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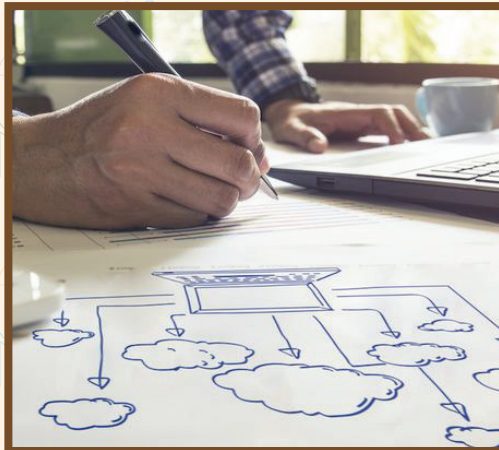


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Facilitator Guide



Sector
Telecom

Sub-Sector
Network Managed Services

Occupation
Project Engineering

Reference ID: TEL/Q6305, Version 2.0
NSQF level 6

**System
Architect – 5G
Cloud RAN**



Shri Narendra Modi
Prime Minister of India

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

Acknowledgements

The Telecom Sector Skill Council (TSSC) would like to thank all the individuals and institutions who contributed in various ways towards the preparation of this facilitator guide. The guide could not have been completed without their active contribution. Special gratitude is extended to those who collaborated during the development of the different modules in the facilitator guide. Wholehearted appreciation is also extended to all who provided peer review for these modules.

The preparation of this guide would not have been possible without the telecom industry's support. Industry feedback has been extremely beneficial since inception to conclusion, and it is with the industry's guidance that we have tried to bridge the existing skill gaps in the industry. This facilitator guide is dedicated to the aspiring youth, who desire to achieve special skills that will be a lifelong asset for their future endeavours.

About this Guide

The facilitator guide (FG) for System Architect - 5G Cloud RAN is primarily designed to facilitate skill development and training of people, who want to become professional System Architect - 5G Cloud RAN in various stores. The facilitator guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) as drafted by the Sector Skill Council (TSSC) and ratified by National Skill Development Corporation (NSDC).

It includes the following National Occupational Standards (NOSs)-

1. TEL/N6316: Prepare for the Delivery of 5G Cloud RAN Project
2. TEL/N6317: Use the appropriate hardware platform and environment for 5G Cloud RAN
3. TEL/N6318: Manage orchestration, automation, and RAN programmability
4. TEL/N9103: Implement Effective Interaction at workplace
5. TEL/N9104: Manage Work, Resources and Safety at workplace
6. DGT/VSQ/N0103: Employability Skills (90 Hours)

Post this training, the participants will be able to perform tasks as professional Assistant Technician (Wireless). We hope that this Facilitator Guide provides a sound learning support to our young friends to build a lucrative career in the Telecom Skill Sector of our country.

Symbols Used



Ask



Explain



Elaborate



Notes



Objectives



Do



Demonstrate



Activity



Team Activity



Facilitation Notes



Practical



Say



Resources



Example



Summary



Role Play




Learning Outcomes

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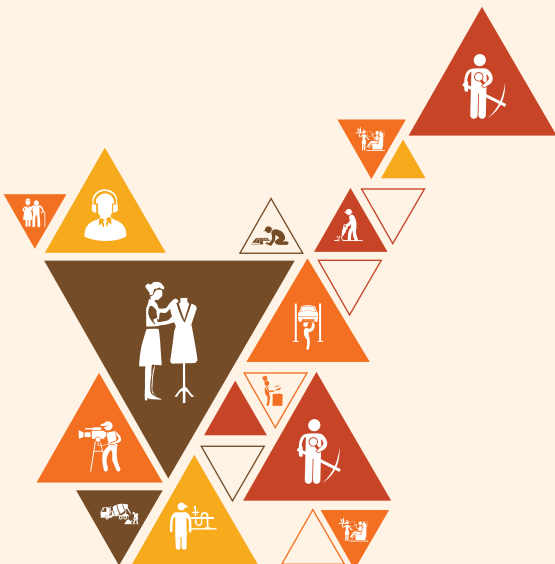
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1. Introduction to the Role of a System Architect – 5G Cloud RAN

Unit 1.1 - Introduction to C-RAN

Unit 1.2 - Understanding the Telecom Industry and System Architect Role



Bridge Module

Key Learning Outcomes



By the end of this module, the participants will be able to:

1. Discuss the role and responsibilities of a System Architect – 5G Cloud RAN.
2. Identify various employment opportunities for a System Architect – 5G Cloud RAN.
3. Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR).
4. Describe the process workflow in the organization and the role of a System Architect – 5G Cloud RAN in the process.
5. List the various daily, weekly, monthly operations/activities that take place at the site under a System Architect – 5G Cloud RAN.

Unit 1.1: Introduction to C-RAN

Unit Objectives

By the end of this unit, the participants will be able to:

1. Understand the concepts of Cloud RAN (C-RAN) in 5G Network Architecture.
2. Discuss the advantages and disadvantages of C-RAN.
3. Describe the use and application of Virtual RAN.
4. Illustrate the importance of C-RAN Architecture.

Resources to be Used

Participant Handbook, Notepad, Pen, Whiteboard, Markers, Presentation Slides, Overhead Projector or Large Screen, Computer/Laptop with Internet Connection

Do

- Introduce yourself and welcome the trainees
- Begin the session with a brief icebreaker or introduction activity to create a positive and interactive learning environment.
- Incorporate live polling using the computer/laptop to gather participants' opinions and insights on C-RAN-related questions. This will encourage active participation.
- Introduce real-world scenarios where C-RAN could make a significant impact. Encourage participants to discuss potential solutions and benefits.
- Have participants explore and analyse case studies or examples of organizations successfully implementing C-RAN. Discuss the outcomes and lessons learned.

Say

- Welcome to the 'Introduction to C-RAN' class. Today, we will delve into the fascinating world of Cloud Radio Access Network (C-RAN) in 5G Network Architecture.
- Get ready to explore the concepts, advantages, and applications of C-RAN as we navigate through this session.
- Let us begin the session by playing a game.

Team Activity



1. **Activity name:** Two Truths and a Lie (Icebreaker)
2. **Type:** Group activity
3. **Objective of the activity:** To help participants introduce themselves to each other in a fun and interactive way and build a positive rapport within the group.
4. **Resources:** None
5. **Time Duration:** 20-30 minutes
6. **Instructions:**
 - Ask each participant to introduce themselves to the group by stating their name and three statements about themselves.
 - Explain to the group that two statements are true and one false.
 - Ask the participants to take turns sharing their statements with the group in any order they choose.
 - After each participant shares their statements, ask the group to guess which statement is the lie.
 - Once the group has made their guess, the participant should reveal the lie and the two true statements.
 - Continue the activity until each participant has shared their statements.
7. **Outcome:** The participants will have the opportunity to get to know each other in a fun and interactive way, which will help to create a positive and welcoming environment for the session. Additionally, the activity will help to build trust and rapport between the participants, which is important for effective group learning and collaboration.

Ask



- Encourage participants to share their understanding of traditional RAN and inquire about any prior knowledge of C-RAN.
- Prompt participants to think about potential advantages and challenges associated with C-RAN.

Elaborate



- Overview of C-RAN in 5G Network Architecture.
- Centralized processing model and distributed radio units.
- Benefits, such as improved efficiency and scalability
- Challenges, including potential latency issues and increased complexity
- Virtual RAN (vRAN) and its role in virtualizing network functions
- How vRAN is applied in modern telecommunications
- Significance of C-RAN in enhancing network performance and flexibility
- Role in enabling future technologies and applications

Activity

1. **Activity Name:** Cloud RAN Simulation
2. **Objective of the Activity:** To simulate the functioning of C-RAN and understand its impact on network efficiency.
3. **Resources:** Whiteboard, Markers, Participants' Handbook.
4. **Time Duration:** 30 minutes
5. **Instructions:**
 - Divide participants into small groups.
 - Assign each group a specific aspect of C-RAN (e.g., centralized processing, virtualization).
 - Ask each group to create a diagram on the whiteboard illustrating their assigned aspect.
 - Groups should present their diagrams, explaining how their assigned aspect contributes to the overall efficiency of the network.
 - Encourage discussions and questions after each presentation.
6. **Outcome:** Enhanced understanding of C-RAN components and their collaborative impact on network architecture.

Notes for Facilitation

- Keep the session interactive and engaging.
- Encourage questions and discussions from the participants.
- Use multimedia tools to deliver the content effectively.
- Connect theoretical concepts to practical examples or industry case studies to reinforce understanding.
- Ensure that each section is covered within the allocated time to maintain a balanced pace and avoid rushing through important topics.

Unit 1.2: Understanding the Telecom Industry and System Architect Role

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the size and scope of the Telecom industry and its sub-sectors.
2. Discuss the role and responsibilities of a System Architect – 5G Cloud RAN.
3. Identify various employment opportunities for a System Architect – 5G Cloud RAN.
4. Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR).
5. Describe the process workflow in the organization and the role of a System Architect – 5G Cloud RAN in the process.
6. Analyse the requirements for the course and prepare for the pre-requisites of the course

Resources to be Used

Participant Handbook, Notepad, Pen, Whiteboard, Markers, Presentation Slides, Overhead Projector or Large Screen, Computer/Laptop with Internet Connection.

Say

- Welcome, everyone! Today, we are diving into the vast world of the Telecom industry and exploring the crucial role of a System Architect in the 5G Cloud RAN context.
- Let's begin our journey into understanding the scope, responsibilities, and opportunities within this dynamic field.

Ask

- Can anyone share their thoughts on what makes the telecom industry essential in today's connected world?
- What do you think might be the key responsibilities of a System Architect in the context of 5G Cloud RAN?
- Have you ever considered a career in the telecom industry? If so, what aspects intrigue you the most

Do

- Begin with a brief overview of the telecom industry's size and sub-sectors. Share statistics and key players to provide a comprehensive understanding.
- Conduct a short role-play scenario to illustrate the day-to-day responsibilities of a System Architect in a 5G Cloud RAN setting. This will enhance engagement and comprehension.
- Guide participants through various employment opportunities available for System Architects in the telecom industry. Discuss potential career paths and growth trajectories.
- Break down the organization's process workflow, emphasizing the role of a System Architect at different stages. This will provide insights into their impact on the overall system.

Elaborate

- Overview of the telecom industry and its sub-sectors.
- Detailed discussion on the responsibilities, skills, and challenges faced by System Architects
- Exploration of various career paths and positions available for System Architects
- Workplace ethics, site management, quality standards, personnel management, and public relations policies
- Analysis of the organization's process workflow with a focus on the contributions of a System Architect.

Activity

- 1. Career Path Mapping**
- 2. Objective of the Activity:** To help participants map potential career paths within the telecom industry, specifically focusing on the role of a System Architect.
- 3. Resources:** Whiteboard, Markers, Participants' Handbook.
- 4. Time Duration:** 40 minutes
- 5. Instructions:**
 - Divide participants into small groups.
 - Provide each group with a large sheet of paper and markers.
 - Ask each group to create a visual representation (diagram or mind map) of potential career paths for a System Architect in the telecom industry.
 - Groups should consider different sectors, levels of responsibility, and growth opportunities.
 - Each group presents their career path map, explaining the rationale behind their choices.
- 6. Outcome:** Enhanced understanding of potential career trajectories within the telecom industry, specifically for System Architects.

Notes for Facilitation

- Emphasize the importance of networking within the industry. Provide tips on building professional connections and staying updated on industry trends.
- Share real-world examples of successful System Architects and their career journeys to inspire participants.
- During discussions on organizational policies, foster a conversation around ethical considerations in decision-making and workplace behaviour.
- Establish a feedback loop throughout the session to gauge participants' understanding and address any questions promptly.
- Direct participants to additional resources for further career development within the telecom industry, such as relevant courses, certifications, or industry events.

Answers to Exercises for PHB

Multiple Choice Questions:

1. b. Designing system architecture
2. b. Telecom service providers
3. b. Equal opportunity and non-discrimination
4. b. During system design and technology evaluation
5. d. Monitoring network performance

Descriptive Questions:

1. Refer to- Unit 1.2: Understanding the Telecom Industry and System Architect Role
Topic-1.2.2 Role and Responsibilities of a System Architect - 5G Cloud RAN
2. Refer to- Unit 1.2: Understanding the Telecom Industry and System Architect Role
Topic-1.2.2 Role and Responsibilities of a System Architect - 5G Cloud RAN
3. Refer to- Unit 1.2: Understanding the Telecom Industry and System Architect Role
1.2.3 Organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR)
4. Refer to- Unit 1.2: Understanding the Telecom Industry and System Architect Role
1.2.2 Role and Responsibilities of a System Architect - 5G Cloud RAN
5. Refer to- Unit 1.1. Introduction to C-RAN
1.1.1 Understanding Cloud RAN (C-RAN) in 5G Network Architecture
6. Refer to- Unit 1.1. Introduction to C-RAN
1.1.2 Advantages and Disadvantages of C-RAN



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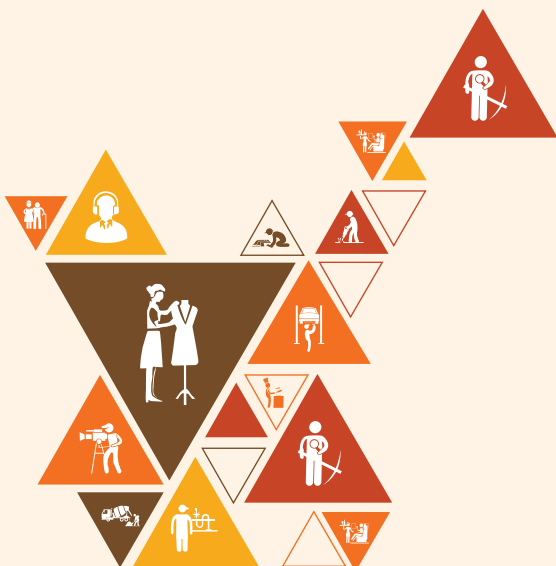
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2. Process of Preparing for the Delivery of 5G Cloud RAN Project

Unit 2.1 - Understanding Client Requirements and Project Preparation

Unit 2.2 - Implementation and Service Quality Assurance



TEL/N6316

Key Learning Outcomes



By the end of this module, the participants will be able to:

1. Describe the process of determining the client's requirements for the delivery of 5G cloud RAN project and identifying the relevant parameters and limitations to its delivery.
2. Describe the process of preparing the estimates for the required resources and getting approval for the project budget.
3. Describe the process of developing appropriate strategies concerning Cloud delivery, DevOps and SDMC automation according to the organisational goals and standards.
4. Describe the process of developing and managing the implementation of appropriate processes for test automation and service quality assurance.
5. Describe the process of preparing documents explaining RAN call flows, and Key Performance Indicator (KPIs) to be used for solution development.
6. Describe the process of preparing the service assurance architecture, and test automation architecture documents.
7. Show how to analyse the vendor products and develop a multi-vendor RAN architecture as per the organisational requirements.
8. Demonstrate how to prepare the service assurance architecture, and test automation architecture documents.

Unit 2.1: Understanding Client Requirements and Project Preparation

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the process of determining the client's requirements for the delivery of a 5G cloud RAN project and identifying the relevant parameters and limitations to its delivery.
2. Explain the importance and process of determining the interworking and compatibility of Cloud RAN with the existing and installed base.
3. Describe the process of developing appropriate strategies concerning Cloud delivery, DevOps, and SDMC automation according to the organizational goals and standards.
4. Explain the importance of assisting the infrastructure and DevOps team members concerning the project objectives and delivery

Resources to be Used

Project documentation templates, case studies of successful 5G Cloud RAN projects, organizational guidelines on Cloud delivery, DevOps, and SDMC automation, relevant industry standards and best practices

Say

- Introduce the importance of understanding client requirements in the context of a 5G Cloud RAN project.
- Emphasize the significance of identifying parameters and limitations to ensure project success.
- Explain the role of interworking and compatibility in the context of existing infrastructure.
- Discuss the relevance of developing strategies aligned with organizational goals and standards.
- Highlight the importance of collaboration between the project team, infrastructure, and DevOps team members.

Ask

- Encourage participants to share any experiences they have had in determining client requirements for complex projects.
- Discuss participants' perspectives on the challenges of ensuring compatibility with existing infrastructure.
- Inquire about strategies they have employed or encountered concerning Cloud delivery, DevOps, and SDMC automation.

Do

- Engage participants in group discussions to brainstorm and share insights on determining client requirements.
- Conduct a case study analysis session where participants evaluate successful 5G Cloud RAN projects.
- Facilitate a workshop on developing project strategies, encouraging participants to align with organizational goals.
- Organize a collaborative session where participants share their experiences in assisting infrastructure and DevOps teams.

Elaborate

- Expand on the importance of clear communication in understanding client requirements and avoiding misunderstandings.
- Elaborate on the challenges of ensuring the interworking and compatibility of Cloud RAN with existing infrastructure.
- Discuss in-depth the components of effective strategies for Cloud delivery, DevOps, and SDMC automation.
- Elaborate on the role of collaboration between different teams in achieving project objectives.

Demonstrate

- Demonstrate the use of project documentation templates for capturing and analysing client requirements.
- Showcase a scenario where the lack of compatibility with existing infrastructure leads to project delays.
- Illustrate the implementation of strategies through a simulated scenario in a Cloud environment.
- Demonstrate effective communication and collaboration techniques between project, infrastructure, and DevOps teams.

Activity

1. Client Requirement Role-Play

2. **Objective:** Apply knowledge of determining client requirements in a simulated project scenario.

3. **Type of activity:** Role-play.

4. **Resources:** Project documentation templates, case studies, and role-play scenarios.

5. **Duration of the activity:** 45 minutes.

6. Instructions:

- Assign roles to participants, including project managers, clients, and team members.
- Provide a client requirement scenario, and participants role-play the interactions and processes involved in understanding and documenting the requirements.

7. **Outcome:** Improved understanding of the challenges and best practices in determining client requirements for a 5G Cloud RAN project.

Notes for Facilitation

- Foster an environment that encourages active participation and open communication.
- Emphasize the practical application of theoretical concepts through case studies and real-world examples.
- Encourage participants to share their perspectives and insights during discussions.
- Monitor group dynamics and facilitate collaborative learning opportunities.
- Summarize key takeaways and relate them to the overall learning objectives at the end of the session.

Unit 2.2: Implementation and Service Quality Assurance

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the process of developing and managing the implementation of appropriate processes for test automation and service quality assurance.
2. Describe the process of preparing documents explaining RAN call flows, and Key Performance Indicator (KPIs) to be used for solution development.
3. Describe the process of preparing the service assurance architecture and test automation architecture documents.
4. Demonstrate how to create the design and framework for Cloud, DevOps, and Software Development Life Cycle (SDLC) automation.
5. Show how to analyse the vendor products and develop a multi-vendor RAN architecture as per the organizational requirements.
6. Demonstrate how to prepare the service assurance architecture and test automation architecture documents.

Resources to be Used

Test automation tools and frameworks, documentation templates for RAN call flows and KPIs, samples of service assurance and test automation architecture documents, cloud, DevOps, and SDLC automation design templates, vendor product analysis materials, multi-vendor RAN architecture guidelines

Say

- Introduce the importance of robust processes for test automation and service quality assurance in the implementation phase.
- Explain the significance of RAN call flows and KPIs in solution development.
- Discuss the essential components and purpose of service assurance and test automation architecture documents.
- Emphasize the need for a well-defined design and framework for Cloud, DevOps, and SDLC automation.
- Highlight the challenges and considerations in analysing vendor products and developing a multi-vendor RAN architecture.

Ask

- Encourage participants to share their experiences with implementing test automation processes and service quality assurance.
- Discuss participants' familiarity with documenting RAN call flows and KPIs for solution development.
- Inquire about participants' experiences in preparing service assurance and test automation architecture documents.
- Ask participants about their understanding of Cloud, DevOps, and SDLC automation design.

Do

- Facilitate hands-on sessions using test automation tools to demonstrate the process of developing and managing test automation processes.
- Guide participants in creating documents explaining RAN call flows and KPIs for solution development.
- Conduct a workshop on preparing service assurance and test automation architecture documents, providing templates for guidance.
- Demonstrate the creation of a design and framework for Cloud, DevOps, and SDLC automation using industry best practices.
- Conduct a practical session on analysing vendor products and developing a multi-vendor RAN architecture.

Elaborate

- Expand on the importance of traceability and repeatability in test automation processes.
- Discuss the key elements to include in documents explaining RAN call flows and KPIs.
- Elaborate on the components of effective service assurance and test automation architecture documents.
- Provide detailed insights into the design principles for Cloud, DevOps, and SDLC automation.
- Discuss the challenges and considerations in analysing vendor products and achieving interoperability in a multi-vendor RAN architecture.

Activity

1. Test Automation Workshop

2. **Objective:** Apply knowledge of test automation processes in a simulated project scenario.

3. **Type of activity:** Hands-on workshop.

4. **Resources:** Test automation tools, sample test scenarios, and documentation templates.

5. **Duration of the activity:** 1 hour.

6. Instructions:

- Guide participants through a practical session using a test automation tool to create and execute automated test scenarios.
- Participants will work on predefined test cases and learn to manage and document the automated testing process.

7. **Outcome:** Improved understanding of implementing test automation processes and the ability to apply these skills in a real-world scenario.

Notes for Facilitation



- Ensure participants have access to necessary tools and templates during hands-on activities.
- Encourage collaboration and knowledge sharing among participants.
- Address any questions or challenges participants may encounter during practical sessions.
- Summarize key takeaways and relate them to the broader context of service quality assurance and implementation.
- Reinforce the practical application of theoretical concepts through real-world examples and case studies.

Answers to Exercises for PHB

Multiple Choice Questions:

1. b. Identifying relevant parameters
2. c. Providing financial control
3. b. Aligning with organizational goals
4. b. Ensuring service quality assurance
5. c. Facilitating solution development

Descriptive Questions:

1. Refer to-UNIT 2.1: Understanding Client Requirements and Project Preparation
Topic-2.1.1 Process of Determining the Client's Requirements for the Delivery of a 5G Cloud RAN
2. Refer to--UNIT 2.1: Understanding Client Requirements and Project Preparation
Topic- 2.1.4 Importance of Assisting the Infrastructure and DevOps Team Members for 5G Cloud RAN Project
3. Refer to- 2.1: Understanding Client Requirements and Project Preparation
Topic- 2.1.3 Process of Developing Appropriate Strategies Concerning Cloud Delivery, DevOps, and SDMC Automation
4. Refer to- UNIT 2.2: Implementation and Service Quality Assurance
Topic- 2.2.1 Developing and Managing the Implementation of Appropriate Processes for Test Automation
5. Refer to- UNIT 2.2: Implementation and Service Quality Assurance
Topic- Refer to- UNIT 2.2: Implementation and Service Quality Assurance



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3. Process of using the Appropriate Hardware Platform and Environment for 5G Cloud RAN

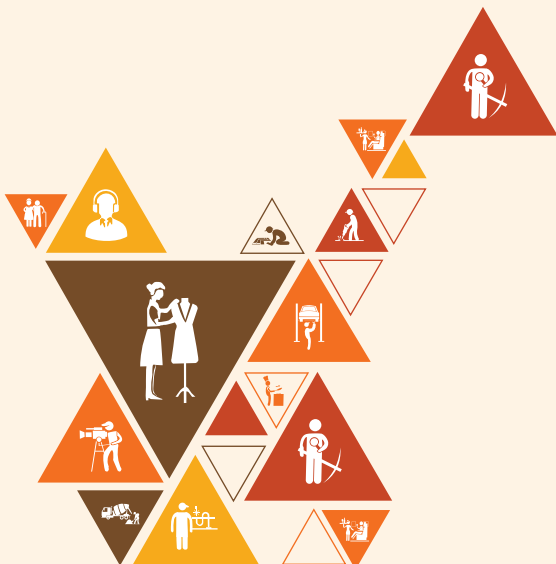
Unit 3.1 - Cloud RAN Fundamentals and Virtualization

Unit 3.2 - Cloud RAN Architecture and Implementation

Unit 3.3 - Cloud RAN Deployment and Optimization

Unit 3.4 - Cloud RAN Integration and Optimization

Unit 3.5 - Advanced Cloud RAN Deployment and Optimization



TEL/N6317

Key Learning Outcomes



By the end of this module, the participants will be able to:

1. Explain the functioning of centralized and Cloud computing-based Cloud Radio Access Network (RAN), and its relevance and deployment in 5G networks.
2. Describe the process through which Cloud RAN virtualizes 5G network functions using Network Functions Virtualization (NFV) and provides a platform for other cloud-based application services, such as a Multi-access Edge Computing (MEC).
3. Explain the use of Baseband Units (BBUs) by a Cloud RAN to convert digital signals to radio transmissions and vice-versa.
4. Explain the use of Radio Frequency Units (RFUs) in 5G Cloud RAN.
5. Explain the benefit of using Cloud RAN architecture for easy and economical deployment and scaling of 5G wireless network and IoT.
6. Explain the concept of BBU hotel and how it helps lower the total cost of hardware cooling and power requirements, allowing for easier maintenance access and management of BBUs.
7. Explain how virtualization of network functions helps the scalability and flexibility of wireless networks, allowing for pooling and dynamic allocation of resources.
8. Explain the use of Cloud CLI, APIs, CloudFormation templates and Management Console, Monitoring and Logging, Cloud Optimization, Security Services Cloud Build Services, Cloud Migration (CSP to CSP, On-premises to CSP), Cloud Managed Services, CSPs and costing.
9. Describe the process of creating DevOps tool chain using DevOps tools.
10. Describe the process of automation using python or shell scripting.
11. Describe the appropriate measures to achieve application-level reliability with platform abstraction, with simplified operations and maintenance with network automation.

Unit 3.1: Cloud RAN Fundamentals and Virtualization

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the functioning of centralized and Cloud computing-based Cloud Radio Access Network (RAN), and its relevance and deployment in 5G networks.
2. Describe the process through which Cloud RAN virtualizes 5G network functions using Network Functions Virtualization (NFV) and provides a platform for other cloud-based application services, such as Multi-access Edge Computing (MEC).
3. Explain the use of Baseband Units (BBUs) by a Cloud RAN to convert digital signals to radio transmissions and vice-versa.
4. Explain the use of Radio Frequency Units (RFUs) in 5G Cloud RAN.

Resources to be Used

Presentation slides with diagrams explaining Cloud RAN architecture, NFV documentation and case studies, Visual aids depicting the role of BBUs and RFUs, 5G network deployment guides and standards

Say

- Introduce the concept of Cloud RAN and its relevance in 5G networks.
- Explain the functioning of centralized and Cloud computing-based Cloud RAN.
- Discuss the deployment scenarios of Cloud RAN in 5G networks.
- Describe the virtualization process of 5G network functions using NFV in Cloud RAN.
- Emphasize the role of Cloud RAN as a platform for cloud-based services, such as MEC.
- Explain the purpose and functioning of Baseband Units (BBUs) in a Cloud RAN.
- Discuss the use of Radio Frequency Units (RFUs) in 5G Cloud RAN.

Ask

- Encourage participants to share their understanding of Cloud RAN and its significance in 5G networks.
- Ask participants to discuss any challenges or concerns they foresee in deploying Cloud RAN.
- Inquire about participants' familiarity with NFV and its role in virtualizing network functions.
- Prompt discussion on the potential benefits and drawbacks of using BBUs and RFUs in Cloud RAN.

Do

- Facilitate a hands-on session where participants explore NFV documentation and simulate virtualization processes.
- Use visual aids to demonstrate the role of BBUs in converting digital signals for radio transmissions.
- Walk through a deployment scenario of a Cloud RAN in a 5G network, discussing key components.
- Showcase the configuration and deployment of RFUs in a 5G Cloud RAN.

Elaborate

- Provide additional insights into the advantages of centralized and Cloud-based Cloud RAN architectures.
- Expand on the different use cases for Multi-access Edge Computing (MEC) in a Cloud RAN environment.
- Discuss the technical aspects of NFV and how it enables the virtualization of network functions in Cloud RAN.
- Elaborate on the specific functionalities and features of BBUs and RFUs in 5G Cloud RAN.

Demonstrate

- Demonstrate the deployment of Cloud RAN in a simulated 5G network environment.
- Use visual aids to illustrate the virtualization process of network functions through NFV.
- Showcase the conversion of digital signals by BBUs and the role of RFUs in radio transmissions.
- Conduct a live demonstration of how Cloud RAN serves as a platform for cloud-based applications.

Activity

1. Cloud RAN Deployment Simulation

2. **Objective:** Simulate the deployment of Cloud RAN in a virtual 5G network.

3. **Type of activity:** Simulation.

4. **Resources:** Virtualization tools, deployment scenarios, and visual aids.

5. **Duration of the activity:** 1 hour.

6. Instructions:

- Divide participants into groups and provide them with a simulated 5G network deployment scenario.
- Each group will use virtualization tools to deploy Cloud RAN components, discussing the challenges and solutions they encounter.

7. **Outcome:** Enhanced understanding of the practical aspects of Cloud RAN deployment and its role in a 5G network.

Notes for Facilitation

- Encourage active participation through discussions and hands-on activities.
- Provide opportunities for participants to ask questions and seek clarification.
- Relate theoretical concepts to practical scenarios for better comprehension.
- Summarize key points at the end of each section to reinforce learning.
- Foster a collaborative and inclusive learning environment.

Unit 3.2: Cloud RAN Architecture and Implementation

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the benefit of using Cloud RAN architecture for easy and economical deployment and scaling of 5G wireless network and IoT.
2. Explain the concept of BBU hotel and how it helps lower the total cost of hardware cooling and power requirements, allowing for easier maintenance access and management of BBUs.
3. Explain how virtualization of network functions helps the scalability and flexibility of wireless networks, allowing for pooling and dynamic allocation of resources

Resources to be Used

Presentation slides explaining Cloud RAN benefits and concepts, diagrams illustrating BBU hotel architecture, documentation on virtualization of network functions in wireless networks, case studies highlighting successful Cloud RAN implementations

Say

- Let us discuss about the benefits of Cloud RAN architecture in the context of 5G wireless networks and IoT deployment.
- We will be discussing about Cloud RAN enables easy and economical scaling of wireless networks.
- Let us know about the concept of a BBU hotel and its role in reducing total hardware costs, power requirements, and simplifying maintenance access.
- Let us know about the advantages of virtualization in enhancing the scalability and flexibility of wireless networks.
- We will highlight the points about how virtualization enables pooling and dynamic allocation of resources for optimized network performance.

Ask

- Can you share your understanding of the challenges in deploying and scaling 5G wireless networks.
- Share your experiences or knowledge regarding traditional BBU deployments and their limitations.
- Are you familiar with the concept of virtualization and its applications in network functions.

Do

- Facilitate a group discussion on real-world scenarios where Cloud RAN benefits could be maximized.
- Showcase diagrams and visuals illustrating the architecture of a BBU hotel and its impact on hardware costs and maintenance.
- Walk participants through the virtualization process of network functions, emphasizing scalability and flexibility.
- Use case studies to demonstrate successful Cloud RAN implementations and their positive outcomes.

Elaborate

- Provide additional insights into the specific economic advantages of Cloud RAN deployment.
- Expand on the concept of a BBU hotel, discussing its role in reducing operational costs and improving accessibility.
- Discuss the technical aspects of virtualization, emphasizing how it enhances the scalability and flexibility of wireless networks.
- Elaborate on real-world examples where virtualization has led to efficient resource pooling and dynamic allocation.

Demonstrate

- Demonstrate the use of Cloud RAN architecture in a simulated 5G wireless network deployment.
- Showcase a virtual tour of a BBU hotel, illustrating its physical layout and advantages.
- Conduct a live demonstration of the virtualization process, showcasing the dynamic allocation of resources.
- Present case studies with before-and-after scenarios to highlight the positive impacts of Cloud RAN implementation.

Activity

- 1. Cloud RAN Cost-Benefit Analysis**
- 2. Objective:** Evaluate the economic benefits of Cloud RAN deployment.
- 3. Type of activity:** Group discussion and analysis.
- 4. Resources:** Cost-benefit analysis templates, case studies, and economic impact documentation.
- 5. Duration of the activity:** 45 minutes.
- 6. Instructions:**
 - Divide participants into groups and provide them with cost-benefit analysis templates.
 - Each group will analyse the potential economic benefits of Cloud RAN deployment, considering factors such as hardware costs, maintenance, and scalability.
- 7. Outcome:** Improved understanding of the economic advantages of Cloud RAN and enhanced analytical skills in evaluating deployment options.

Notes for Facilitation

- Encourage active participation and open discussion.
- Relate theoretical concepts to practical scenarios for better comprehension.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios.

Unit 3.3: Cloud RAN Deployment and Optimization

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the process of software development, including cloud computing and DevOps activities.
2. Explain the benefits and process of using Infrastructure as Code software tools.
3. Explain the use of cloud services offered by different providers, such as Amazon, Azure Cloud Service, GCP, IBM Cloud, etc.
4. State various DevOps practices and tools, system monitoring and integration with logging and monitoring tools.
5. Describe the process of implementing distributed applications in a container environment (Docker/ Kubernetes), and application migration to Cloud.
6. Explain the benefits of using cloud infrastructure and Open Application Model (OAM).

Resources to be Used

Presentation slides on software development, cloud computing, DevOps, and Infrastructure as Code (IaC), demonstrations of cloud services from providers like Amazon, Azure, GCP, IBM Cloud, documentation on DevOps practices, tools, and system monitoring, examples of distributed applications using Docker/ Kubernetes, materials explaining the benefits of cloud infrastructure and the Open Application Model (OAM)

Say

- Introduction to the software development process, highlighting cloud computing and DevOps activities.
- Explanation of the benefits and process of using Infrastructure as Code (IaC) software tools.
- Discussion about the offerings of cloud services from different providers such as Amazon, Azure, GCP, and IBM Cloud.
- Presentation of various DevOps practices and tools, emphasizing system monitoring and integration with logging and monitoring tools.
- We will discuss about the process of implementing distributed applications in a container environment (Docker/Kubernetes) and application migration to the Cloud.
- We will be discussing about the benefits of using cloud infrastructure and the Open Application Model (OAM).

Ask

- What are your experiences or challenges in software development, cloud computing, or DevOps?
- Discuss about familiarity with Infrastructure as Code and its application in deployment?
- What are the experiences with different cloud service providers and their preferences?
- Can you share their knowledge of DevOps practices and tools they have used?

Do

- Facilitate a hands-on workshop on using Infrastructure as Code tools for deploying and managing infrastructure.
- Demonstrate the features and offerings of cloud services from major providers like Amazon, Azure, GCP, and IBM Cloud.
- Conduct a live demonstration of DevOps practices and tools, highlighting system monitoring and integration with logging and monitoring tools.
- Guide participants through the process of implementing distributed applications using Docker/Kubernetes.
- Showcase the benefits of cloud infrastructure and the Open Application Model (OAM) through practical examples.

Elaborate

- Provide additional insights into best practices in software development within a cloud environment.
- Expand on the advantages of using Infrastructure as Code for maintaining consistent and reproducible infrastructure.
- Discuss the specific features and capabilities offered by different cloud service providers.
- Elaborate on the importance of DevOps practices, emphasizing system monitoring and integration.
- Discuss the benefits of containerization with Docker/Kubernetes and the considerations in migrating applications to the Cloud.
- Provide insights into the advantages of cloud infrastructure and the principles behind the Open Application Model (OAM).

Demonstrate

- Demonstrate the process of writing code for Infrastructure as Code and deploying it.
- Showcase the features and offerings of cloud services from major providers through a live demonstration.
- Conduct a live demonstration of using DevOps practices and tools for system monitoring and integration.
- Walk through the steps of implementing distributed applications in a container environment using Docker/Kubernetes.
- Present a case study demonstrating the benefits of cloud infrastructure and the Open Application Model (OAM).

Activity

1. **Cloud Deployment Simulation**
2. **Objective:** Simulate the deployment of a distributed application in a cloud environment.
3. **Type of activity:** Simulation.
4. **Resources:** Simulation tools, cloud service documentation, and deployment scenarios.
5. **Duration of the activity:** 1 hour.

6. Instructions:

- Divide participants into groups and provide them with a simulated scenario for deploying a distributed application.
- Each group will use simulation tools to deploy the application in a cloud environment, considering factors such as scalability, reliability, and resource optimization.

7. Outcome: Enhanced understanding of the practical aspects of deploying and optimizing applications in a cloud environment.

Notes for Facilitation

- Encourage active participation and open discussion.
- Provide opportunities for participants to ask questions and seek clarification.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios.

Unit 3.4: Cloud RAN Integration and Optimization

Unit Objectives

By the end of this unit, the participants will be able to:

1. State the challenges concerning server and accelerator selection, capacity dimensioning, power efficiency planning and security planning, and how to overcome them.
2. Explain the benefits of introducing Cloud Native Service Management and Orchestration (SMO) in parallel to the network to bring RAN programmability.
3. Describe the process of implementing DevOps architectural framework for cloud platform and applications, resiliency/disaster recovery, microservices, and other PaaS services.
4. Describe the process of architecting solutions within a public cloud.
5. Explain the use of Cloud CLI, APIs, CloudFormation templates and Management Console, Monitoring and Logging, Cloud Optimization, Security Services, Cloud Build Services, Cloud Migration (CSP to CSP, On-premises to CSP), Cloud Managed Services, CSPs and costing.
6. Describe the process of setting appropriate server configurations based on workload demands for DUs.
7. Describe the appropriate measures to achieve application-level reliability with platform abstraction, with simplified operations and maintenance with network automation

Resources to be Used

Presentation slides on Cloud RAN challenges, benefits, and architectural frameworks, Documentation on Cloud Native Service Management and Orchestration (SMO), Examples and templates for DevOps architectural frameworks, Public cloud architectural guides and best practices, Hands-on experience with Cloud CLI, APIs, CloudFormation, Monitoring tools, etc.

Say

- Introduce the challenges associated with server and accelerator selection, capacity dimensioning, power efficiency planning, and security planning in Cloud RAN integration.
- Discuss strategies and solutions to overcome challenges in server configuration based on workload demands for DUs.
- Explain the benefits of Cloud Native Service Management and Orchestration (SMO) for enhancing RAN programmability.
- Describe the process of implementing a DevOps architectural framework for cloud platforms, applications, resiliency/disaster recovery, microservices, and other PaaS services.
- Highlight the steps involved in architecting solutions within a public cloud environment.
- Discuss the various tools and services, such as Cloud CLI, APIs, CloudFormation, Monitoring, Logging, Cloud Optimization, Security Services, Cloud Build Services, Cloud Migration, Cloud Managed Services, CSPs, and costing.
- Describe the measures to achieve application-level reliability with platform abstraction and simplified operations and maintenance through network automation.

Ask

- What are your experiences or concerns regarding challenges in Cloud RAN integration.
- Do you know Cloud Native Service Management and Orchestration and its potential benefits.
- What are your experiences with implementing DevOps architectural frameworks for cloud platforms.
- Discuss about the tools and services they have used for cloud integration and optimization.

Do

- Facilitate a group discussion on overcoming challenges in server and accelerator selection, capacity dimensioning, power efficiency planning, and security planning in Cloud RAN.
- Conduct a hands-on workshop on Cloud Native Service Management and Orchestration, demonstrating its integration with the network to enhance RAN programmability.
- Guide participants through the process of implementing a DevOps architectural framework for cloud platforms and applications.
- Showcase the steps involved in architecting solutions within a public cloud environment.
- Demonstrate the use of various tools and services like Cloud CLI, APIs, CloudFormation, Monitoring, Logging, Cloud Optimization, Security Services, Cloud Build Services, and Cloud Migration through live demonstrations.

Elaborate

- Provide additional insights into specific strategies for overcoming challenges in Cloud RAN integration.
- Expand on the benefits of Cloud Native Service Management and Orchestration, emphasizing its role in enhancing RAN programmability.
- Discuss the principles and best practices of implementing a DevOps architectural framework for cloud platforms.
- Elaborate on the considerations and steps involved in architecting solutions within a public cloud environment.
- Explain in detail the functionalities and use cases of various tools and services for cloud optimization, security, and migration.

Demonstrate

- Demonstrate the process of overcoming challenges in server and accelerator selection, capacity dimensioning, power efficiency planning, and security planning in Cloud RAN through real-world examples.
- Showcase a live demonstration of Cloud Native Service Management and Orchestration in action, illustrating its impact on RAN programmability.
- Walk through the implementation of a DevOps architectural framework for cloud platforms, highlighting key components and practices.
- Demonstrate the steps involved in architecting solutions within a public cloud environment using a real-world scenario.
- Conduct live demonstrations of various tools and services for cloud optimization, security, and migration.

Activity

1. **Cloud RAN Optimization Workshop**
2. **Objective:** Optimize a simulated Cloud RAN environment.
3. **Type of activity:** Hands-on workshop.
4. **Resources:** Simulation tools, documentation on Cloud RAN challenges, benefits, and optimization strategies.
5. **Duration of the activity:** 1.5 hours.
6. **Instructions:**
 - Divide participants into groups and provide them with a simulated Cloud RAN environment facing challenges.
 - Each group will use optimization strategies discussed to improve server configurations, enhance security, and streamline operations.
7. **Outcome:** Enhanced understanding of practical optimization strategies for Cloud RAN environments.

Notes for Facilitation

- Encourage active participation and open discussion.
- Provide opportunities for participants to ask questions and seek clarification.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios.

Unit 3.5: Advanced Cloud RAN Deployment and Optimization

Unit Objectives

By the end of this unit, the participants will be able to:

1. Demonstrate how to set appropriate server configurations based on workload demands for Distributed Units (DUs).
2. Demonstrate how to use accelerators to manage layer one pipeline functions and meet the demands of large Multiple Input, Multiple Output (MIMO) radios.
3. Show how to use the appropriate Cloud native technologies, such as Kubernetes and apply DevOps principles to realise RAN functions as micro-services in containers over bare metal servers.
4. Demonstrate the process of performing cloud RAN's independent life cycle management following the DevOps principles and CI/CD

Resources to be Used

Demonstration environment with Cloud RAN deployment tools, Documentation on server configurations, accelerators, Cloud-native technologies, and DevOps principles, Kubernetes setup and examples of microservices in containers, CI/CD tools and documentation

Say

- We will know about importance of setting appropriate server configurations for Distributed Units (DUs) based on workload demands in Cloud RAN.
- We will discuss about the role of accelerators in managing layer one pipeline functions to meet the demands of large Multiple Input, Multiple Output (MIMO) radios.
- Let us know about the application of Cloud-native technologies, specifically Kubernetes, and the application of DevOps principles to realize RAN functions as microservices in containers over bare metal servers.
- We will be knowing about the process of performing Cloud RAN's independent lifecycle management following DevOps principles and Continuous Integration/Continuous Deployment (CI/CD).

Ask

- What are your experiences or challenges in setting server configurations for DUs.
- Do you know anything regarding Cloud-native technologies like Kubernetes and DevOps principles in RAN deployment.

Do

- Facilitate hands-on demonstrations of setting appropriate server configurations based on workload demands for DUs in a simulated Cloud RAN environment.
- Demonstrate the use of accelerators to manage layer one pipeline functions and meet the demands of large MIMO radios.
- Guide participants through the application of Cloud-native technologies, focusing on Kubernetes, and applying DevOps principles to deploy RAN functions as microservices in containers over bare metal servers.
- Showcase the process of performing Cloud RAN's independent lifecycle management following DevOps principles and CI/CD.

Elaborate

- Provide additional insights into the considerations and best practices in setting server configurations for DUs in a Cloud RAN.
- Expand on the functionalities and benefits of accelerators in managing layer one pipeline functions for large MIMO radios.
- Discuss the specific features and advantages of Cloud-native technologies, particularly Kubernetes, in deploying RAN functions as microservices.
- Elaborate on the principles of DevOps and CI/CD in the independent lifecycle management of Cloud RAN.

Demonstrate

- Demonstrate the step-by-step process of setting server configurations for DUs based on workload demands.
- Showcase the use of accelerators in managing layer one pipeline functions through a live demonstration.
- Walk through the deployment of RAN functions as microservices in containers using Cloud-native technologies and DevOps principles.
- Conduct a live demonstration of the independent lifecycle management of Cloud RAN following DevOps principles and CI/CD.

Activity

- 1. Cloud RAN Optimization Challenge**
- 2. Objective:** Optimize a simulated Cloud RAN environment focusing on advanced deployment and optimization techniques.
- 3. Type of activity:** Simulation and hands-on challenge.
- 4. Resources:** Simulation tools, documentation on advanced Cloud RAN deployment and optimization, demonstration environment.
- 5. Duration of the activity:** 2 hours.

6. Instructions:

- Divide participants into groups and provide them with a simulated Cloud RAN environment facing advanced deployment and optimization challenges.
- Each group will apply the techniques discussed to optimize the environment, considering factors such as server configurations, accelerators, Cloud-native technologies, and DevOps principles.

7. Outcome: Improved understanding and practical application of advanced Cloud RAN deployment and optimization techniques.

Notes for Facilitation

- Encourage active participation and open discussion.
- Provide opportunities for participants to ask questions and seek clarification.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios.

Answers to Exercises for PHB

Multiple Choice Questions:

1. b. Economical deployment and scaling
2. b. Digital-to-radio signal conversion
3. a. Signal conversion to radio transmissions
4. b. Improved maintenance access and management
5. c. Allowing pooling and dynamic allocation of resources

Descriptive Questions:

1. Refer to- UNIT 3.1: Cloud RAN Fundamentals and Virtualization
Topic- 3.1.1 Introduction to Cloud RAN in 5G Networks
2. Refer to- UNIT 3.1: Cloud RAN Fundamentals and Virtualization
Topic- 3.1.2 Virtualization in Cloud RAN
3. Refer to- UNIT 3.3: Cloud RAN Deployment and Optimization
Topic-3.3.1 Software Development and DevOps Processes
4. Refer to- UNIT 3.4: Cloud RAN Integration and Optimization
Topic- 3.4.5 Cloud RAN Lifecycle Management and Application Reliability
5. Refer to-- UNIT 3.4: Cloud RAN Integration and Optimization
Topic- 3.4.2 Cloud Service Utilization and Architecture



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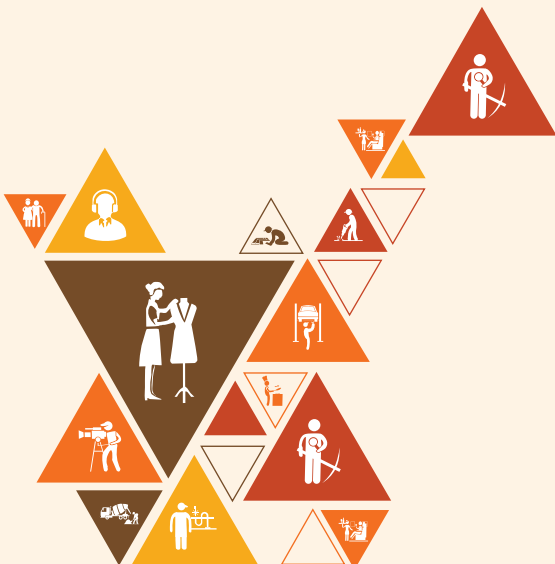
Transforming the skill landscape



4. Process of Managing Orchestration, Automation and RAN Programmability

Unit 4.1 - Cloud RAN Management and Orchestration

Unit 4.2 - Cloud-Native Implementation and Virtualization



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Key Learning Outcomes



By the end of this module, the participants will be able to:

1. Describe the process of performing Cloud RAN management to manage hybrid network functions in RAN.
2. Describe the process of carrying out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries.
3. Describe the process of cloud-native realisation of CU-CP and CU-UP, providing independent scaling for centralized control and user planes and creating locational flexibility in deployments.
4. Demonstrate how to use the orchestration systems to manage Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF) and end-to-end life cycle management of services across Cloud RAN, and 5G core and underlying cloud infrastructure.
5. Demonstrate the process of carrying out virtualization of Central Unit (CU)/ CU-UP for flexible distributed edge placement of vCU-UP and virtual User Plane Function (vUPF)

Unit 4.1: Cloud RAN Management and Orchestration

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the process of performing Cloud RAN management to manage hybrid network functions in RAN.
2. Describe the process of carrying out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries.
3. Describe the process of evaluating the key use cases and deployment scenarios to select the appropriate cloud infrastructure, including the infrastructure hardware, cloud platform and RAN applications that will be hosted on it.
4. Describe the process of enabling interworking of Cloud RAN with the existing and installed base

Resources to be Used

Presentation slides on Cloud RAN management, automation, orchestration, and use cases, Documentation on Cloud RAN deployment scenarios and interworking strategies, Case studies illustrating successful Cloud RAN implementations, Demonstration environment with Cloud RAN management tools, Whitepapers and industry reports on cloud infrastructure selection

Say

- Let us discuss about the process of performing Cloud RAN management to handle hybrid network functions in RAN.
- What are the importance and process of Cloud RAN automation, management, and orchestration for delivering 5G network services across various industries.
- We will discuss about process of evaluating key use cases and deployment scenarios to select the appropriate cloud infrastructure, including infrastructure hardware, cloud platforms, and RAN applications.

Ask

- Share your experiences or challenges in managing hybrid network functions in Cloud RAN.
- Do you know anything about Cloud RAN automation, management, and orchestration and its role in 5G network service delivery.

Do

- Facilitate a hands-on workshop on Cloud RAN management tools, showcasing the process of managing hybrid network functions.
- Conduct live demonstrations of Cloud RAN automation, management, and orchestration tools, illustrating their role in delivering 5G network services.
- Guide participants through the evaluation process for selecting cloud infrastructure for different use cases and deployment scenarios.
- Showcase strategies and techniques for enabling the interworking of Cloud RAN with the existing and installed base.

Elaborate

- Provide additional insights into best practices in Cloud RAN management for handling hybrid network functions.
- Expand on the benefits and challenges of Cloud RAN automation, management, and orchestration in delivering 5G network services.
- Discuss specific considerations and criteria for evaluating use cases and deployment scenarios when selecting cloud infrastructure.
- Elaborate on strategies and approaches for enabling smooth interworking of Cloud RAN with existing installations.

Demonstrate

- Demonstrate the practical application of Cloud RAN management tools for handling hybrid network functions.
- Showcase live demonstrations of Cloud RAN automation, management, and orchestration tools in action, highlighting their impact on 5G network service delivery.
- Walk through the evaluation process for selecting cloud infrastructure, emphasizing considerations for infrastructure hardware, cloud platforms, and hosted RAN applications.
- Conduct live demonstrations of strategies for enabling the interworking of Cloud RAN with the existing and installed base.

Activity

- 1. Cloud RAN Use Case Evaluation**
- 2. Objective:** Evaluate and select cloud infrastructure for specific Cloud RAN use cases.
- 3. Type of activity:** Group discussion and analysis.
- 4. Resources:** Use case scenarios, documentation on cloud infrastructure selection criteria.
- 5. Duration of the activity:** 1.5 hours.
- 6. Instructions:**
 - Divide participants into groups and provide them with specific Cloud RAN use case scenarios.

- Each group will evaluate the use cases and select the most appropriate cloud infrastructure, considering factors such as hardware, platform, and hosted applications.
7. **Outcome:** Enhanced understanding of practical considerations in selecting cloud infrastructure for Cloud RAN use cases.

Notes for Facilitation

- Encourage active participation and open discussion.
- Provide opportunities for participants to ask questions and seek clarification.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios.

Unit 4.2: Cloud-Native Implementation and Virtualization

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the process of cloud-native realization of CU-CP and CU-UP, providing independent scaling for centralized control and user planes and creating locational flexibility in deployments.
2. Demonstrate how to use the orchestration systems to manage Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF) and end-to-end life cycle management of services across Cloud RAN, and 5G core and underlying cloud infrastructure.
3. Demonstrate how to use cloud RAN to enable programmable networks and model-driven management and orchestration systems.
4. Demonstrate the process of carrying out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries.
5. Demonstrate the process of carrying out virtualization of Central Unit (CU)/ CU-UP for flexible distributed edge placement of vCU-UP and virtual User Plane Function (vUPF)

Resources to be Used

Presentation slides on cloud-native implementation, virtualization, and orchestration systems, documentation on Cloud RAN automation, management, and orchestration tools, demonstration environment with Cloud RAN and 5G core systems, case studies illustrating successful cloud-native and virtualization implementation

Say

- We will know about the process of cloud-native realization of Central Unit (CU) - Control Plane (CP) and CU - User Plane (UP), emphasizing independent scaling for centralized control and user planes.
- We will discuss about the locational flexibility achieved in deployments through cloud-native implementation.
- We will be knowing about the use of orchestration systems for managing Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF), and end-to-end lifecycle management across Cloud RAN, 5G core, and underlying cloud infrastructure.

Ask

- What are your understanding of cloud-native implementation and virtualization in the context of 5G networks.
- Do you know anything about the importance and challenges of virtualizing Central Unit (CU) and CU-UP for flexible distributed edge placement.

Do

- Facilitate hands-on workshops on cloud-native realization of CU-CP and CU-UP, allowing participants to experiment with independent scaling and locational flexibility.
- Conduct live demonstrations of orchestration systems managing PNF, VNF, CNF, and providing end-to-end lifecycle management across Cloud RAN, 5G core, and cloud infrastructure.
- Showcase the capabilities of Cloud RAN in enabling programmable networks and model-driven management and orchestration.
- Guide participants through the process of Cloud RAN automation, management, and orchestration for delivering 5G network services.
- Provide a step-by-step demonstration of virtualizing Central Unit (CU)/CU-UP for flexible distributed edge placement of vCU-UP and vUPF.

Elaborate

- Provide additional insights into the advantages of cloud-native realization, including independent scaling and locational flexibility.
- Expand on the functionalities and considerations of orchestration systems in managing diverse network functions and end-to-end lifecycle management.
- Discuss the potential benefits and challenges of enabling programmable networks and model-driven management in Cloud RAN.
- Elaborate on the key components and considerations in the virtualization of Central Unit (CU) and CU-UP for distributed edge placement.

Demonstrate

- Demonstrate the step-by-step process of cloud-native realization of CU-CP and CU-UP with a live example.
- Showcase live demonstrations of orchestration systems managing PNF, VNF, CNF, and providing end-to-end lifecycle management.
- Walk through the capabilities of Cloud RAN in enabling programmable networks and model-driven management and orchestration.
- Conduct live demonstrations of Cloud RAN automation, management, and orchestration for delivering 5G network services.
- Provide a hands-on demonstration of virtualizing Central Unit (CU)/CU-UP for flexible distributed edge placement of vCU-UP and vUPF.

Activity

1. **Cloud-Native Design Challenge**
2. **Objective:** Design a cloud-native architecture for a specific 5G network scenario.
3. **Type of activity:** Group design challenge.
4. **Resources:** Design templates, documentation on cloud-native principles, case studies.

5. Duration of the activity: 1.5 hours.

6. Instructions:

- Divide participants into groups and provide them with a specific 5G network scenario.
- Each group will design a cloud-native architecture considering independent scaling, locational flexibility, and end-to-end lifecycle management.

7. Outcome: Enhanced understanding of practical considerations in designing cloud-native architectures for 5G networks.

Notes for Facilitation

- Encourage active participation and open discussion.
- Provide opportunities for participants to ask questions and seek clarification.
- Foster a collaborative learning environment by promoting group interactions.
- Address any questions or concerns raised by participants.
- Conclude the session with a summary of key takeaways and their relevance in real-world scenarios

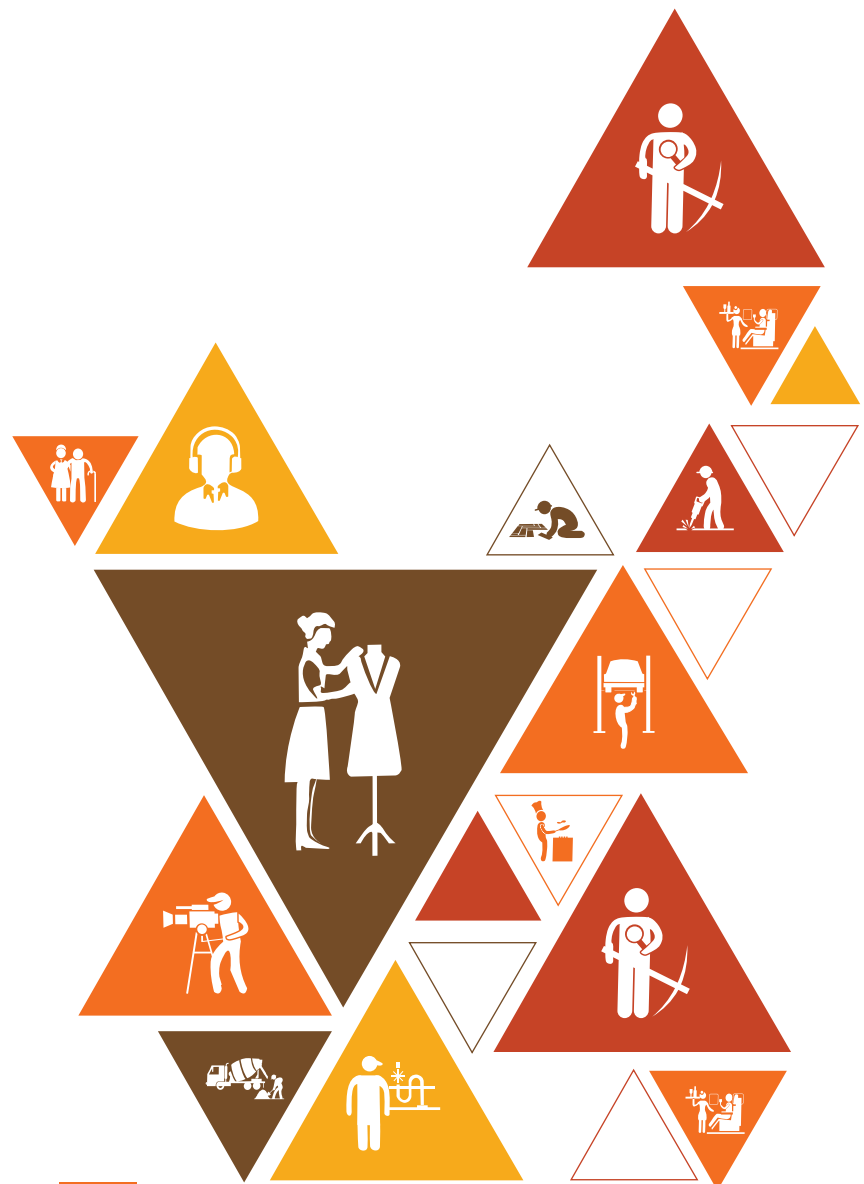
Answers to Exercises for PHB

Multiple Choice Question

1. d. Physical Network Functions (PNF)
2. a. Delivering 5G network services
3. b. Independent scaling and locational flexibility
4. c. End-to-end life cycle management of services
5. c. Flexible distributed edge placement

Descriptive Questions:

1. Refer to-UNIT 4.1: Cloud RAN Management and Orchestration
Topic-4.1.1 Hybrid Network Functions Management in Cloud RAN
2. Refer to- UNIT 4.1: Cloud RAN Management and Orchestration
Topic- 4.1.2 Cloud RAN Automation and Orchestration
3. Refer to- UNIT 4.2: Cloud-Native Implementation and Virtualization
Topic- 4.2.1 Cloud-Native Realization and Scalability in Cloud RAN
4. UNIT 4.2: Cloud-Native Implementation and Virtualization
Topic- 4.2.5 Virtualization Strategies for Enhanced Edge Performance
5. UNIT 4.2: Cloud-Native Implementation and Virtualization
Topic- 4.2.5 Virtualization Strategies for Enhanced Edge Performance





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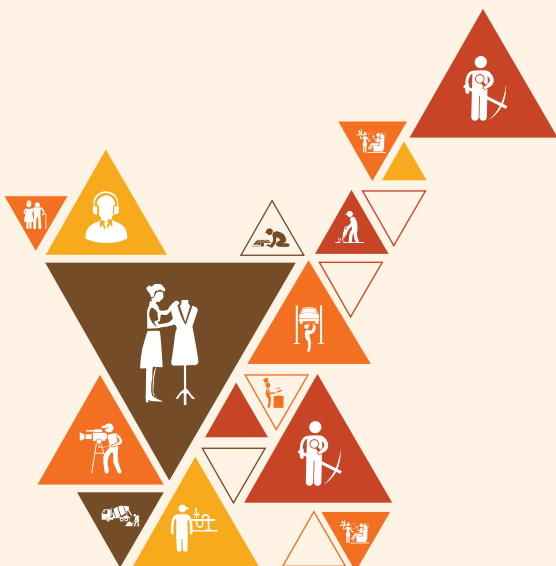
5. Communication and Interpersonal Skills

Unit 5.1 - Personal Hygiene and Dress Code

Unit 5.2 - Importance of Effective Communication and Interpersonal Skills

Unit 5.3 - Gender and PWD Sensitisation

Unit 5.4 - Work Ethics and Team Goals



TEL/N9103

Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. List organisational guidelines for dress code, time schedules, language and other soft skill aspects
2. Explain the importance of effective communication and interpersonal skills
3. Demonstrate appropriate communication skills and etiquette while interacting with others.
4. Discuss the common reasons for interpersonal conflicts and ways of managing them effectively
5. Discuss the need for implementing standards, guidelines and practices regarding gender sensitivity
6. Explain the work ethics, workplace etiquette, standards and guidelines to make communication inclusive for all genders and PwD.
7. List the health and safety requirements mandatory and recommended at the workplace for persons with disability
8. Describe the process of recruiting people with disability for a specific job
9. Demonstrate appropriate behaviour towards all genders and differently-abled people
10. Demonstrate appropriate behaviour towards all genders and differently-abled people
11. Illustrate the importance of team goals over individual goals.

Unit 5.1: Personal Hygiene and Dress Code

Unit Objectives

By the end of this unit, the trainees will be able to:

1. List the organisation guidelines for personal hygiene and dress code

Resources to be Used

Organization's Dress Code Policy, Visual aids (images or infographics on personal hygiene), Flipchart or whiteboard

Say

- Let us get introduced to the importance of personal hygiene and adherence to the dress code within the organization.
- We will learn about the organization's guidelines for personal hygiene and dress code.
- We will be knowing how personal appearance contributes to a positive work environment and reflects professionalism.

Ask

- Questions to the participants about their understanding of the organization's dress code and personal hygiene policies.
- Encourage participants to share their experiences and perspectives on the impact of personal appearance in a professional setting.

Do

- Role-playing scenarios where participants can practice appropriate and inappropriate attire in the workplace.
- Group discussions on the challenges individuals may face in maintaining personal hygiene and adhering to the dress code.

Elaborate

- Discuss the consequences of not adhering to the organization's guidelines on personal hygiene and dress code.
- Explore cultural considerations that may influence personal grooming and clothing choices.
- Demonstration:
- Provide a demonstration on proper grooming techniques and appropriate dress, incorporating examples from the organization's guidelines.

Activity

- 1. Dress for Success**
- 2. Objective:** To reinforce the importance of adhering to the organization's dress code and personal hygiene guidelines.
- 3. Type of Activity:** Role-play and group discussion
- 4. Resources:** Images or examples of appropriate and inappropriate attire, Flipchart or whiteboard,
- 5. Duration of the Activity:** 60 minutes
- 6. Instructions:**
 - Divide participants into small groups.
 - Assign each group a scenario related to workplace attire and personal hygiene.
 - Ask each group to create a short role-play that demonstrates both appropriate and inappropriate choices.
 - After the role-plays, facilitate a group discussion on the impact of personal appearance on professional success.
 - Use the images and examples to reinforce key points from the organization's guidelines.
- 7. Outcome:** Participants will have a better understanding of the organization's dress code and personal hygiene expectations, and they will recognize the importance of maintaining a professional appearance in the workplace.

Notes for Facilitation

- Encourage open discussion and questions throughout the session.
- Relate the discussion to real-world examples within the organization.
- Be sensitive to cultural differences and diverse perspectives on personal appearance.
- Use the activity to make the session interactive and engaging.

Unit 5.2: Importance of Effective Communication and Interpersonal Skills

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Discuss about different methods of effective communication
2. Explain the importance of effective communication and interpersonal skills in the workplace
3. Identify the common reasons for interpersonal conflicts and ways to avoid them
4. Discuss ways to interact with supervisor regarding escalations, reporting and receiving feedback.

Resources to be Used

Presentation slides, Whiteboard or flipchart, Examples of effective and ineffective communication scenarios, Handouts on communication styles and conflict resolution techniques

Say

- Let's discuss about the importance of effective communication and interpersonal skills in the workplace.
- We will be knowing about the various communication methods, including verbal, non-verbal, written, and digital communication.
- We will get an idea about how effective communication contributes to a positive work environment, team collaboration, and overall success.
- Let us discuss the key interpersonal skills, such as active listening, empathy, and conflict resolution.

Ask

- Questions to participants about their experiences with communication challenges in the workplace.
- Encourage participants to share examples of successful communication and instances where communication breakdowns led to challenges.

Do

- Conduct role-playing activities to practice effective communication and interpersonal skills.
- Facilitate group discussions on common reasons for interpersonal conflicts and ways to avoid or resolve them.

Elaborate

- Expand on the impact of effective communication on productivity, team dynamics, and workplace culture.
- Discuss how different communication styles may affect interactions within a team.

Demonstrate

- Provide demonstrations on active listening, using appropriate body language, and delivering constructive feedback.

Activity

1. Communication Skills Workshop

2. **Objective:** To enhance participants' understanding and application of effective communication and interpersonal skills in the workplace.

3. **Activity:** Interactive workshop

4. **Resources:** Examples of effective and ineffective communication scenarios, Handouts on communication styles and conflict resolution techniques

5. **Duration of the Activity:** 90 minutes

6. Instructions:

- Start with a brief presentation on different methods of communication and the importance of effective communication in the workplace.
- Divide participants into small groups and provide them with scenarios depicting workplace communication challenges.
- Ask each group to discuss and present solutions to address the communication challenges in their given scenarios.
- Facilitate a debriefing session, encouraging participants to share insights and lessons learned.
- Conclude with a discussion on ways to interact with a supervisor regarding escalations, reporting, and receiving feedback.

7. Outcome:

- Participants will gain practical insights into effective communication and interpersonal skills, applying them to real-world workplace scenarios.
- They will also develop strategies for handling conflicts and communicating with supervisors.

Notes for Facilitation

- Foster a safe and open environment for participants to share their experiences.
- Encourage active participation in role-playing and group discussions.
- Relate the workshop content to the participants' specific work situations.
- Provide constructive feedback and guidance during role-playing activities.
- Emphasize the ongoing development of communication skills and their relevance to personal and professional growth.

Unit 5.3: Gender and PWD Sensitisation

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Illustrate the guidelines for gender-neutral behaviour in communication with clients and colleagues
2. Discuss about PWD sensitisation at the workplace
3. List the rights, duties and benefits available at the workplace for persons with a disability

Resources to be Used

Presentation slides, Handouts on gender-neutral communication guidelines, Case studies or real-life examples, Information on rights and benefits for Persons with Disabilities (PwD)

Say

- We will provide an overview of the importance of gender and PwD sensitization in the workplace.
- Let's take a look at the guidelines for gender-neutral behavior in communication with clients and colleagues.
- We will be discussing about the significance of creating an inclusive workplace for persons with disabilities.

Ask

- Will you be able to share your perspectives on gender-related challenges in the workplace?
- Can you please share your experiences related to interacting with persons with disabilities and the importance of sensitivity?

Do

- Conduct role-playing scenarios that depict gender-neutral communication in workplace settings.
- Facilitate group discussions on practical ways to promote inclusivity for persons with disabilities in the workplace.

Elaborate

- Elaborate on the impact of gender-neutral communication on fostering a respectful and inclusive work environment.
- Discuss different types of disabilities and the importance of understanding diverse needs and accommodations.

Demonstrate

- Demonstrate inclusive practices by incorporating gender-neutral language and highlighting accessibility considerations.

Activity

1. Inclusive Workplace Scenario Analysis

2. Objective: To enhance participants' understanding of gender-neutral communication and PwD sensitization in the workplace.

3. Type of Activity: Scenario analysis and group discussion

4. Resources: Case studies or real-life examples, Handouts on gender-neutral communication guidelines, Information on rights and benefits for PwD

5. Duration of the Activity: 60 minutes

6. Instructions:

- Present participants with workplace scenarios related to gender-neutral communication and interactions with persons with disabilities.
- Divide participants into small groups and ask them to analyze the scenarios, considering how they would respond to promote inclusivity.
- Facilitate a group discussion where each group presents their analysis and proposed solutions.
- Discuss the rights, duties, and benefits available at the workplace for persons with disabilities.
- Conclude with a summary of key takeaways and the importance of creating an inclusive and respectful workplace.

7. Outcome:

- Participants will gain practical insights into gender-neutral communication and sensitization towards persons with disabilities.
- They will also develop an understanding of the rights and benefits available to PwD in the workplace.

Notes for Facilitation

- Foster a non-judgmental and open environment for discussions.
- Encourage participants to share their experiences and insights.
- Emphasize the importance of ongoing awareness and sensitivity training.
- Provide additional resources for participants to explore after the session.
- Reiterate the organization's commitment to creating an inclusive and diverse workplace.

Unit 5.4: Work Ethics and Team Goals

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Demonstrate ideal workplace ethics while interacting with colleagues
2. Follow the organisation's policy for working with team members
3. Illustrate the importance of team goals over individual goals

Resources to be Used

Presentation slides, Workplace ethics policy document, Scenarios depicting ethical and unethical workplace behaviour, Information on the organization's team goals and policies

Say

- We will discuss about the importance of work ethics and collaboration in achieving team goals.
- Let us get an idea about ideal workplace ethics while interacting with colleagues, emphasizing respect, integrity, and professionalism.
- We will discuss about the organization's policy for working with team members and the expectations for ethical conduct.

Ask

- Discuss about your experiences with ethical dilemmas in the workplace?
- Share examples of successful collaboration and instances where ethical behaviour positively impacted team dynamics.

Do

- Conduct role-playing activities that depict scenarios requiring ethical decision-making in a team setting.
- Facilitate group discussions on the challenges and benefits of working collaboratively with team members.

Elaborate

- Elaborate on the impact of workplace ethics on team morale, productivity, and overall organizational success.
- Discuss real-life examples of successful teams that prioritize collaboration and adhere to high ethical standards.

Demonstrate



- Demonstrate effective communication and conflict resolution within a team setting while maintaining ethical standards.

Activity



1. Team Challenge - Ethical Decision-Making

2. Objective: To enhance participants' understanding of workplace ethics and the importance of collaboration in achieving team goals.

3. Type of Activity: Simulation and group discussion

4. Resources: scenarios depicting ethical and unethical workplace behaviour, workplace ethics policy document, information on the organization's team goals and policies

5. Duration of the Activity: 75 minutes

6. Instructions:

- Present participants with scenarios depicting ethical and unethical workplace behavior related to team collaboration.
- Divide participants into small groups and ask them to discuss and make decisions on how to handle each scenario while adhering to ethical standards.
- Facilitate a group discussion where each group shares their decisions and the reasoning behind them.
- Discuss the organization's team goals and policies, highlighting the importance of ethical conduct in achieving those goals.
- Conclude with a summary of key learnings and the significance of maintaining work ethics while working towards team goals.

7. Outcome: Participants will gain practical experience in making ethical decisions within a team context. They will also understand the alignment between workplace ethics, team collaboration, and achieving organizational goals.

Notes for Facilitation



- Encourage participants to actively participate in the scenario discussions.
- Foster a collaborative environment during the group activities.
- Emphasize the organization's commitment to maintaining high ethical standards.
- Relate the activity to real-world situations within the organization.
- Reinforce the importance of ongoing communication and adherence to workplace policies.

Answers to Exercises for PHB

Multiple Choice Questions

1. 1. b.
2. 2. a.
3. 3. a.
4. 4. d.
5. 5. a.

Answer the following:

1. UNIT 5.2: Importance of Effective Communication and Interpersonal skills
5.2.1 What is Communication?
2. UNIT 5.3: Gender and PwD Sensitisation
5.3.3 PwD Sensitisation at Workplace
3. UNIT 5.2: Importance of Effective Communication and Interpersonal skills
5.2.3 Interpersonal Conflicts
4. UNIT 5.3: Gender and PwD Sensitisation
5.3.1 Non Discrimination Policies
5. UNIT 5.4: Work Ethics and Team Goals
5.4.3 Individual Goals vs Team Goals



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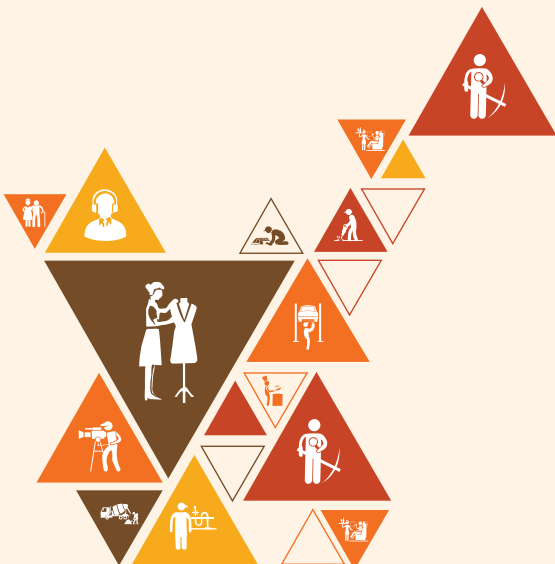
6. Manage Work, Resources and Safety at Workplace

Unit 6.1 - Workplace Health & Safety

Unit 6.2 - Importance of Safe Working Practices

Unit 6.3 - Optimal Utilisation of Resources

Unit 6.4 - Waste Management



TEL/N9104

Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. Explain about workplace health and safety
2. Differentiate various health hazards
3. Demonstrate various first-aid techniques
4. Importance of safety at the workplace
5. Understand Basic hygiene Practices and hand-washing techniques
6. Explain the need for social distancing
7. Understand the reporting of hazards at the workplace
8. Explain e-waste and the process of disposing of them
9. Explain the greening of jobs

Unit 6.1: Workplace Health & Safety

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Discuss about workplace safety
2. Explain workplace hazards and how to treat workplace hazards
3. Elaborate the process of reporting hazards
4. Demonstrate workplace hygiene
5. Explain ways to handle poor hygiene at the workplace

Resources to be Used

Presentation slides, Workplace safety manual, Visual aids depicting workplace hazards, First aid kit (for demonstration purposes), Examples of good workplace hygiene practices

Say

- Let us know about the importance of workplace safety and hygiene for the well-being of employees.
- We will discuss the concept of workplace safety, including the identification and prevention of hazards.
- We will know about common workplace hazards and the appropriate ways to treat them.
- We will be knowing about the process of reporting hazards and the importance of timely reporting for a safer work environment.
- We will know about the good workplace hygiene practices and their impact on health and safety.

Ask

- Share your experiences with workplace safety concerns and hazards?
- Discuss about the responsibility of each employee in maintaining a safe and hygienic work environment.

Do

- Conduct a demonstration on basic first aid procedures for common workplace injuries.
- Facilitate group discussions on real-life scenarios related to workplace safety and hygiene.

Elaborate

- Elaborate on the legal and ethical aspects of workplace safety and hygiene.
- Discuss the potential consequences of neglecting safety protocols and poor hygiene practices.

Demonstrate



- Demonstrate the correct way to handle and report workplace hazards.
- Showcase the proper use of personal protective equipment (PPE) for specific job roles.

Activity



1. Hazard Identification and Reporting

2. Objective: To enhance participants' understanding of workplace hazards and the importance of reporting them.

3. Type of Activity: Interactive group activity

4. Resources: Visual aids depicting workplace hazards, workplace safety manual, examples of good workplace hygiene practices

5. Duration of the Activity: 90 minutes

6. Instructions:

- Divide participants into small groups.
- Provide each group with scenarios depicting workplace hazards.
- Ask each group to identify the hazards and discuss how they would report and address them.
- Facilitate a group discussion where each group presents their findings and solutions.
- Conclude with a summary of key takeaways and emphasize the importance of proactive hazard reporting.

7. Outcome: Participants will gain practical experience in identifying and reporting workplace hazards, contributing to a safer and more hygienic work environment.

Notes for Facilitation



- Ensure that participants feel comfortable sharing their experiences and insights.
- Relate the discussion to specific workplace safety policies and procedures.
- Encourage a proactive approach to hazard reporting and resolution.
- Reinforce the importance of collective responsibility for maintaining a safe and healthy workplace.
- Provide additional resources for ongoing safety and hygiene training.

Unit 6.2: Importance of Safe Working Practices

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Understand the health hazards
2. Demonstrate First Aid Techniques

Resources to be Used

Presentation slides, visual aids on basic hygiene practices, guidelines on social distancing, demonstration materials for safe working practices

Say

- We will discuss about the importance of safe working practices for the well-being of employees and the overall workplace.
- Let us know about fundamental hygiene practices, including handwashing, respiratory etiquette, and cleanliness.
- We will discuss the significance of social distancing in preventing the spread of illnesses, especially in the context of contagious diseases.
- Let us discuss about specific safe working practices relevant to the participants' work environment.

Ask

- Share your experiences with maintaining safe working practices.
- What are the challenges faced in implementing safe practices and strategies for overcoming them.

Do

- Conduct hands-on demonstrations of basic hygiene practices, including proper handwashing techniques.
- Facilitate role-playing scenarios to practice social distancing and other safe working practices.

Elaborate

- Elaborate on the consequences of neglecting safe working practices, both for individual health and the broader workplace community.
- Discuss the role of each employee in ensuring a safe and healthy work environment.

Demonstrate



- Demonstrate the correct way to wear personal protective equipment (PPE), if applicable to the workplace.
- Showcase the proper implementation of social distancing measures within a work setting.

Activity



1. Safe Workplace Scenarios

2. **Objective:** To reinforce the importance of safe working practices through practical scenarios.

3. **Type of Activity:** Role-playing and group discussion

4. **Resources:** Guidelines on social distancing, demonstration materials for safe working practices, visual aids on basic hygiene practices, duration of the Activity: 60 minutes

5. Instructions:

- Divide participants into small groups.
- Provide each group with scenarios related to safe working practices, including hygiene and social distancing.
- Ask each group to discuss and demonstrate how they would address the scenarios while adhering to safe practices.
- Facilitate a group discussion where each group presents their solutions and discusses the importance of safe working practices.
- Conclude with a summary of key takeaways and encourage participants to apply these practices in their daily work routines.

6. **Outcome:** Participants will gain practical experience in applying safe working practices, fostering a culture of health and safety within the workplace.

Field Visit



1. Safety Scavenger Hunt

2. **Objective:** Reinforce the importance of safe working practices through practical application and observation.

3. **Type of Activity:** Interactive and Observational Field Visit.

4. **Resources:** Checklist of safety practices, safety equipment (if applicable), and observation sheets.

5. **Duration of the Activity:** Half a day.

6. Instructions:

- Preparation:
 - Prepare a checklist of basic hygiene practices and safety measures.
 - Identify key areas in the workplace relevant to safety (e.g., restrooms, workstations, common areas).
 - Ensure participants are familiar with safety equipment and emergency exits.
- Formation of Groups:
 - Divide participants into small groups.

- Scavenger Hunt:
 - Provide each group with a safety checklist and task them with a “Safety Scavenger Hunt” around the workplace.
 - Instruct participants to observe and document instances of basic hygiene practices, social distancing measures, and safe working practices.
 - Encourage them to take photos or make brief notes.
 - Discussion and Reflection:
 - Gather participants after the scavenger hunt.
 - Discuss the findings as a group. Ask each group to share their observations and discuss how each observed safety practice contributes to a safe working environment.
 - Facilitate a reflection session where participants can discuss any challenges or areas for improvement.
 - Demonstration Station:
 - Set up a demonstration station where participants can practice and demonstrate safe working practices (e.g., proper handwashing, correct use of personal protective equipment).
 - Allow participants to ask questions and seek clarification on safety practices.
- 7. Outcome:** Participants gain practical insights into basic hygiene practices, the importance of social distancing, and safe working practices through real-world observations. The scavenger hunt promotes active engagement and a deeper understanding of the safety measures in their workplace. The demonstration station allows for hands-on learning and clarification of any doubts.

Notes for Facilitation

- Emphasize the relevance of safe working practices to the current health context.
- Foster open communication for participants to share their thoughts and concerns.
- Relate the discussion to specific workplace policies and guidelines.
- Reinforce the importance of consistent adherence to safe practices for individual and collective well-being.
- Provide additional resources for ongoing training on workplace safety practices.

Unit 6.3: Optimal Utilisation of Resources

Unit Objectives

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

1. Discuss about efficient utilisation of material and water
2. State ways for efficient energy conservation

Resources to be Used

Presentation slides, Examples of efficient resource utilization practices, Visual aids on water and energy conservation, Case studies on successful resource management

Say

- We will emphasize on the importance of optimal resource utilization for sustainability and cost-effectiveness.
- Let us discuss strategies for efficient material usage and water conservation in various settings.
- We will discuss about ways to conserve energy and reduce wastage in daily operations.

Ask

- Can you share your experiences with resource utilization challenges in their work environment?
- Conduct a discussions on innovative solutions and best practices for optimizing resource use?

Do

- Conduct group activities where participants brainstorm and propose ideas for improving resource utilization in their specific contexts.
- Facilitate discussions on the environmental and economic benefits of optimal resource utilization.

Elaborate

- Elaborate on the impact of optimal resource utilization on cost savings, environmental sustainability, and corporate social responsibility.
- Discuss the interconnectedness of resource conservation with overall organizational efficiency and effectiveness.

Demonstrate

- Demonstrate practical ways to minimize waste in material usage, such as through recycling and repurposing.
- Showcase energy-efficient practices in lighting, equipment use, and heating/cooling systems.

Activity

1. Resource Efficiency Workshop

2. **Objective:** To enhance participants' understanding of efficient resource utilization and encourage the development of practical strategies for their work settings.

3. **Type of Activity:** Interactive workshop and group discussion

4. **Resources:** examples of efficient resource utilization practices, visual aids on water and energy conservation, case studies on successful resource management

5. **Duration of the Activity:** 90 minutes

6. Instructions:

- Begin with a presentation on the importance of optimal resource utilization and its impact on the organization.
- Divide participants into small groups and provide case studies or scenarios related to their specific work settings.
- Ask each group to discuss and propose practical strategies for optimizing material, water, and energy use.
- Facilitate a group discussion where each group shares their ideas and insights.
- Conclude with a summary of key takeaways and encourage participants to implement the discussed strategies in their work environment.

7. **Outcome:** Participants will gain practical insights into resource efficiency and develop actionable strategies to optimize material, water, and energy use in their workplaces.

Notes for Facilitation

- Encourage open dialogue and idea-sharing among participants.
- Relate the discussion to the organization's sustainability goals, if applicable.
- Provide examples of successful resource management initiatives in similar industries.
- Emphasize the long-term benefits of resource efficiency for both the organization and the environment.
- Encourage ongoing collaboration among participants to implement and evaluate resource efficiency strategies.

Unit 6.4: Waste Management

Unit Objectives

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

1. Understand what is e-waste
2. Understand the concept of waste management
3. Explain the process of recycling e-waste

Resources to be Used

Presentation slides, visual aids on e-waste and waste management, informational materials on recycling processes, samples of e-waste for demonstration

Say

- We will be highlighting the environmental impact of improper waste disposal and the need for effective waste management.
- Let us define electronic waste (e-waste) and discuss the challenges it poses to the environment.
- We will be explaining the broader concept of waste management, covering reduction, reuse, and recycling.
- We will learn about the detail the process of recycling e-waste and its importance for minimizing environmental harm.

Ask

- Do you have any experience and perspectives on waste disposal practices in their workplaces?
- Discuss on the challenges of e-waste disposal and ideas for improvement.

Do

- Conduct a hands-on demonstration of proper e-waste disposal methods and the sorting process for recycling.
- Facilitate group discussions on practical steps individuals can take to reduce e-waste.

Elaborate

- Elaborate on the potential hazards associated with incorrect disposal of electronic devices.
- Discuss the benefits of recycling e-waste, including resource conservation and pollution reduction.

Demonstrate

- Demonstrate the proper methods of disassembling and sorting electronic devices for recycling.
- Showcase examples of recycled products made from e-waste.

Activity

1. E-Waste Sorting Simulation

2. **Objective:** To enhance participants' understanding of the e-waste recycling process and encourage responsible waste management.

3. **Type of Activity:** Simulation and group discussion

4. **Resources:** Samples of e-waste for demonstration , visual aids on e-waste and waste management

5. **Duration of the Activity:** 60 minutes

6. Instructions:

- Begin with a brief presentation on the challenges of e-waste and the importance of proper recycling.
- Divide participants into small groups and provide them with simulated e-waste items (or images).
- Ask each group to discuss and categorize the items into those suitable for recycling and those requiring special disposal.
- Facilitate a group discussion where each group shares their categorization and reasoning.
- Conclude with a summary of key learnings and emphasize the significance of responsible e-waste management.

7. **Outcome:** Participants will gain hands-on experience in sorting e-waste for recycling, fostering a better understanding of responsible waste management practices.

Notes for Facilitation

- Ensure the availability of samples or images of e-waste for the simulation.
- Emphasize the importance of personal responsibility in waste reduction and recycling.
- Encourage participants to share insights and ideas for promoting responsible e-waste management in their workplaces.
- Provide information on local e-waste recycling facilities or programs.
- Reinforce the role of continuous education and awareness in fostering a culture of responsible waste management.

Answers to Exercises for PHB

Multiple Choice Questions

1. c. Central Pulmonary Resuscitation
2. a. Incineration
3. c. Composting
4. d. All of the above
5. a. Eyestrain

Answer the following:

1. Refer UNIT 6.2: Importance of Safe Working Practices
Topic - 6.2.3 Safe Workplace Practices
2. Refer UNIT 6.1: Workplace Hygiene and Safety
Topic - 6.1.1 Organisational Hazards
3. Refer UNIT 6.1: Workplace Hygiene and Safety
Topic - 6.1.5 Sanitising and Disinfecting Work Area
4. Refer UNIT 6.3: Optimal Utilisation of Resources
Topic - 6.3.1 Efficient Utilisation of Water
5. Refer UNIT 6.4: Waste Management
Topic - 6.4.7 Waste Disposal Methods



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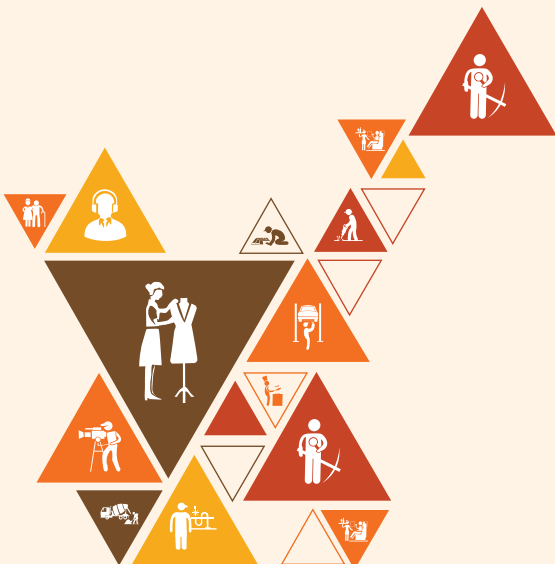


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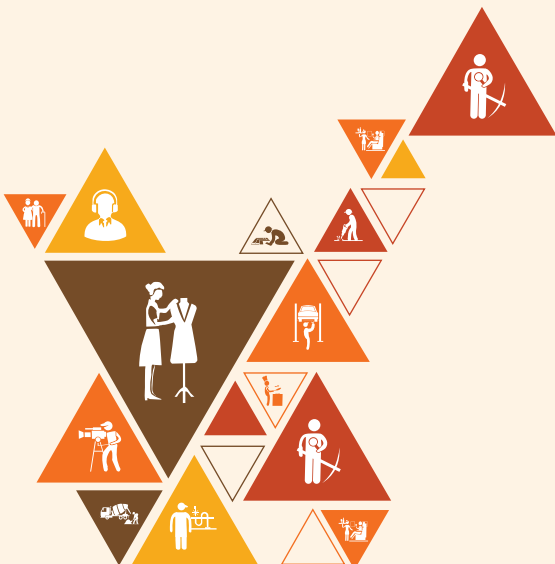


8. Annexures

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria

Annexure III: List of QR Codes Used in PHB



Annexure I

Training Delivery Plan

Training Delivery Plan			
Program Name:	System Architect - 5G Cloud RAN		
Qualification Pack Name & Ref. ID	System Architect - 5G Cloud RAN, TEL/Q6305, V2.0		
Version No.	2.0	Version Update Date	31/03/2022
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	<p>By the end of this program, the participants will be able to:</p> <ol style="list-style-type: none"> 1. Describe the process of preparing for the delivery of 5G Cloud RAN project. 2. Describe the process of selecting the appropriate hardware platform and environment for 5G Cloud RAN. 3. Demonstrate the process of managing orchestration, automation and RAN programmability. 4. Explain the importance of implementing effective communication and coordination at work. 5. Explain the importance of managing work and resources and ensuring health and safety at work. 		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the role of a System Architect – 5G Cloud RAN	Telecom industry overview	<ul style="list-style-type: none"> Describe the size and scope of the Telecom industry and its sub-sectors. Discuss the role and responsibilities of a System Architect - 5G Cloud RAN. 	Bridge Module	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit - Trainer Guide, Presentations, White-board, Marker, Projector, Laptop	7 Theory (05:00) Practical (02:00)
		Organisations and role of System Architect	<ul style="list-style-type: none"> Identify various employment opportunities for a System Architect – 5G Cloud RAN. Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR). 	Bridge Module			7 Theory (05:00) Practical (02:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Process of System Architect's workflow	<ul style="list-style-type: none"> Describe the process workflow in the organization and the role of a System Architect - 5G Cloud RAN in the process. List the various daily, weekly, monthly operations/activities that take place at the site under a System Architect - 5G Cloud RAN. 	Bridge Module			8 Theory (05:00) Practical (03:00)
		Roles and responsibilities of a System Architect	<ul style="list-style-type: none"> Role play based on case studies, outlining the scope, responsibilities, and challenges of a System Architect – 5G Cloud RAN. Analyse the requirements for the course and prepare for the pre-requisites of the course. 	Bridge Module			8 Theory (05:00) Practical (03:00)
2	Process of preparing for the delivery of 5G Cloud RAN project	Understanding Client Requirements for 5G Cloud RAN Project	<ul style="list-style-type: none"> Determine the interworking and compatibility of Cloud RAN with the existing and installed base of Radio Network. Describe the process of determining the client's requirements for the delivery of 5G Cloud RAN project and identifying relevant parameters and limitations. 	TEL/N6316 PC3, KU3	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit (Trainer Guide, Presentations). White-board, Marker, Projector, Laptop, RAN Software, Commercial off-the-shelf (COTS)	8 Theory (05:00) Practical (03:00)
		Formulating Strategies for 5G Cloud RAN Project	<ul style="list-style-type: none"> Analyze the client requirements to formulate appropriate strategies for the delivery of 5G Cloud RAN project. Develop appropriate strategies concerning Cloud delivery, DevOps, and SDLC automation according to organizational goals and standards. 	TEL/N6316 PC1, KU7		Server Hardware, Network Interface Cards.	8 Theory (04:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Estimating Resources and Budget Approval	<ul style="list-style-type: none"> Prepare the estimates for the required resources and coordinate with relevant personnel for the approval of the project budget. Describe the process of preparing estimates for required resources and obtaining approval for the project budget. 	TEL/N6316 PC4, KU5			8 Theory (04:00) Practical (04:00)
		Designing Cloud, DevOps, and SDLC Automation	<ul style="list-style-type: none"> Create the design and framework for Cloud, DevOps, and SDLC automation. Explain the process of creating the design and framework for initiatives on Cloud, DevOps, and SDLC automation. 	TEL/N6316 PC5, KU6			8 Theory (04:00) Practical (04:00)
		Vendor Product Analysis and Multi-vendor RAN Architecture	<ul style="list-style-type: none"> Analyze the vendor products and develop a multi-vendor open RAN architecture as per organizational requirements. Explain the process of analyzing vendor products and developing a multi-vendor RAN architecture as per organizational requirements. 	TEL/N6316 PC8, KU8			7 Theory (03:00) Practical (04:00)
		Mentoring and Guiding Infrastructure and DevOps Teams	<ul style="list-style-type: none"> Assist the infrastructure and DevOps team members by mentoring and guiding them concerning project objectives and delivery. Describe the importance of assisting the infrastructure and DevOps team members concerning the project objectives and delivery. 	TEL/N6316 PC9, KU9			7 Theory (03:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Support for Agile Projects and Infrastructure Needs	<ul style="list-style-type: none"> Provide support to agile projects concerning all their infrastructure and DevOps needs. Explain the process of providing support to agile projects concerning all their infrastructure and DevOps needs. 	TEL/N6316 PC10, KU10			7 Theory (03:00) Practical (04:00)
		Developing and Managing Test Automation Processes	<ul style="list-style-type: none"> Develop and manage the implementation of appropriate processes for test automation and service quality assurance. Describe the process of developing and managing the implementation of appropriate processes for test automation and service quality assurance. 	TEL/N6316 PC11, KU10			7 Theory (03:00) Practical (04:00)
		Coordination for Documentation on RAN Call Flows and KPIs	<ul style="list-style-type: none"> Coordinate with relevant personnel to prepare documents explaining RAN call flows and Key Performance Indicators (KPIs) for solution development. Explain the process of preparing documents explaining RAN call flows and KPIs to be used for solution development. 	TEL/N6316 PC12, KU11			8 Theory (03:00) Practical (05:00)
		Service Assurance and Test Automation Architecture Documents	<ul style="list-style-type: none"> Prepare service assurance architecture and test automation architecture documents. Describe the process of preparing service assurance architecture and test automation architecture documents. 	TEL/N6316 PC13, KU12			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Benefits of Open RAN Architecture Integration	<ul style="list-style-type: none"> Explain the benefits of making 5G RAN an open RAN architecture, allowing integration with the central unit packet core network through standard 3GPP defined protocols. 	TEL/N6316 KU1			8 Theory (03:00) Practical (05:00)
		Benefits of Edge Clouds for 5G Backhaul Connectivity	<ul style="list-style-type: none"> Explain the benefit of opting for edge clouds for 5G backhaul connectivity optimization, which are closer to the last mile delivery points, i.e., gNodeB, and allow for easy aggregation to the centralized cloud data center. 	TEL/N6316 KU2			8 Theory (03:00) Practical (05:00)
		Establishing the Importance of Interworking Compatibility	<ul style="list-style-type: none"> Describe the importance and process of determining the interworking and compatibility of Cloud RAN with the existing and installed base. Determine the interworking and compatibility of Cloud RAN with the existing and installed base of Radio Network. 	TEL/N6316 KU4, PC3			8 Theory (03:00) Practical (05:00)
		Ensuring Alignment with Organizational Goals and Standards	<ul style="list-style-type: none"> Develop appropriate strategies concerning Cloud delivery, DevOps, and SDLC automation according to organizational goals and standards. Develop appropriate strategies concerning Cloud delivery, DevOps, and SDLC automation according to organizational goals and standards. 	TEL/N6316 PC6, KU7			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Gaining Approval for Project Budget	<ul style="list-style-type: none"> Describe the process of preparing estimates for the required resources and getting approval for the project budget. Coordinate with relevant personnel for the approval of the project budget. 	TEL/N6316 PC4, KU5			8 Theory (03:00) Practical (05:00)
		Crafting Design and Framework for Automation Initiatives	<ul style="list-style-type: none"> Explain the process of creating the design and framework for initiatives on Cloud, DevOps, and SDLC automation. Create the design and framework for Cloud, DevOps, and SDLC automation. 	TEL/N6316 PC5, KU6			8 Theory (03:00) Practical (05:00)
		Analyzing Vendor Products and Architectural Development	<ul style="list-style-type: none"> Explain the process of analyzing vendor products and developing a multi-vendor RAN architecture as per organizational requirements. Analyze the vendor products and develop a multi-vendor open RAN architecture as per organizational requirements. 	TEL/N6316 PC8, KU8			8 Theory (03:00) Practical (05:00)
		Mentoring and Guiding Project Team Members	<ul style="list-style-type: none"> Describe the importance of assisting the infrastructure and DevOps team members concerning the project objectives and delivery. Assist the infrastructure and DevOps team members by mentoring and guiding them concerning project objectives and delivery. 	TEL/N6316 PC9, KU9			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Agile Project Support and Infrastructure Needs	<ul style="list-style-type: none"> Explain the process of providing support to agile projects concerning all their infrastructure and DevOps needs. Provide support to agile projects concerning all their infrastructure and DevOps needs. 	TEL/N6316 PC10, KU10			8 Theory (03:00) Practical (05:00)
		Managing Test Automation Processes	<ul style="list-style-type: none"> Describe the process of developing and managing the implementation of appropriate processes for test automation and service quality assurance. Develop and manage the implementation of appropriate processes for test automation and service quality assurance. 	TEL/N6316 PC11, KU10			8 Theory (03:00) Practical (05:00)
		Coordination for Documentation on RAN Call Flows and KPIs	<ul style="list-style-type: none"> Explain the process of preparing documents explaining RAN call flows and KPIs to be used for solution development. 	TEL/N6316 PC12, KU11			
			<ul style="list-style-type: none"> Coordinate with relevant personnel to prepare documents explaining RAN call flows and Key Performance Indicators (KPIs) for solution development. 				8 Theory (03:00) Practical (05:00)
		Preparing Service Assurance and Test Automation Architecture Documents	<ul style="list-style-type: none"> Describe the process of preparing service assurance architecture and test automation architecture documents. 	TEL/N6316 PC13, KU12			6 Theory (02:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Prepare service assurance architecture and test automation architecture documents. 				
3	Process of using the appropriate hardware platform and environment for 5G Cloud RAN	Understanding Cloud RAN Architecture and Deployment in 5G Networks	<ul style="list-style-type: none"> Explain the functioning of centralized and Cloud computing-based Cloud Radio Access Network (RAN) in 5G networks. 	TEL/N6317 KU1	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit (Trainer Guide, Presentations). White-board, Marker, Projector, Laptop, Radio Frequency Units, Non-Real Time RAN Intelligent Controller (Non-RT RIC), Near Real Time RAN Intelligent Controller (Near-RT RIC)	7 Theory (04:00) Practical (03:00)
		Virtualization of Cloud RAN Network Functions	<ul style="list-style-type: none"> Describe the process of virtualization of Cloud RAN 5G network functions using Network Functions Virtualization (NFV) and its platform relevance. Explain the use of Baseband Units (BBUs) by a Cloud RAN to convert digital signals to radio transmissions and vice versa. Explain the use of Radio Frequency Units (RFUs) in 5G Cloud RAN. 	TEL/N6317 KU2, KU3, KU4			7 Theory (04:00) Practical (03:00)
		Benefits of Cloud RAN Architecture	<ul style="list-style-type: none"> Describe the benefit of using Cloud RAN architecture for easy and economical deployment and scaling of 5G wireless networks and IoT. Explain the concept of BBU Hotel and how it helps lower the total cost of hardware cooling and power requirements, allowing for easier maintenance access and management of BBUs. 	TEL/N6317 KU5, KU6			7 Theory (04:00) Practical (03:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Virtualization's Impact on Wireless Networks	<ul style="list-style-type: none"> Explain how virtualization of network functions helps the scalability and flexibility of wireless networks, allowing for pooling and dynamic allocation of resources. 	TEL/N6317 KU7			8 Theory (04:00) Practical (04:00)
		Software Development in Cloud Computing and DevOps	<ul style="list-style-type: none"> Explain the process of software development, including cloud computing and DevOps activities. Ensure the use of the latest software development tools, techniques, and approaches. Monitor and ensure the recommended best practices are followed by the organization in Cloud computing, infrastructure as code, DevOps, CI/CD, and Release Engineering (RE). 	TEL/N6317 PC8, KU8, KU9			8 Theory (04:00) Practical (04:00)
		Cloud Service Providers and DevOps Practices	<ul style="list-style-type: none"> Explain the use of cloud services offered by different providers, such as Amazon, Azure Cloud Service, GCP, IBM Cloud, etc. Describe various DevOps practices and tools, system monitoring, and integration with logging and monitoring tools. Explain the process of implementing distributed applications in a container environment (Docker/Kubernetes) and application migration to Cloud. 	TEL/N6317 KU10, KU11, KU12			8 Theory (04:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Benefits of Cloud Infrastructure and Open Application Model (OAM)	<ul style="list-style-type: none"> Describe the benefits of using cloud infrastructure and Open Application Model (OAM). 	TEL/N6317 KU13			8 Theory (04:00) Practical (04:00)
		Challenges and Solutions in Server and Accelerator Selection	<ul style="list-style-type: none"> Explain the challenges concerning server and accelerator selection, capacity dimensioning, power efficiency planning, and security planning, and how to overcome them. 	TEL/N6317 KU14			8 Theory (04:00) Practical (04:00)
		Cloud Native Service Management and Orchestration (SMO)	<ul style="list-style-type: none"> Describe the benefits of introducing Cloud Native Service Management and Orchestration (SMO) in parallel to the network to bring RAN programmability. 	TEL/N6317 KU15			8 Theory (04:00) Practical (04:00)
		Architectural Solutions with Public Cloud Services	<ul style="list-style-type: none"> Explain the process of finding deep architectural solutions using AWS, Azure, GCP, IBM Cloud services in IaaS, PaaS, etc. Explain the public cloud network and security capabilities/services across AWS, GCP, Azure, etc. Describe the process of implementing DevOps architectural framework for cloud platform and applications, resiliency/disaster recovery, micro-services, and other PaaS services. Explain the process of architecting solutions within a public cloud. 	TEL/N6317 KU16, KU17, KU18, KU19, KU20			8 Theory (04:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Explain the use of Cloud CLI, APIs, CloudFormation templates and Management Console, Monitoring and Logging, Cloud Optimization, Security Services Cloud Build Services, Cloud Migration (CSP to CSP, On-premises to CSP), Cloud Managed Services, CSPs, and costing. 				
		DevOps Tool Chain and Automation	<ul style="list-style-type: none"> Describe the process of creating DevOps tool chain using DevOps tools. Explain the process of automation using Python or shell scripting 	TEL/N6317 KU21, KU22			8 Theory (04:00) Practical (04:00)
		Hardware and Virtualization Environment Selection	<ul style="list-style-type: none"> Describe the process of selecting the appropriate hardware platform and the virtualization environment, such as COTS server hardware with processors, NICs, and hardware accelerators. Select the appropriate hardware platform and the virtualization environment such as COTS server hardware with processors, Network Interface Cards (NICs), and hardware accelerators. 	TEL/N6317 PC1, KU23			8 Theory (04:00) Practical (04:00)
		Configuring Servers Based on Workload Demands	<ul style="list-style-type: none"> Explain the process of setting appropriate server configurations based on workload demands for Distributed Units (DUs). 	TEL/N6317 PC2, KU24			8 Theory (04:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Set appropriate server configurations based on workload demands for Distributed Units (DUs). 				
		Utilizing Accelerators for Layer One Pipeline Functions	<ul style="list-style-type: none"> Describe the process of using accelerators to manage layer one pipeline functions to meet the demands of large MIMO radios. Use accelerators to manage layer one pipeline functions and meet the demands of large Multiple Input, Multiple Output (MIMO) radios. 	TEL/N6317 PC3, KU25			8 Theory (04:00) Practical (04:00)
		Cloud RAN Lifecycle Management and DevOps Principles	<ul style="list-style-type: none"> Explain the process of performing Cloud RANs independent lifecycle management and the relevant DevOps principles and CI/CD. Perform cloud RAN independent lifecycle management following the DevOps principles and Continuous Integration (CI) and Continuous Deployment (CD). 	TEL/N6317 PC5, KU26			7 Theory (03:00) Practical (04:00)
		Scaling RAN Micro-services with Cloud Native Architecture	<ul style="list-style-type: none"> Explain the process of using the Cloud-native architecture and its software modularity to increase/scale component RAN micro-services. 	TEL/N6317 KU27			7 Theory (03:00) Practical (04:00)
		Application-level Reliability and Network Automation	<ul style="list-style-type: none"> Explain the appropriate measures to achieve application-level reliability with platform abstraction, along with simplified operations and maintenance with network automation. 	TEL/N6317 PC7, KU28			7 Theory (03:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Follow the appropriate measures to achieve application-level reliability with platform abstraction, along with simplified operations and maintenance with network automation. 				
		Continuous Monitoring and Best Practices	<ul style="list-style-type: none"> Monitor and ensure the recommended best practices are followed by the organization in Cloud computing, infrastructure as code, DevOps, CI/CD, and Release Engineering (RE). 	TEL/N6317 KU9			8 Theory (03:00) Practical (05:00)
		Continuous Improvement with Latest Software Development Tools	<ul style="list-style-type: none"> Ensure the use of the latest software development tools, techniques, and approaches. 	TEL/N6317 PC8			8 Theory (03:00) Practical (05:00)
		Cloud RAN Lifecycle Management and DevOps Principles	<ul style="list-style-type: none"> Explain the process of performing Cloud RAN's independent lifecycle management and the relevant DevOps principles and CI/CD. Perform cloud RAN independent lifecycle management following the DevOps principles and Continuous Integration (CI) and Continuous Deployment (CD). 	TEL/N6317 PC5, KU26			8 Theory (03:00) Practical (05:00)
		Ensuring Application-level Reliability and Network Automation	<ul style="list-style-type: none"> Explain the appropriate measures to achieve application-level reliability with platform abstraction, along with simplified operations and maintenance with network automation. 	TEL/N6317 PC7, KU28			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Follow the appropriate measures to achieve application-level reliability with platform abstraction, along with simplified operations and maintenance with network automation. 				
		Monitoring and Ensuring Best Practices	<ul style="list-style-type: none"> Monitor and ensure the recommended best practices are followed by the organization in Cloud computing, infrastructure as code, DevOps, CI/CD, and Release Engineering (RE). 	TEL/N6317 KU9			8 Theory (03:00) Practical (05:00)
4	Process of managing orchestration, automation and RAN programmability	Orchestrating Network Functions in Cloud RAN and 5G Core Part 1	<ul style="list-style-type: none"> Describe the process of using orchestration systems to manage PNF, VNF, CNF, and end-to-end life cycle management of services across Cloud RAN, and 5G core and underlying cloud infrastructure. Use orchestration systems to manage Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF), and end-to-end life cycle management of services across Cloud RAN and 5G core and underlying cloud infrastructure. 	TEL/N6318 KU1, PC1	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop, Open Radio Unit (O-RU), Open Distributed Unit (O-DU), Open Centralized Unit (O-CU), RAN Controller, RF Cable	7 Theory (03:00) Practical (04:00)
		Orchestrating Network Functions in Cloud RAN and 5G Core Part 2					7 Theory (03:00) Practical (04:00)
		Orchestrating Network Functions in Cloud RAN and 5G Core Part 3					7 Theory (03:00) Practical (04:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Managing Hybrid Network Functions in RAN Part 1	<ul style="list-style-type: none"> Explain the process of performing Cloud RAN management to manage hybrid network functions in RAN. 	TEL/N6318 PC2, KU2			7 Theory (03:00) Practical (04:00)
		Managing Hybrid Network Functions in RAN Part 2	<ul style="list-style-type: none"> Perform Cloud RAN management to manage hybrid network functions in RAN. 				8 Theory (04:00) Practical (04:00)
		Managing Hybrid Network Functions in RAN Part 3					8 Theory (03:00) Practical (05:00)
		Enabling Programmable Networks with Cloud RAN Part 1	<ul style="list-style-type: none"> Describe the process of using Cloud RAN to enable programmable networks and model-driven management and orchestration systems. 	TEL/N6318 PC3, KU3			8 Theory (03:00) Practical (05:00)
		Enabling Programmable Networks with Cloud RAN Part 2	<ul style="list-style-type: none"> Use Cloud RAN to enable programmable networks and model-driven management and orchestration systems. 				8 Theory (03:00) Practical (05:00)
		Cloud RAN Automation for 5G Network Services	<ul style="list-style-type: none"> Explain the process of carrying out Cloud RAN automation, management, and orchestration to deliver 5G network services across various industries. Carry out Cloud RAN automation, management, and orchestration to deliver 5G network services across various industries. 	TEL/N6318 PC4, KU4			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Selecting Appropriate Cloud Infrastructure Part 1	<ul style="list-style-type: none"> Describe the process of evaluating key use cases and deployment scenarios to select the appropriate cloud infrastructure, including infrastructure hardware, cloud platform, and RAN applications. Evaluate key use cases and deployment scenarios to select the appropriate cloud infrastructure, including infrastructure hardware, cloud platform, and RAN applications. 	TEL/N6318 PC5, KU5			8 Theory (03:00) Practical (05:00)
	Selecting Appropriate Cloud Infrastructure Part 2	8 Theory (03:00) Practical (05:00)					
	Selecting Appropriate Cloud Infrastructure Part 3	8 Theory (03:00) Practical (05:00)					
		Enabling Interworking of Cloud RAN Part 1	<ul style="list-style-type: none"> Explain the process of enabling interworking of Cloud RAN with the existing and installed base of Radio Network resources. Follow appropriate measures to enable interworking of Cloud RAN with the existing and installed base. 	TEL/N6318 PC6, KU6			8 Theory (03:00) Practical (05:00)
		Enabling Interworking of Cloud RAN Part 2					8 Theory (02:00) Practical (06:00)
		Virtualization of Central Unit (CU)-User Plane (UP) Part 1	<ul style="list-style-type: none"> Describe the process of carrying out virtualization of CU-User Plane for flexible distributed edge placement of vCU-UP and Virtual User Plane Function (VUPF). Carry out virtualization of Central Unit (CU)-User Plane (UP) for flexible distributed edge placement of vCU-UP and VUPF. 	TEL/N6318 KU7, PC7			8 Theory (02:00) Practical (06:00)
		Virtualization of Central Unit (CU)-User Plane (UP) Part 2					8 Theory (02:00) Practical (06:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Cloud-native Realization of CU-CP and CU-UP Part 1	<ul style="list-style-type: none"> Explain the process of cloud-native realization of CU-CP and CU-UP, providing independent scaling for centralized control and user planes and creating locational flexibility in deployments. Follow appropriate measures for full cloud-native realization of both CU-CP and CU-UP, providing independent scaling for centralized control and user planes and creating locational flexibility in deployments. 	TEL/N6318 PC8, KU8			8 Theory (02:00) Practical (06:00)
		Cloud-native Realization of CU-CP and CU-UP Part 2					8 Theory (02:00) Practical (06:00)
5	Process of implementing Effective Interaction at work-place	Communication and Team Coordination	<ul style="list-style-type: none"> Interpret work requirements from the superior and customers. Report any unforeseen disruptions or delays to superiors and/or concerned persons. Explain the work requirements and the scope of work to the team. Communicate information using different techniques such as face-to-face, telephonic, and written means. Coordinate with the team to integrate work as per requirements. 	TEL/N9103 PC1, PC2, PC4, PC5, PC6	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop, Personal Protective Equipment, Hygiene Equipment and Materials like Sanitizer, Soap, Mask, etc.	8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Team Collaboration and Conflict Resolution	<ul style="list-style-type: none"> Respect colleagues and customers and communicate, taking care of their personal spaces. Find solutions to work-related difficulties with mutual agreement with colleagues and customers. Resolve conflicts within the team at work to achieve smooth workflow. Motivate team members to put organizational goals over individual goals. Encourage the team to provide feedback on any issues facing them. 	TEL/N9103 PC7, PC8, PC9, PC10, PC11			8 Theory (03:00) Practical (05:00)
		Sensitivity and Inclusivity	<ul style="list-style-type: none"> Ensure personal behavior of self and team is conducted, taking gender and disability of the person into consideration. Demonstrate sensitivity towards gender and persons with disabilities while communicating. List the different types of disabilities with their respective issues. Provide help to PwD team members in overcoming any challenges faced in work. Use inclusive language irrespective of the disability and the gender of the person. 	TEL/N9103 PC12, PC13, PC14, PC15, PC16			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Workplace Legislation and Awareness	<ul style="list-style-type: none"> • Treat all colleagues and co-workers equally. • Respect the personal space of colleagues and co-workers. • Explain the importance of effective and different means of communication and establishing good working relationships with colleagues and superiors. • Explain the importance of helping colleagues with problems to meet quality and time standards as a team. • Describe different methods of communication. • Explain different types of information that colleagues might need and the importance of providing this information in an appropriate manner. • Describe helping colleagues with problems to meet quality and time standards as a team. • Explain organization's policies and procedures for working with colleagues and superiors. • Describe implications of own work on the work and schedule of others. • Explain the importance of understanding consequences of gender-based behavior. 	TEL/N9103 PC17, PC18, KU1, KU2, KU3, KU4, KU5, KU6, KU7, KU8			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
6	Process of Manage Work, Resources and Safety at the workplace	Skill De-velopment and Team Training	<ul style="list-style-type: none"> Develop technical and personal skills to be updated with new technologies prevalent in the industry. Train the team to adapt the latest products/services in their working environment. Describe strategies pertinent to the field that can be used to pursue an advancement of skills. Explain key performance indicators for the new tasks. 	TEL/N9104 PC1, PC2, KU1, KU2	Classroom lecture/ PowerPoint Presentation/ Question & Answer and Group Discussion	Training Kit (Trainer Guide, Presentations). White-board, Marker, Projector, Laptop, Relevant stationery, First Aid Kit and Equipment used in Medical Emergencies.	8 Theory (03:00) Practical (05:00)
		Team Building and Task Management	<ul style="list-style-type: none"> Identify opportunities for team-building workshops and motivational trainings. Guide the team to be accountable for the timely completion of tasks. Analyse problems accurately to be able to correctly suggest suitable solutions to the concerned persons. Train the team to estimate the cause of the problem and validate. Implement ways to keep the immediate as well as the team's work area clean and tidy. Maintain efficiency and productivity while performing the role/responsibility. Explain feedback processes and formats. Describe timelines and goals as well as their relevance to work allocated. 	TEL/N9104 PC3, PC4, PC5, PC6, PC7, PC8, KU3, KU4			8 Theory (03:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Health, Safety, and Security Procedures	<ul style="list-style-type: none"> Supervise the team to ensure that the work is done as per the assigned and agreed requirements. Create schedules and rosters for the team to ensure they understand individual work requirements. Identify the organization's health, safety, security policies, and procedures. Instruct the team to report any identified breaches in health, safety, and security policies and procedures to the designated person. Manage hazards such as illness, accidents, fires, or any other natural calamity safely, as per the organization's emergency procedures, within the limits of individual's authority. Report any hazard outside the individual's authority to the relevant person in line with organizational procedures and warn others who may be affected. Explain the importance of quality and timely delivery of the product/service. Describe the layout of the workstation and equipment used. Explain the escalation matrix and its importance, especially in case of emergencies. Describe ways of time and cost management. 	TEL/N9104 PC9, PC10, PC11, PC12, PC13, PC14, KU5, KU6, KU7, KU8			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Resource Optimization and Electrical Safety	<ul style="list-style-type: none"> Implement ways to optimize the usage of material, including water, in various tasks/activities/processes. Supervise the team to ensure responsible use of resources. Motivate the team to carry out routine cleaning of tools, machines, and equipment. Guide the team to optimize the use of electricity/energy in various tasks/activities/processes. Implement periodic checks of the functioning of the equipment/machine and rectify wherever required. Guide the team to report malfunctioning and lapses in maintenance of equipment. Implement ways to use electrical equipment and appliances properly. Explain rules/regulations for maintaining health and safety at the workplace. Define the meaning of hazard, different types of health and safety hazards found in the workplace, risks and threats based on the nature of work. 	TEL/N9104 PC15, PC16, PC17, PC18, PC19, PC20, PC21, KU9, KU10, KU11, KU12, KU13			7 Theory (02:00) Practical (05:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			<ul style="list-style-type: none"> Describe procedures to report breaches in health, safety, and security. Explain ways of managing resources and material efficiently. Describe ways to recognize common electrical problems and common practices of conserving electricity. 				
Total Duration							Theory: 240:00 Practical: 330:00
Employability Skills (DGT/VSQ/N0101) (https://www.skillindiadigital.gov.in/content/list)							90:00
OJT							120:00
Total Duration							Theory + Practical + ES + OJT = 780:00

Annexure II

Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for System Architect – 5G Cloud RAN	
Job Role	System Architect – 5G Cloud RAN
Qualification Pack	TEL/Q6305, V2.0
Sector Skill Council	Telecom Sector Skill Council

S. No.	Guidelines for Assessment
1	The assessment for the theory part will be based on knowledge bank of questions approved by the SSC.
2	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/ Set of NOS.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
5	To pass the Qualifications File, every trainee should score a minimum of 50% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

Assessment Outcomes	Assessment Criteria for Outcomes	Marks Allocation		
		Theory	Practical	Viva
TEL/N6316: Prepare for the Delivery of 5G Cloud RAN Project	PC1. analyse the client requirements to formulate appropriate strategies for the delivery of 5G Cloud RAN project	3	4	2
	PC2. identify the relevant parameters and limitations to the delivery of 5G cloud RAN project	2	3	2
	PC3. determine the interworking and compatibility of Cloud RAN with the existing and installed base of Radio Network	2	4	2
	PC4. prepare the estimates for the required resources and coordinate with the relevant personnel for the approval of the project budget	2	5	1
	PC5. create the design and framework for Cloud, DevOps and Software Development Life Cycle (SDLC) automation	3	4	1
	PC6. develop appropriate strategies concerning Cloud delivery, DevOps and SDMC automation according to the organisational goals and standards	3	4	1
	PC7. collect inputs for gNodeB integration with the central units	2	2	1
	PC8. analyse the vendor products and develop a multi-vendor open RAN architecture as per the organisational requirements	4	4	1
	PC9. assist the infrastructure and DevOps team members by mentoring and guiding them concerning the project objectives and delivery	4	5	1

	PC10. provide support to agile projects concerning all their infrastructure and DevOps needs	2	4	1
	PC11. develop and manage the implementation of appropriate processes for test automation and service quality assurance	3	4	1
	PC12. coordinate with the relevant personnel to prepare documents explaining RAN call flows, and Key Performance Indicators (KPIs) to be used for solution development	3	4	1
	PC13. prepare service assurance architecture and test automation architecture documents	2	3	-
	NOS Total	35	50	15
TEL/N6317: Use the appropriate hardware platform and environment for 5G Cloud RAN	PC1. select the appropriate hardware platform and the virtualization environment such as COTS server hardware with processors, Network Interface Cards (NICs) and hardware accelerators	5	5	2
	PC2. set appropriate server configurations based on workload demands for Distributed Units (DUs)	2	4	2
	PC3. use accelerators to manage layer one pipeline functions and meet the demands of large Multiple Input, Multiple Output (MIMO) radios	3	4	2
	PC4. use the appropriate Cloud native technologies, such as Kubernetes and apply DevOps principles to realise RAN functions as micro-services in containers over bare metal servers	4	8	2
	PC5. perform cloud RAN independent life cycle management following the DevOps principles and Continuous Integration (CI) and Continuous Deployment (CD)	4	8	2
	PC6. utilize the Cloud native architecture and its software modularity to increase/ scale component RAN micro-services	2	8	2
	PC7. follow the appropriate measures to achieve application-level reliability with platform abstraction, along with simplified operations and maintenance with network automation	4	8	-
	PC8. ensure the use of the latest software development tools, techniques and approaches	2	4	1
	PC9. monitor and ensure the recommended best practices are followed by the organization in Cloud computing, infrastructure as code, DevOps, CI/CD and Release Engineering (RE)	4	6	2
		NOS Total	30	55
TEL/N6318: Manage orchestration, automation, and RAN programmability	PC1. use the orchestration systems to manage Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF) and end-to-end life cycle management of services across Cloud RAN and 5G core and underlying cloud infrastructure	5	8	1
	PC2. perform Cloud RAN management to manage hybrid network functions in RAN	2	4	1
	PC3. use cloud RAN to enable programmable networks and model-driven management and orchestration systems	3	5	1
	PC4. carry out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries for IoT and other use cases	3	6	2
	PC5. evaluate the key use cases and deployment scenarios to select the appropriate cloud infrastructure including infrastructure hardware, cloud platform and RAN applications that will be hosted on it	4	8	3
	PC6. follow the appropriate measures to enable interworking of Cloud RAN with the existing and installed base	4	8	2

	PC7. carry out virtualization of Central Unit (CU)- User Plane (UP) for flexible distributed edge placement of VCU-UP and Virtual User Plane Function (VUPF)	5	10	2
	PC8. follow the appropriate measures for full Cloud-native realisation of both CU-CP and CU-UP, providing independent scaling for centralized control and user planes and creating locational flexibility in deployments	4	6	3
	NOS Total	30	55	15
TEL/N9103: Implement Effective Interaction at workplace	PC1. interpret work requirements from the superior and customers	1	2	-
	PC2. report any unforeseen disruptions or delays to superiors and/or concerned person	1	2	1
	PC3. achieve productivity and quality of work as per the company procedure	-	5	-
	PC4. explain the work requirements and the scope of work to the team	2	3	-
	PC5. communicate information using different techniques such as face-to-face, telephonic and written means	2	4	1
	PC6. co-ordinate with team to integrate work as per requirements	-	4	1
	PC7. respect colleagues and customers and communicate taking care of their personal spaces	-	3	-
	PC8. find solutions to work related difficulties with mutual agreement with colleagues and customers	3	3	-
	PC9. resolve conflicts within the team at work to achieve smooth workflow	-	4	1
	PC10. motivate team members to put organizational goals over individual goals	3	4	1
	PC11. encourage the team to provide feedback on any issues facing them	3	2	1
	PC12. ensure personal behaviour of self and team is conducted taking gender and disability of the person into consideration	2	4	-
	PC13. demonstrate sensitivity towards gender and person with disability while communicating	2	3	1
	PC14. list the different types of disabilities with their respective issues	2	3	1
	PC15. provide help to PwD team members in overcoming any challenges faced in work	2	3	-
	PC16. use inclusive language irrespective of the disability and the gender of the person	2	3	1
	PC17. treat all colleagues and co-workers equally	2	3	-
		PC18. respect personal space of colleagues and co-workers	3	5
	NOS Total	30	60	10
TEL/N9104: Manage Work, Resources and Safety at workplace	PC1. develop technical and personal skills to be updated with new technologies prevalent in the industry	2	1	-
	PC2. train the team such that they are able to adapt latest products/ services in their working environment	1	2	-
	PC3. identify opportunities for team building workshops and motivational trainings	1	2	-
	PC4. guide the team to be accountable for timely completion of tasks	2	3	-
	PC5. analyse problems accurately to be able to correctly suggest suitable solutions to the concerned persons	1	2	-






	PC6. train the team to estimate the cause of the problem and validate	1	2	-
	PC7. implement ways to keep immediate as well as team's work area clean and tidy	1	2	-
	PC8. maintain efficiency and productivity while performing role/responsibility	1	2	2
	PC9. supervise the team to ensure that the work is done as per the assigned and agreed requirements	1	2	1
	PC10. create schedules and rosters for the team to ensure they understand individual work requirements	2	3	1
	PC11. identify organisation's health, safety, security policies and procedures	3	3	-
	PC12. instruct team to report any identified breaches in health, safety, and security policies and procedures to the designated person	3	3	-
	PC13. manage hazards such as illness, accidents, fires or any other natural calamity safely, as per organisation's emergency procedures, within the limits of individual's authority	3	4	1
	PC14. report any hazard outside the individual's authority to the relevant person in line with organisational procedures and warn others who may be affected	3	3	1
	PC15. implement ways to optimize usage of material including water in various tasks/activities/processes	1	2	1
	PC16. supervise the team to ensure responsible use of resources	2	2	1
	PC17. motivate the team to carry out routine cleaning of tools, machine and equipment	2	2	1
	PC18. guide the team to optimize use of electricity/energy in various tasks/activities/processes	3	4	-
	PC19. implement periodic checks of the functioning of the equipment/machine and rectify wherever required	2	2	1
	PC20. guide the team to report malfunctioning and lapses in maintenance of equipment	3	2	-
	PC21. implement ways to use electrical equipment and appliances properly	2	2	-
	NOS Total	40	50	10
DGT/VSQ/N0103: Employability Skills (90 Hours)	Introduction to Employability Skills	1	1	-
	PC1. understand the significance of employability skills in meeting the current job market requirement and future of work	-	-	-
	PC2. identify and explore learning and employability relevant portals	-	-	-
	PC3. research about the different industries, job market trends, latest skills required and the available opportunities	-	-	-
	Constitutional values – Citizenship	1	1	-
	PC4. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-
	PC5. follow environmentally sustainable practices	-	-	-
Becoming a Professional in the 21st Century	1	3	-	
PC6. recognize the significance of 21st Century Skills for employment	-	-	-	






PC7. practice the 21st Century Skills such as Self- Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-
PC8. adopt a continuous learning mindset for personal and professional development	-	-	-
Basic English Skills	3	4	-
PC9. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-
PC10. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-
PC11. write short messages, notes, letters, e-mails etc. in English	-	-	-
Career Development & Goal Setting	1	2	-
PC12. identify career goals based on the skills, interests, knowledge, and personal attributes	-	-	-
PC13. prepare a career development plan with short- and long-term goals	-	-	-
Communication Skills	2	2	-
PC14. follow verbal and non-verbal communication etiquette while communicating in professional and public settings	-	-	-
PC15. use active listening techniques for effective communication	-	-	-
PC16. communicate in writing using appropriate style and format based on formal or informal requirements	-	-	-
PC17. work collaboratively with others in a team	-	-	-
Diversity & Inclusion	1	1	-
PC18. communicate and behave appropriately with all genders and PwD	-	-	-
PC19. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-
Financial and Legal Literacy	2	3	-
PC20. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.	-	-	-
PC21. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook	-	-	-
PC22. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-
PC23. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-
Essential Digital Skills	3	5	-
PC24. operate digital devices and use their features and applications securely and safely	-	-	-
PC25. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.	-	-	-
PC26. display responsible online behaviour while using various social media platforms	-	-	-
PC27. create a personal email account, send and process received messages as per requirement	-	-	-






PC28. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications	-	-	-
PC29. utilize virtual collaboration tools to work effectively	-	-	-
Entrepreneurship	2	3	-
PC30. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-
PC31. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-
PC32. identify sources of funding, anticipate, and mitigate any financial/legal hurdles for the potential business opportunity	-	-	-
Customer Service	1	2	-
PC33. identify different types of customers and ways to communicate with them	-	-	-
PC34. identify and respond to customer requests and needs in a professional manner	-	-	-
PC35. use appropriate tools to collect customer feedback	-	-	-
PC36. follow appropriate hygiene and grooming standards	-	-	-
Getting ready for apprenticeship & Jobs	2	3	-
PC37. create a professional Curriculum vitae (Résumé)	-	-	-
PC38. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-
PC39. apply to identified job openings using offline /online methods as per requirement	-	-	-
PC40. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-
PC41. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-
NOS Total	20	30	-






Annexure III

List of QR Codes Used in PHB

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
Module 1: Introduction to the role of a System Architect – 5G Cloud RAN	Unit 1.1: Introduction to C-RAN	1.1.1 Understanding Cloud RAN (C-RAN) in 5G Network Architecture	22	https://www.youtube.com/watch?v=UteidGTgPC0	 Virtualized RAN, Cloud RAN, and Open RAN
		1.1.3 Virtual RAN	22	https://www.youtube.com/watch?v=pVIHgTzq8y4	 Virtual RAN and Open RAN
	Unit 1.2: Understanding the Telecom Industry and System Architect Role	1.2.1 Size and scope of the Telecom industry in India	22	https://www.youtube.com/watch?v=T2SaEuF6i1M&t=62s	 Evolution of Telecom Industry in India
		1.2.4 Workflow in the organization and the role of a System Architect – 5G Cloud RAN in the process	22	https://www.youtube.com/watch?v=5nvjQvy_Cbg	 Systems Architect & Systems Engineer
Module 2: Process of preparing for the delivery of 5G Cloud RAN project	Unit 2.1 Understanding Client Requirements and Project Preparation	2.1.3 Process of developing appropriate strategies concerning Cloud delivery, DevOps, and SDMC automation	42	https://www.youtube.com/watch?v=Xrgk023l4ll	 What Is DevOps?

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
	Unit 2.2 Implementation and Service Quality Assurance	2.2.6 Importance of multi-vendor RAN architecture	42	https://www.youtube.com/watch?v=AskCWzlesFg	 Different Types of RAN Architectures
Module 3: Process of using the appropriate hardware platform and environment for 5G Cloud RAN	Unit 3.1: Cloud RAN Fundamentals and Virtualization	3.1.3 Baseband Units (BBUs) in Cloud RAN	94	https://www.youtube.com/watch?v=YhiokNRuyM	 Base band unit in BTS
		3.1.4 Radio Frequency Units (RFUs) in Cloud RAN	94	https://www.youtube.com/watch?v=FVmTooGICNc	 What is RF?
	Unit 3.2: Cloud RAN Architecture and Implementation	3.2.3 Virtualization and Wireless Network Scalability	94	https://www.youtube.com/watch?v=ABrXGwNsFfA	 Network Virtualization
	Unit 3.3: Cloud RAN Deployment and Optimization	3.3.1 Software Development and DevOps Processes	94	https://www.youtube.com/watch?v=BPJ1RuBRJLQ	 What is Infrastructure as Code(IaC)?

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
	Unit 3.4: Cloud RAN Integration and Optimization	3.4.4 Automation and Hardware Configuration	94	https://www.youtube.com/watch?v=Ma-NBj_1e-0	 <p>What is Open Radio Access Network (Open RAN)</p>
Module 4: Process of managing orchestration, automation and RAN programmability	Unit 4.2: Cloud-Native Implementation and Virtualization	4.2.1 Cloud-Native Realization and Scalability in Cloud RAN	112	https://www.youtube.com/watch?v=gx8VTa1c8DA	 <p>Cloud Run Overview</p>
5. Communication and Interpersonal Skills	5.1: Personal Hygiene and Dress Code	5.1.1 Personal Hygiene and Grooming	134	https://www.youtube.com/watch?v=3Zlcmzp9oTI	 <p>Disease Transmission</p>
	5.2: Importance of Effective Communication and Interpersonal skills	5.2.1 What is Communication?	134	https://www.youtube.com/watch?v=RkebtEk2zU0	 <p>What is Communication?</p>
		5.2.2 Importance of Effective Communication	134	https://www.youtube.com/watch?v=I6IAhXM-vps	 <p>CICD Pipeline To Deploy To Kubernetes Cluster Using Jenkins</p>

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
	5.3: Gender and PwD Sensitisation	5.3.2 Guidelines for Gender Neutral Behavior at Workplace	134	https://www.youtube.com/watch?v=uHYuDDHvU64	 Diversity and Inclusion in the Workplace
6. Manage Work, Resources and Safety at Workplace	6.1: Workplace Hygiene and Safety	6.1.1 Organisational Hazards	162	https://www.youtube.com/watch?v=2B823bEBKGU	 Understanding Disasters, Hazards, Risk and Vulnerability
		6.1.5 Sanitising and Disinfecting Work Area	162	https://www.youtube.com/watch?v=3Z1cmzp9oTI	 Disease Transmission
	6.4: Waste Management	6.4.9 Source of Pollution	162	https://www.youtube.com/watch?v=qS8mfAX1tAk	 Environment Pollution
Employability Skills				https://www.skillindiadigital.gov.in/content/list	



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