Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

Telecom Sector Skill Council

Participant Handbook

Sector
Telecom-Tower Technician

Sub-Sector
Passive Infrastucture

Occupation
Operation & Maintenance

Reference ID: **TEL/Q4100, Version 1.0**
NSQF Level 4

Telecom-Tower Technician

Takshila Learning Pvt. Ltd.

141D, Block AC, Shalimar Bagh

New Delhi - 110088

Email:info@takshilalearning.com

Website: www.takshilalearning.com

All Rights Reserved,

First Edition, March 2016

ISBN 978-1-111-22222-45-7

Printed in India at

Takshila Learning

New Delhi - 110088

Copyright © 2016

Telecom Sector Skill Council

Sector Skill Council Contact Details:

2nd Floor, Plot No:- 105,Sector 44 Rd,

Sector 44, Kanahi,

Haryana - 122003

Email: tssc@tsscindia.com

Phone: +91-124 4148029/+91-124 4375891

Disclaimer

The information contained herein has been obtained from sources reliable to Telecom Sector Skill Council(TSSC). TSSC disclaims all warranties to the accuracy, completeness or adequacy of such information. TSSC shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgments in future editions of the book. No entity in TSSC shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the TSSC.

> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

TELECOM SECTOR SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Tower Technician'
QP No. '**TEL/Q4100 NSQF Level 4**'

Date of Issuance: **May 15th, 2016**

Valid up to*: **May 15th , 2018**

**Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)*

Authorised Signatory
(Telecom Sector Skill Council)

Acknowledgements

Telecom Sector Skill Council would like to express its gratitude to all the individuals and institutions who contributed in different ways towards the preparation of this "Participant Manual". Without their contribution it could not have been completed. Special thanks are extended to those who collaborated in the preparation of its different modules. Sincere appreciation is also extended to all who provided peer review for these modules.

The preparation of this manual would not have been possible without the Telecom Industry's support. Industry feedback has been extremely encouraging from inception to conclusion and it is with their input that we have tried to bridge the skill gaps existing today in the Industry.

This participant manual is dedicated to the aspiring youth who desire to achieve special skills which will be a lifelong asset for their future endeavors.

About this book

In the last five years, the growth of the Indian telecommunications sector has outpaced the overall economic growth. This sector is poised for strong growth of about 15 percent in short term during 2013–17, driven by growth in organised retail, technological advancements, changing consumer preferences and government support. With over 1000 million subscribers, India is the second largest telecom market in the world.

The sector currently employs over 2.08 million employees and is slated to employ more than 4.16 million employees by 2022. This implies additional creation of ~2.1 million jobs in the nine-year period.

This Participant book is designed to impart theoretical and practical skill training to students for becoming a Tower Technician. Tower Technician in the Telecom industry is also known as Site Engineer/Tower Engineer/Site Technician.

Individuals at this job needs maintain site live 24x7, maintain and repair level-1 faults/issues at telecom tower site, level-1 preventive and corrective maintenance and report faults to the supervisor in time. Individual also needs to travel inter-state and work during odd hours, when required.

This Trainee Manual is based on Tower Technician Qualification Pack (TEL/Q4100) & includes the following National Occupational Standards (NOSs)

1. Site Hygiene
2. Preventive Maintenance
3. Site Management
4. Task reporting
5. Corrective Maintenance

The Key Learning Outcomes and the skills gained by the participant are defined in their respective units.

Post this training, the participant will be able to keep sites live 24x7 through site maintenance.

We hope that this Trainee Manual will provide a sound learning support to our young friends to build an attractive career in the telecom industry.

Symbols Used

Key Learning Outcomes

Steps

Practical

Notes

Unit Objectives

Exercise

Table of Contents

S.No	Modules and Units	Page No
1.	**Introduction**	**1**
	Unit 1.1 - Introduction to Telecom Industry	3
	Unit 1.2 - Types of Communication	6
	Unit 1.3 - Types of Cellular Network	9
	Unit 1.4 - Components of a Cellular Network	10
	Unit 1.5 - Tower Infrastructure Industry	11
2.	**Site Hygiene (TEL/N4100)**	**14**
	Unit 2.1 - Introduction to Components at a Tower Site	16
	Unit 2.2 - Tower	18
	Unit 2.3 - Telecom Shelter Unit	25
	Unit 2.4 - PIU- Power Interface Unit	34
	Unit 2.5 - Battery Bank	43
	Unit 2.6 - Power Plant/ Rectifier Unit	57
	Unit 2.7 - Air Conditioning	62
	Unit 2.8 - Fire Extinguisher and Smoke Detectors	64
	Unit 2.9 - EB Supply	66
	Unit 2.10 - Earthing	68
	Unit 2.11 - Aviation Lamp	75
	Unit 2.12 - Diesel Generator	78
	Unit 2.13 - Guidelines for First-Aid Facilities	95
3.	**Preventive and Corrective Maintenance (TEL/N4101 & TEL/N4104)**	**97**
	Unit 3.1 - Guidelines for Maintenance Activities	99
	Unit 3.2 - Routine Preventive Maintenance	103
	Unit 3.3 - Maintenance of Batteries	108
	Unit 3.4 - Maintenance of Diesel Generator	117
	Unit 3.5 - Maintenance of Tower & Shelter	133
	Unit 3.6 - Maintenance Schedule of AC Plant	134
	Unit 3.7 - Maintenance Schedule for AMF/PIU	136
	Unit 3.8 - Maintenance Schedule for Power Plant	139

Table of Contents

S.No	Modules and Units	Page No
4.	**Site Management (TEL/N4102)**	**142**
	Unit 4.1 - Site Management Activities	144
	Unit 4.2 - Waste Management at Site	155
	Unit 4.3 - Operation of Equipment at Site	157
	Unit 4.4 - Fault Management System	159
	Unit 4.5 - Escalation Procedure for Fire Accident	161
5.	**Task Reporting (TEL/N4103)**	**170**
	Unit 5.1 - Tower Site Audit Check List	172
	Unit 5.2 - Tower Site Maintenance Check List	174
	Unit 5.3 - Alarm Management Reporting	176
	Unit 5.4 - Preventive Maintenance Reporting	177
	Unit 5.5 - Acceptance Testing Report	179
	Unit 5.6 - Fuel and Energy Management Report	182
	Unit 5.7 - Outage Analysis Report	183
	Unit 5.8 - Outage Management Reporting	184
	Unit 5.9 - Site Equipment Database Reporting	189
	Unit 5.10 - Battery Testing Reports	191
6.	**Employability & Entrepreneurship Skills**	**197**
	Unit 6.1 – Personal Strengths & Value Systems	201
	Unit 6.2 – Digital Literacy: A Recap	220
	Unit 6.3 – Money Matters	226
	Unit 6.4 – Preparing for Employment & Self Employment	237
	Unit 6.5 – Understanding Entrepreneurship	246
	Unit 6.6 – Preparing to be an Entrepreneur	268

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

Telecom
Sector
Skill
Council

1. Introduction

Unit 1.1 - Introduction to the Course

Unit 1.2 - Types of Communication

Unit 1.3 - Types of Cellular Network

Unit 1.4 - Components of a Cellular Network

Unit 1.5 - Tower Infrastructure Industry

Key Learning Outcomes

At the end of this module, you will be able to:

1. Discuss about the telecom sector.
2. Understand about different types of Cellular networks.
3. Identify various companies in Tower Infra industry and develop understanding about them.
4. Know about various organization in telecom industry.
5. Get knowledge of Companies in Tower Infra Industry.

UNIT 1.1: Introduction to Telecom Industry

Unit Objectives

At the end of this unit, you will be able to:

1. Get an overview of the Telecom Industry.
2. Identify various telecom operators in India and internationally..
3. Develop an understanding about Telecom product companies and Telecom solution providers.

1.1.1 Telecom Industry at a Glance

India, the second largest telecom market of the world by subscriber base after China, witnessed phenomenal growth in mobile connectivity and penetration during the last few decades(Refer to Fig. 1.1.1). This growth was mainly in voice connectivity. A similar growth in broadband penetration and data connectivity is envisaged in the coming years. In order to support this growth in number of users and also support their data needs, technology has moved from 2G to 3G to 4G and will go to 5G in years to come. As these technologies are changing they are putting up a huge requirement for active (equipment and electronics) and passive infrastructure (cables and towers) at switching center and at telecom tower sites across the country. In order to support and manage this requirement a large pool of trained manpower is needed in the coming years at all telecom service providers.

Internationally also scenario is similar as telecom operators and service providers worldwide have to match the speed of growth of voice and data traffic across their networks and for the same they are in constant need of trained engineers and technicians.

This course is intended to provide a thorough training to students who want to take tower technician as their profession.

Who should take this course?

This Course should be taken by

a. New entrants who are interested in making a career in Telecom Industry.

b. Existing members of telecom industry who want to get enhanced training for career growth.

Fig. 1.1.1 Telecom Services in Operation

1.1.2 Indian Telecom Operators

Telecom Operators are the companies who have taken licence from the govt. to provide telecommunication services to users. They own all the elements necessary (Radio spectrum, wireless network infrastructure, back haul network, a billing solution, customer care, marketing and repair organization) to sell and deliver communications services to end users. They are also called mobile network operator, wireless service provider, wireless carrier, cellular company or mobile network carrier. There are usually multiple Telecom operators in a country to ensure competition and better quality of service to users. Examples of some Indian telecom operators and international telecom operators are provided for your reference(Refer to Fig. 1.1.2).

Fig. 1.1.2 Major Telecom operators of India

1.1.3 International Telecom Operators

Telecom operators which are present in the countries out of India are known as international telecom operators. Many of these have operation in multiple countries. Few of these international operators are given below (Refer to Fig. 1.1.3).

Fig. 1.1.3 Key International Telecom Operators

1.1.4 Telecom Product Companies

Telecom product Companies and Telecom Solution Providers are organizations who work towards building technologies, products and solutions needed for deploying the wireless/wireline networks, back haul networks and other connectivity/IT solutions used for a proper operation of a Telecom service provider. There are many companies world wide who specialize in a particular field of technology needed by these telecom operators. These are called Telecom Products companies and they sell their products directly to telecom operators as product companies or through bigger companies These bigger companies are called Telecom solution providers and they put together multiple products as an overall solution for Telecom operators put together multiple products as an overall solution and are called Telecom Solution Providers. Some major Indian and Global telecom product companies and solution providers are referred below (Refer to Fig. 1.1.4).

Fig. 1.1.4 Telecom product Companies and Telecom Solution Providers

UNIT 1.2: Types of Communication

Unit Objectives

At the end of this unit, you will be able to:

1. Clearly understand the definition of Tele communication.
2. Differentiate between wireless and wire line communications.

What is Telecommunication?

Tele communication is exchange of information between individuals at a distance, using electronic products over a medium which could be wired (landline communication) or wireless (Cellular or Mobile communication). A complete telecommunication arrangement is made up of two or more stations equipped with transmitter and receiver devices communicating over a medium.

Below shows communications between various individuals. Both users have a handset which is a receiving and transmitting device. This handset can be of a land line network or of a Mobile Network. Communicating medium could be wires or open air depending on the telecom operator user 1 and user 2 have selected (Refer to Fig. 1.2.1 & 1.2.2) .

Fig 1.2.1 Caller making a Tele call

Fig 1.2.2 Receiver receiving a Tele call

1.2.1 Wired/Landline Communication

In Wired/ Landline communication the information is shared between individuals using a physical cable which could be a copper cable or a Fibre optic Cable. The communication between users passes through a telephone exchange which routes the call to the destination user. As per a recent survey there are 1.3 billion land line users world wide, but many user are shifting to wireless/Mobile communication. Picture below shows a land line caller calling through a wire line network to the receiver he wants to talk to.

In the Fig. 1.2.3 a land line user picks up her handset dials the number of her friend. Call goes through the wire line network (Refer to Fig. 1.2.4) and reaches her friend (Refer to Fig. 1.2.5). Her friend picks up phone and they start talking.

Fig 1.2.3 Caller with Handset

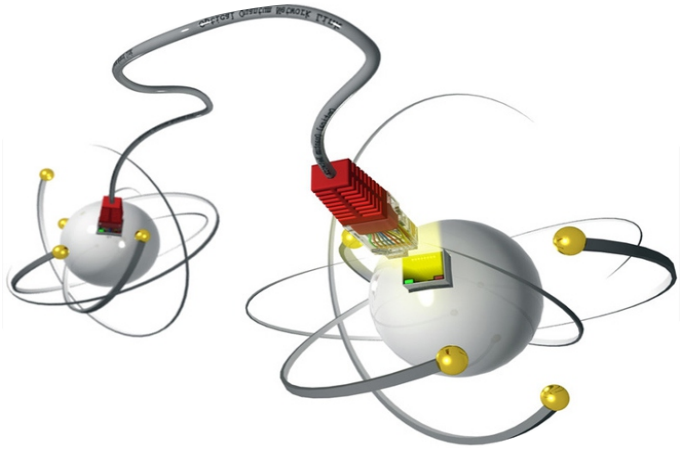


Fig 1.2.4 Wire-line Telecom Network

Fig 1.2.5 Receiver with Handset

1.2.2 Wireless/ Cellular/ Mobile Communication

In Wireless/ Cellular/ Mobile Communication information is shared between individuals using airwaves as shown in the picture below. While there are many wireless technologies like Radio, free space optics, Wi-fi, blue-tooth etc. but for mobile communication between individuals there are predominantly two technologies being used, which are GSM and CDMA. In both GSM & CDMA signals goes to a mobile tower and from mobile tower they reaches the mobile switching center to be directed to the cell tower where the recipient user is stationed. As per estimates there are around 5 billion mobile users in the world. The picture below shows the call flow between two users. User 1 (Refer to Fig 1.2.6) is calling mobile User 2 (Refer to Fig 1.2.10) through her mobile Handset. Her call is taken by airwaves which are using CDMA/GSM technology to a nearest cellular tower (Refer to Fig 1.2.7) . From the cellular tower a back haul network of mobile operator carry this call to mobile switching center (Refer to Fig 1.2.8) . Mobile Switching Center will find the location of user 2 based on her mobile number. After finding the location of User 2, mobile Switching Center will forward the call to a cell tower nearest to the location (Refer to Fig 1.2.9) of mobile User 2 on the back haul network of the telecom operator. From the Cell tower the communication is passed on to Mobile User 2 over air waves. Mobile User 2 gets a ringing tone on her handset.

Fig.1.2.6 Mobile user 1 with Handset

Fig. 1.2.7 Cell Tower

Fig. 1.2.8 Mobile Switching Centre

Fig. 1.2.9 Cell Tower

Fig. 1.2.10 Mobile User 2 with Handset

UNIT 1.3: Types of Cellular Networks

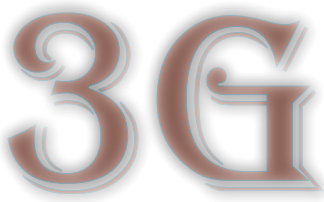
Unit Objectives

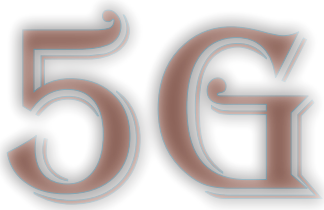
At the end of this unit, you will be able to:

1. Know about CDMA and GSM Networks.
2. Differentiate between 2G,3G,4G and 5G networks.
3. Understand the advantages of new technology network over previous ones.

Types of Cellular Networks

In Wireless/ Cellular/ Mobile Communication information is shared between individuals using airwaves using any of the following technology. As discussed earlier these airwaves used two technologies which are CDMA and GSM. CDMA and GSM networks can be of the following types. We can see as we are moving from 2G to 5G network both CDMA and GSM technologies are converging into one.





1.4 Components of a Cellular Network

A Cellular Network is a network where the last link is always wireless. The network is distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station. This Network consists of the following components:

Mobile Station (MS) – A Mobile Station is a mobile/Wireless Device used for communication by a user. Example: Mobile Phone with a Sim Card. This is explained in pictures shown earlier.

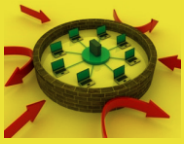
Base Station (BS) - A Base Station is a fixed station in a mobile cellular Network used for radio communication with mobile Stations (MS). They consist of radio channels, transmitter/ receiver antenna mounted on a tower. A cell Tower with antennas is example of a Base station.

Gateway: The gateway is the communication links between two wireless systems or between wireless and wired systems. There are two components inside a Gateway:

a. Mobile Switching Centre (MSC) – Connects BS and MS from one location to BS a MS at a distant place.

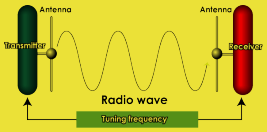
b. Inter working function (IWF) – Connects BS and MS to Internet for data connectivity

Databases: Databases are used to keep track of billing, Caller Location and Subscriber information. A shown in Fig 1.2.6 to 1.2.10 earlier mobile swiching center finds the location of User 2 based on her mobile number. This location information is kept in the databases as discussed here.



Security Mechanism : To authenticate user to get into the cellular network. This is needed to prevent Users who have not bought services from the mobile operator to get into the network and use the services.

Radio Wave Standards : Defines the type Radio communication waves used to connects users to each other. This is explained in detail in unit 1.3.



1.5 Tower Infrastructure Industry

Telecom towers or cell towers are the integral part of the telecom network infrastructure and telecom industry. In fact they are the most expensive to build and the valuations are heavy. The cost and business of towers has outgrown itself as compared to the overall business of a telecom operator. This has resulted in most of the companies having off the tower business as an independent business entity. These independent tower companies forms the tower infrastructure industry.

Tower Infrastructure industry is showing explosive growth and exponential investments are involved. As it requires a lot of investment to grow, companies are also getting merged and acquired to be more profitable, for example Indus Towers a joint venture of Vodafone, Bharti, Airtel and IDEA with the given composition.

Indus Towers = Ortus Infratel Holding (Vodafone – 42%) + Bhart Airtel (42%) + IDEA (16%)

American Tower Corp has acquired Xcel Telecom towers for Rs. 700 crore. Quippo telecom has acquired Spice Telecom's tower business and Tata Teleservices has merged into it. BSNL has planned to lease its towers for better revenues. Because of the intense competition and to save cost each tower needs to support more than two telecom operators to stay profitable. This has recently led to a new concept of infrastructure sharing between different companies. Details of some of the tower companies are shown in the table below(Refer to Fig. 1.5.1) which has a list of 12 telecom tower companies of India and the approximate number of towers they have.

Recently American Tower Corporation has bought Viom Networks.

S. NO.	COMPANY	Approx no. of towers (As per March 15)
1.	Indus	119800
2.	Reliance Infratel	43000
3.	Bharti Infratel	38000
4.	Viom Networks	38000
5.	GTL	28000
6.	Essar Telecom	30000
7.	American Tower Corp	13000
8.	Tower Vision	3200
9.	Aster Infrastructure	1000
10.	India Telecom Infra Limited	1000
11.	KEC International	400
12.	Independent Mobile Infrastructure	400

Fig. 1.5.1 Telecom Tower Companies of India