Model Curriculum

QP Name: System Architect – 5G Cloud RAN

QP Code: TEL/Q6305

Version: 1.0

NSQF Level: 6

Model Curriculum Version: 1.0

Telecom Sector Skill Council || 3rd Floor, Plot No 126, Sector – 44, Gurgaon - 122003

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Training Parameters

Sector	Telecom
Sub-Sector	Network Managed Services
Occupation	Project Engineering
Country	India
NSQF Level	6
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NA
Minimum Educational Qualification and Experience	Post-Graduate in relevant field **OR** B.E./B.Tech (Electronics/Telecom /IT and other relevant fields) with 1 years of relevant experience **OR** Graduate in the relevant filed with 2 years of relevant experience **OR** Diploma after Class 12th (3 years in Electronics/Telecom /IT and other relevant fields) with 2 years of relevant experience **OR** Certified in NSQF-L5 5G Project Engineer with 2 years of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	22 Years
Last Reviewed On	31/03/2022
Next Review Date	31/03/2026
NSQC Approval Date	31/03/2022
QP Version	1.0
Model Curriculum Creation Date	31/03/2022
Model Curriculum Valid Up to Date	31/03/2026
Model Curriculum Version	1.0
Minimum Duration of the Course	690 Hours
Maximum Duration of the Course	690 Hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills to:

- Describe the process of preparing for the delivery of 5G Cloud RAN project.
- Describe the process of selecting the appropriate hardware platform and environment for 5G Cloud RAN.
- Demonstrate the process of managing orchestration, automation and RAN programmability.
- Explain the importance of implementing effective communication and coordination at work.
- Explain the importance of managing work and resources and ensuring health and safety at work.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module	**08:00**	**04:00**	**12:00**	-	**24:00**
Module 1: Introduction to the role of a System Architect – 5G Cloud RAN	08:00	04:00	12:00	-	24:00
TEL/N6316: Prepare for the delivery of 5G Cloud RAN project NOS Version-1.0 NSQF Level- 6	**66:00**	**94:00**	**36:00**	-	**196:00**
Module 2: Process of preparing for the delivery of 5G Cloud RAN project	66:00	94:00	36:00	-	196:00
TEL/N6317: Use the appropriate hardware platform and environment for 5G Cloud RAN Version-1.0 NSQF Level- 6	**66:00**	**92:00**	**36:00**	-	**194:00**

Module 3: Process of using the appropriate hardware platform and environment for 5G Cloud RAN	66:00	92:00	36:00	-	194:00
TEL/N6318: Manage orchestration, automation and RAN programmability **Version-1.0** **NSQF Level- 6**	**68:00**	**92:00**	**36:00**	-	**196:00**
Module 4: Process of managing orchestration, automation and RAN programmability	68:00	92:00	36:00	-	196:00
TEL/N9103: Implement Effective Interaction at workplace **NOS Version-1.0** **NSQF Level-5**	**16:00**	**24:00**	**00:00**	-	**40:00**
Module 4: Process of implementing Effective Interaction at workplace	16:00	24:00	00:00	-	40:00
TEL/N9104: Manage Work, Resources and Safety at workplace **NOS Version-1.0** **NSQF Level-5**	**16:00**	**24:00**	**00:00**	-	**40:00**
Module 5: Process of Manage Work, Resources and Safety at the workplace	16:00	24:00	00:00	-	40:00
Total Duration	**240:00**	**330:00**	**120:00**	**-**	**690:00**

Module Details

Module 1: Introduction to the role of a System Architect – 5G Cloud RAN
Bridge Module

Terminal Outcomes:

- Discuss the job role of a System Architect – 5G Cloud RAN.
- Explain the scope of work for a System Architect - 5G Cloud RAN.

Duration: 08:00	Duration: 04:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- 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. - 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). - 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.	- 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.
Classroom Aids	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
NA	

Module 2: Process of preparing for the delivery of 5G Cloud RAN project
Mapped to TEL/N6316 v1.0

Terminal Outcomes:

- Explain the importance of determining the scope of work.
- Describe the process of developing strategy and preparing for project delivery.

Duration: 66:00	Duration: 94:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- 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. - Explain the importance and process of determining the interworking and compatibility of Cloud RAN with the existing and installed base. - Describe the process of preparing the estimates for the required resources and getting approval for the project budget. - Describe the process of developing appropriate strategies concerning Cloud delivery, DevOps and SDMC automation according to the organisational goals and standards. - Explain the importance of assisting the infrastructure and DevOps team members concerning the project objectives and delivery. - Describe the process of developing and managing the implementation of appropriate processes for test automation and service quality assurance. - Describe the process of preparing documents explaining RAN call flows, and Key Performance Indicator (KPIs) to be used for solution development. - Describe the process of preparing the service assurance architecture, and test automation architecture documents.	- Demonstrate how to create the design and framework for Cloud, DevOps and Software Development Life Cycle (SDLC) automation. - Show how to analyse the vendor products and develop a multi-vendor RAN architecture as per the organisational requirements. - Demonstrate how to prepare the service assurance architecture, and test automation architecture documents.
Classroom Aids	

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop
Tools, Equipment and Other Requirements
RAN Software, Commercial off-the-shelf (COTS) Server Hardware, Network Interface Cards.

Module 3: Process of using the appropriate hardware platform and environment for 5G Cloud RAN
Mapped to TEL/N6317 v1.0

Terminal Outcomes:

- Demonstrate the process of using the COTS hardware and accelerators
- Demonstrate the process of using the Cloud native architecture.

Duration: 66:00	Duration: 92:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Explain the functioning of centralized and Cloud computing-based Cloud Radio Access Network (RAN), and its relevance and deployment in 5G networks. - 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). - 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. - Explain the benefit of using Cloud RAN architecture for easy and economical deployment and scaling of 5G wireless network 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. - Explain how virtualization of network functions helps the scalability and flexibility of wireless networks, allowing for pooling and dynamic allocation of resources. - Describe the process of software development, including cloud computing and DevOps activities. - Explain the benefits and process of using Infrastructure as Code software tools.	- Demonstrate how to set appropriate server configurations based on workload demands for Distributed Units (DUs). - Demonstrate how to use accelerators to manage layer one pipeline functions and meet the demands of large Multiple Input, Multiple Output (MIMO) radios. - 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. - Demonstrate the process of performing cloud RAN's independent life cycle management following the DevOps principles and CI/CD.

- Explain the use of cloud services offered by different providers, such as Amazon, Azure Cloud Service, GCP, IBM Cloud, etc.

- State various DevOps practices and tools, system monitoring and integration with logging and monitoring tool.

- Describe the process of implementing distributed applications in a container environment (Docker/Kubernetes), and application migration to Cloud.

- Explain the benefits of using cloud infrastructure and Open Application Model (OAM).

- State the challenges concerning server and accelerator selection, capacity dimensioning, power efficiency planning and security planning, and how to overcome them

- Explain the benefits of introducing Cloud Native Service Management and Orchestration (SMO) in parallel to the network to bring RAN programmability.

- Describe 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.

- Describe the process of architecting solutions within a public cloud.

- 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.

- Describe the process of creating DevOps tool chain using DevOps tools.

- Describe the process of automation using python or shell scripting.

- Describe the process of selecting the appropriate hardware platform and the virtualization environment, such as COTS server hardware with processors, NICs and hardware accelerators.

- Describe the process of setting appropriate server configurations based on workload demands for DUs.

- Describe the process of using accelerators to manage layer one pipeline functions to meet the demands of large MIMO radios.

- Describe the process of performing Cloud RAN's independent life cycle management and the relevant DevOps principles and CI/CD.

- Describe the process of using the Cloud native architecture and its software modularity to increase/ scale component RAN micro-services.

- Describe the appropriate measures to achieve application-level reliability with platform abstraction, with simplified operations and maintenance with network automation.

Classroom Aids

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Radio Frequency Units, Non-Real Time RAN Intelligent Controller (Non-RT RIC), Near Real Time RAN Intelligent Controller (Near-RT RIC)

Module 4: Process of managing orchestration, automation and RAN programmability

Mapped to TEL/N6318 v1.0

Terminal Outcomes:

- Describe the process of managing orchestration and automation.
- Describe the process of managing RAN programmability.

Duration: 68:00	Duration: 92:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Describe the process of performing Cloud RAN management to manage hybrid network functions in RAN. - Describe the process of carrying out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries. - 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. - Describe the process of enabling interworking of Cloud RAN with the existing and installed base. - 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.	- 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. - Demonstrate how to use cloud RAN to enable programmable networks and model-driven management and orchestration systems. - Demonstrate the process of carrying out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries. - 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).
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
Open Radio Unit (O-RU), Open Distributed Unit (O-DU), Open Centralized Unit (O-CU), RAN Controller, RF Cable	

Module 5: Process of implementing Effective Interaction at workplace

Mapped to TEL/N9103 v1.0

Terminal Outcomes:

- Explain the importance of interacting effectively with superiors, colleagues and customers.
- Explain the need of respecting differences of gender and ability.

Duration: 16:00	Duration: 24:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- 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, in order to meet quality and time standards as a team. - Describe different methods of communication. - State different types of information that colleagues might need and the importance of providing this information in an appropriate manner. - Explain the importance of helping colleagues with problems, in order to meet quality and time standards as a team. - Describe the organization's policies and procedures for working with colleagues and superior. - Explain the importance of understanding the consequences of gender-based behaviour. - Describe gender-based concepts, issues and legislation - State the organization standards and guidelines to be followed for PwD and knowledge about laws, acts and provisions defined for PwD by the statutory bodies and the right way to use them including various medical conditions associated with PwD	- Demonstrate the process of reporting any unforeseen disruptions or delays to superiors and/or concerned persons. - Show how to communicate information using different techniques such as face-to-face, telephonic and written means. - Demonstrate sensitivity towards gender and person with a disability while communicating.

• Explain the health and safety requirements at a workplace for PwD. • List various rights and duties at a workplace with respect to PwD • Describe the process of recruiting people for a particular job profile w.r.t PwD and gender. • Explain various government / private schemes and benefits available for PwD and information about various institutes working for PwD to enable in providing livelihood opportunities for PwD.	

Classroom Aids

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Personal Protective Equipment, Hygiene Equipment and Materials like Sanitizer, Soap, Mask, etc.

Module 6: Process of Manage Work, Resources and Safety at the workplace
Mapped to NOS TEL/N9104 v1.0

Terminal Outcomes:

- Explain how to manage learning and self-direction.
- Explain the importance of developing critical thinking and problem solving.
- Explain the importance of performing work as per quality standards and maintaining a safe and secure working environment.
- Describe the process of complying with material / energy / electricity conservation practices.

Duration: 16:00	Duration: 24:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Explain the strategies pertinent to the field that can be used to pursue the advancement of skills. - State the key performance indicators for the new tasks. - Describe the feedback processes and formats. - State the timelines and goals as well as their relevance to work allocated. - Explain the importance of quality and timely delivery of the product/service. - State the layout of the workstation and equipment used. - Explain the escalation matrix and its importance, especially in case of emergencies. - Explain various ways of time and cost management. - Explain the rules/regulations for maintaining health and safety at the workplace. - Explain the meaning of hazard, different types of health and safety hazards found in the workplace, risks and threats based on the nature of work. - Describe the procedures to report breaches in health, safety and security. - Explain ways of managing resources	- Demonstrate the process of creating schedules and rosters for the team to ensure they understand individual work requirements. - Demonstrate the process of reporting any hazard outside the individual's authority to the relevant person in line with organizational procedures and warn others who may be affected. - Demonstrate the process of carrying out routine cleaning of tools, machines and equipment.

and material efficiently. • Explain ways to recognize common electrical problems and common practices of conserving electricity.	

Classroom Aids:

Training Kit (Trainer **G**uide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Relevant stationery, First Aid Kit and Equipment used in Medical Emergencies.

Module 7: On-the-Job Training
Mapped to System Architect – 5G Cloud RAN

Mandatory Duration: 120:00	Recommended Duration: 00:00
Location: On-Site	

Terminal Outcomes

1. Explain the process of determining the interworking and compatibility of Cloud RAN with the existing and installed base.

2. Explain the functioning of centralized and Cloud computing-based Cloud Radio Access Network (RAN), and its relevance and deployment in 5G networks.

3. Create the design and framework for Cloud, DevOps and Software Development Life Cycle (SDLC) automation.

4. Prepare the service assurance architecture, and test automation architecture documents.

5. Set appropriate server configurations based on workload demands for Distributed Units (DUs).

6. Use accelerators to manage layer one pipeline functions and meet the demands of large Multiple Input, Multiple Output (MIMO) radios.

7. Use the orchestration systems to manage Physical Network Functions (PNF), Virtual Network Functions (VNF), Cloud Native Network Functions (CNF).

8. Carry out Cloud RAN automation, management and orchestration to deliver 5G network services across various industries.

9. Create schedules and rosters for the team to ensure they understand individual work requirements.

10. Carry out routine cleaning of tools, machines and equipment.

Annexure

Trainer Requirements

Trainer Prerequisites					
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E./B.Tech	Electronics/Telecom /IT and other relevant fields	3	Telecom (5G Cloud RAN)	0	NA	Eligible for ToT Program

Trainer Certification	
Domain Certification	Platform Certification
Certified for the Job Role "**System Architect - 5G Cloud RAN**", mapped to QP: "**TEL/Q6305, v1.0**", Minimum accepted score is 80%.	Certified for the Job Role: "**Trainer**", mapped to the QP: "**MEP/Q2601, v1.0**". Minimum accepted score is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E./B.Tech	Electronics/Telecom/IT and other relevant fields	3	Telecom (5G Cloud RAN)	0	NA	Eligible for ToA Program

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for the Job Role: "**System Architect -5G Cloud RAN**", mapped to QP: "**TEL/Q6305, v1.0**", Minimum accepted score is 80%	Certified for the Job Role: "**Assesso**r", mapped to the Qualification Pack: "**MEP/Q2701, v1.0**", with a minimum score of 80%.

Assessment Strategy

1. Assessment System Overview:
- Batches assigned to the assessment agencies for conducting the assessment on SDSM/SIP or email.
- Assessment agencies send the assessment confirmation to VTP/TC looping SSC.
- Assessment agency deploys the ToA certified Assessor for executing the assessment.
- SSC monitors the assessment process & records.

2. Testing Environment:
- Confirm that the centre is available at the same address as mentioned on SDMS or SIP.
- Check the duration of the training.
- Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
- If the batch size is more than 30, then there should be 2 Assessors.
- Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
- Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
- Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
- Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:
- Question papers created by the Subject Matter Experts (SME).
- Question papers created by the SME verified by the other subject Matter Experts.
- Questions are mapped with NOS and PC.
- Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management.
- Assessor must be ToA certified & trainer must be ToT Certified.
- Assessment agency must follow the assessment guidelines to conduct the assessment.

4. Types of evidence or evidence-gathering protocol:
- Time-stamped & geotagged reporting of the assessor from assessment location.
- Center photographs with signboards and scheme-specific branding.
- Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period.
- Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos.

5. Method of verification or validation:
- Surprise visit to the assessment location.
- Random audit of the batch.

- Random audit of any candidate.

6. Method for assessment documentation, archiving, and access:
- Hard copies of the documents are stored.
- Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage.
- Soft copies of the documents & photographs of the assessment are stored in the Hard Drives.

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	A key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on-site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on-site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work or produce a tangible work output by applying cognitive, affective or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
Terminal Outcome	The terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
NOS	National Occupational Standard (s)
NSQF	National Skills Qualifications Framework
OJT	On-the-job Training
QP	Qualifications Pack
PwD	People with Disability
PPE	Personal Protective Equipment