & Web Technologies: **10 Marks**

Familiarization with various Company applications like CSMS, FMS, HRIS etc. Creation of Static Web Page which includes designing and developing of Static Web Pages using HTML coding and FrontPage; Image processing tools such as Adobe Photoshop: Web site Designing containing Dynamic Web Pages; Active Server Pages (ASP); VB script, Java script, connectivity of the front end web applications (ASP & Java script) with the back end database applications; Hosting of Websites.

6. Miscellaneous: **10 Marks**

Knowledge on Earthing of Telecom systems, maintenance of Battery & Power plants, Fire protection Systems – types, use and maintenance schedule, basic maintenance of EA sets, air-conditioning units.