



**National Competency Standards  
for  
“Computer Networking and Cloud Computing”  
“Jr Programmer/Network Assistant”**

**Level-3**



**National Vocational and Technical Training Commission (NAVTTC),  
Government of Pakistan**



*National Competency Standards for “Computer Networking & Cloud  
Computing”  
“Jr Programmer/Network Assistant”  
Level-3*



## **ACKNOWLEDGEMENT**

National Vocational and Technical Training Commission (NAVTTTC) extends its gratitude and appreciation to representatives of business, industry, academia, government agencies, provincial TEVTAs, sector skill councils and trade associations who spared time and extended their expertise for the development of National Vocational Qualifications for the trade of **Computer Networking and Cloud Computing**. This work would not have been possible without the technical support of the above personnel.

NAVTTTC initiated development of CBT&A based qualifications for 200 traditional / hi-tech trades under the Prime **Minister’s Hunarmand Pakistan Program**, focusing on Development & Standardization of 200 Technical & Vocational Education & Training (TVET) Qualifications. NAVTTTC efforts have received full support from the Ministry of Federal Education and Professional Training which highly facilitated progress under this initiative.

It may not be out of place to mention here that all the experts of Industry, Academia and TVET experts of TEVTAs, BTEs and PVTC work diligently for making this qualification worthy and error free for which all credit goes to them. However, NAVTTTC accepts the responsibility of all the errors and omissions still prevailing in the Qualification document.

It is also noteworthy that development of Skill Standards is a dynamic and ongoing process, and the developed skill standards needs periodic review and updating owing to the constant technological advancements, development in scientific knowledge, and growing experience of implementation at the grass root level as well as the demand of industry. NAVTTTC will ensure to keep the qualifications abreast with the changing demands of both national and international job markets.

**Dr. Nasir Khan,  
Executive Director,  
NAVTTTC**



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## **1. Introduction**

In an enterprise, IT infrastructure is needed to provide employees with the necessary hardware and software to do their job. The key component of the IT infrastructure is the network that connects servers, desktop computers, and mobile devices. The IT infrastructure in an enterprise is a high-cost and high-maintenance unit. It requires expensive hardware and software and skilled IT service staff members to keep it running.

Cloud Computing is the delivery of computing services such as servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet). Cloud computing has become the new trend in delivering business applications and services. The cloud is a cost-effective, flexible, reliable IT infrastructure to support e-commerce and e-learning. Cloud computing can also provide a collaboration platform for developers to participate in an application development project from anywhere and anytime. The cloud resources that are owned and operated by a third-party cloud service provider are termed as public clouds. It delivers computing resources such as servers, software, and storage over the internet. The cloud computing resources that are exclusively used inside a single business or organization are termed as a private cloud. A private cloud may physically be located on the company's on-site datacenter or hosted by a third-party service provider. The combination of public and private clouds, which is bounded together by technology that allows data applications to be shared between them. Hybrid cloud provides flexibility and more deployment options to the business.

Since a cloud can be considered an online IT infrastructure, the network is also a key component of the cloud. Networking theories and practice have been widely used in cloud computing. To understand the usage of the cloud in an enterprise, one has to have a thorough understanding of networking theories and practice.

Being cognizant of this fact, National Vocational & Technical Training Commission (NAVTTTC) developed competency standards for Computer Networking and Cloud Computing under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading development houses and research labs of the country



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## **2. Purpose of the Qualification**

The competency based NVQ has been developed to train the unskilled men and women of Pakistan on the technical and entrepreneurial skills to be employed / self-employed and inevitably set sustainable impact on their lives by enhancing their livelihood income.

The purpose of these qualifications is to set professional standards for upcoming experts, who will serve as key elements enhancing quality of Pakistan’s networking, cloud computing & network security sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competencies of individual in computer networking and cloud computing
- Capacitate the local community and trainers in modern CBT trainings, methodologies and processes as envisaged under NVQF
- Provide flexible pathways and progressions in computer networking and cloud computing
- Enable the trainees to perform their duties in efficient manner
- Establish a standardized and sustainable system of training in Pakistan
- Enabling the youth with greater employment opportunities



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### 3. Date of Validation

The level 5 Computer networking and cloud computing qualification has been validated on 4<sup>th</sup> to 8<sup>th</sup> August, 2020 at PITAC, Lahore, by the qualification validation committee (QVC) members.

### 4. Date of Review

The level 3 in Computer networking and cloud computing qualification has been reviewed on 20<sup>th</sup> Dec 2021, by the qualification validation committee (QVC) members.

### 5. Codes of Qualifications

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification	
Code	Description
061302	National Certificate of level-3 Qualification, in “Computer Networking & Cloud Computing “ <b>Jr Programmer/Network Assistant</b> ”



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## 6. Members of Qualification Development Committee

The following members participated in the qualification development process at PITAC, Lahore.

**Date:** 6<sup>th</sup> to 10<sup>th</sup> July'2020

S#	Name	Designation
1.	Dr. Adnan Noor Mian	Professor – ITU, Lahore
2.	Muhammad Yasir	Deputy Director - NAVTTC
3.	Kashif Babar	Manager – KICS, UET,Lhr
4.	Fahmeed Akram	Manager – KICS, UET,Lhr
5.	Engr. Tayyaba Amin	Sr. Instructor – Tevta, Lahore
6.	Imran Akhtar	Network Lecturer - PUCIT
7.	Mazhar Javed	Assistant Professor - UMT, Lahore
8.	Amir Amin	HOD Electrical – Malaysian Institute
9.	Hafiz M. Ishtiaq Rafique	Asst. Manager IT – ITU, Lahore
10.	Shoaib Bhatti	Manager IT – ITU, Lahore
11.	Ehtasham-ul-Haq	Administrator – LEADS
12.	Ayyaz Ahmed	Research Officer – KICS, UET Lahore
13.	Mushtaq Ahmed	AM (Trainings) – Tevta, Lahore
14.	Faisal Sarwar	PBTE Representative, Lahore
15.	Muhammad Hassaan	GIZ Consultant, Daccum Facilitator



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## 7. Members of Qualification Validation Committee

The following members participated in the qualification development process at PITAC, Lahore.

**Date:** 4<sup>th</sup> to 8<sup>th</sup> August, 2020

S#	Name	Designation
1.	Dr. Adnan Noor Mian	Professor, ITU, Lahore
2.	Muhammad Yasir	Deputy Director - NAVTTC
3.	Hafiz M. Ishtiaq Rafique	Asst. Manager IT – ITU, Lahore
4.	Muhammad Akram	Regional Project Manager, ZTE, Faisalabad
5.	Aemal	Support Engineer, Oracle Pakistan
6.	Sumera Perveen	Instructor, GCTW, Bahawalpur
7.	Kashif Babar	Manager – KICS, UET, Lahore
8.	Muhammad Zubair	Manager Research, KICS, UET, Lahore
9.	Engr. Naseebullah	Lecturer IT – GPI Quetta
10.	Shoaib Bhatti	Manager Network, ITU, Lahore
11.	Hammad Ameer	Corvit System, Lahore
12.	Faisal Sarwar	PBTE Representative, Lahore
13.	Muhammad Hassaan	GIZ Consultant, DACUM Facilitator





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## **8. Entry Requirements**

Entry requirement for this level 3 qualification would be Level 2

## **9. Regulation of the Qualification and schedule of units**

Not Applicable



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## 10. Summary of Competency Standards

Sr No	Competency Standards	NVQF Level	Category	Estimated Hours			
				Th	Pr	Total	Cr Hr
Level 3		Jr Programmer/Network Assistant					
1. Install and configure WAMP		Level 3	Technical	12	39	51	5.1
2. Design Database		Level3	Technical	15	48	63	6.3
3. Create Database in MySQL using WAMP server		Level 3	Technical	15	48	63	6.3
4. Manipulate and Backup Database using Structured Query Language (SQL)		Level 3	Technical	15	69	84	8.4
5. Install/Configure JDK (Java Development Kit)		Level 3	Technical	12	42	54	5.4
6. Install / Configure Eclipse IDE and Run Simple/Program		Level 3	Technical	14	72	86	8.6
7. Create and run GUI program using Java		Level 3	Technical	10	87	97	9.7
8. Create and Run Spring Boot Application		Level 3	Technical	15	57	72	7.2
9. Work in a Team Environment		Level 3	Generic	12	18	30	3
Total				120	480	600	60



## 11. Detail of Qualification and its Competency Standards

### LEVEL 3

#### 061302-A Install and Configure WAMP

**Overview:** After this competency standard candidate will be able to install and configure WAMP.

Competency Unit	Performance Criteria
<b>CU1. Install WAMP server setup</b>	<b>P1.</b> Download latest version of WAMP server setup. <b>P2.</b> Uninstall old version of WAMP server if installed <b>P3.</b> Open the downloaded installer file of WAMP server <b>P4.</b> Complete installation package as per instructional manual.
<b>CU2. Run and Configure WAMP Server</b>	<b>P1.</b> Run WAMP server from program menu <b>P2.</b> Configure WAMP server

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Knowledge and understanding WAMP Server installation
- Knowledge and understanding of LAMP ( Apache, MySQL and PHP)
- Knowledge and understanding of MAMP

### Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	WAMP , LAMP, MAMP server setup



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### **Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Check the green light in the tray menu of the installed WAMP Server.



## 061302-B Design Database

**Overview:** After this competency standard candidate will be able design Database.

Competency Unit	Performance Criteria
<b>CU1. Select database tables and their relationship</b>	<b>P1.</b> List down all the tables required for database <b>P2.</b> List down columns for each table <b>P3.</b> Create primary keys for each table <b>P4.</b> Develop relationship for each table if required <b>P5.</b> Create associate table if required for many to many relationships <b>P6.</b> Assign foreign keys
<b>CU2. Create UML diagram</b>	<b>P1.</b> Draw UML diagram of identified table <b>P2.</b> Make relationship between tables

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Knowledge and understanding of required database (inventory, sales, purchase, office management, store management etc.)
- Basic knowledge of Column and primary keys for each table
- Knowledge and understanding UML diagram of table

### Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	WAMP server

### Critical Evidence(s) Required

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:



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- Check the correctness of relationships
- Check the uniqueness of table/column names



### 061302-C Create Database in MySQL using WAMP server

**Overview:** After this competency standard candidate will be able to create Database in MySQL using WAMP server

Competency Unit	Performance Criteria
<b>CU1. Create database</b>	<b>P1.</b> Start WAMP Server <b>P2.</b> Access PhpMyAdmin command in WAMP server <b>P3.</b> Create new Database by following the creation wizard
<b>CU2. Create Tables</b>	<b>P1.</b> Select the created database <b>P2.</b> Create table with name "orders" by DDL Query. <b>P3.</b> Input number of columns as per given data <b>P4.</b> Create table with name. <b>P5.</b> Create primary keys for tables
<b>CU3. Drop/truncate table</b>	<b>P1.</b> Create a table <b>P2.</b> Insert rows in table <b>P3.</b> Perform TRUNCATE operation on created table <b>P4.</b> Perform DROP operation on create table

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- knowledge and understanding of WAMP server.
- knowledge and understanding of Relational Database
- knowledge and understanding of MySQL
- knowledge and understanding of Structured Query Language (SQL)
- knowledge and understanding of DDL (Data Definition Language)

### Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection



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3. WAMP sever with MySQL

**Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Demonstrate creation and deletion of tables using SQL





## 061302-D Manipulate and Back up Database using Structured Query Language (SQL)

**Overview:** After this competency standard candidate will be able to manipulate Database using structure Query Language.

Competency Unit	Performance Criteria
<b>CU1. Insert data into tables</b>	<b>P1.</b> Select the table to insert data <b>P2.</b> Insert data in row using PhpMyAdmin insert wizard <b>P3.</b> Insert rows by writing SQL query <b>P4.</b> Execute the query and show data inserted
<b>CU2. Display data from DB (database) tables</b>	<b>P1.</b> Perform selection on created table <b>P2.</b> Select all column from table <b>P3.</b> Display selected number of column using select statement <b>P4.</b> Select unique values of column <b>P5.</b> Select records using "where" clause as instructed
<b>CU3. Aggregate Function and Joins</b>	<b>P1.</b> Apply GROUP BY clause for aggregate functions <b>P2.</b> Perform select query and show the total count of status in table <b>P3.</b> Apply "SUM and GROUP BY" clause and join between two tables
<b>CU4. Create backup in SQL format</b>	<b>P1.</b> Select the database for backup. <b>P2.</b> Export database in "SQL" file format.
<b>CU5. Create backup in CSV format</b>	<b>P1.</b> Select the database for backup <b>P2.</b> Export database in "CSV" file format
<b>CU6. Restore backup of required database</b>	<b>P1.</b> Create empty database <b>P2.</b> Restore backup of required database using WAMP server and backup file

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- WAMP server.



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- Database
- MySQL
- Structured Query Language (SQL)
- DML (Data Manipulation Language)
- SQL and CSV file format.
- WAMP server
- Relational Database
- MySQL
- Structured Query Language (SQL)

### **Tools and Equipment**

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	WAMP sever with MySQL

### **Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Demonstrate results of Aggregate Function and Joins
- Backup file is created and downloaded in selected file format (SQL, CSV)



## 061302-E Install / Configure JDK/ Open JDK (Java Development Kit)

**Overview:** After this competency standard candidate will be able to install, configure and upgrade application software on computers.

Competency Unit	Performance Criteria
<b>CU1. Download and install JDK setup</b>	<b>P1.</b> Download JDK version. <b>P2.</b> Save installer file <b>P3.</b> Uninstall old version of Java if installed <b>P4.</b> Perform Complete installation package as per instructional manual
<b>CU2. Set / troubleshoot Environment variable</b>	<b>P1.</b> Include the java JDK path in “Environment Variable” <b>P2.</b> Include the java JRE path in “Environment Variable” <b>P3.</b> Verify Java runtime environment <b>P4.</b> Troubleshoot Java runtime environment configuration

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- JDK history and versions
- Installation steps of JDK
- Knowledge of JRE & JVM

### Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	JDK software setup

### Critical Evidence(s) Required



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The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Demonstrate JAVA commands are running successfully.



## 061302-F Install / Configure Eclipse IDE and Run Simple Programme

**Overview:** After this competency standard candidate will be able to install, configure eclipse IDE for Java program application.

Competency Unit	Performance Criteria
<b>CU1. Install Eclipse IDE in PC</b>	<b>P1.</b> Check the compatibility of JDK according to Eclipse and system <b>P2.</b> Download package for “Eclipse IDE for Java EE Developers” <b>P3.</b> Install Eclipse
<b>CU2. Configure Eclipse</b>	<b>P1.</b> Open Workspace Launcher pop up screen. <b>P2.</b> Provide directory location for projects workspace <b>P3.</b> Add JDK installed directory path under “ Installed JREs” in eclipse
<b>CU3. Create new Java project</b>	<b>P1.</b> Create new java project named using project creation wizard in eclipse <b>P2.</b> Follow the steps in wizard and finish project creation
<b>CU4. Create class in project</b>	<b>P1.</b> Create new class in default package <b>P2.</b> Follow the creation wizard and complete class creation. <b>P3.</b> Add main function in your class.
<b>CU5. Run Programme</b>	<b>P1.</b> Open-source file “Hello.java” in editor panel <b>P2.</b> Write print statement in main function to print “HelloWorld” in eclipse console <b>P3.</b> Build and rectify if any error occurs <b>P4.</b> Run project as java application successfully displaying output
<b>CU6. Write a program to Read/Write file in Java</b>	<b>P1.</b> Create a new java project in Eclipse <b>P2.</b> Write a program in java to create a text file “sample.txt” in working directory <b>P3.</b> Write sample string in file using java file write statements <b>P4.</b> Write a code which can read “sample.txt” and print content on console <b>P5.</b> Run program and verify output result in console

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:



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- IDE & SDK
- Types & versions of Eclipse
- Installation steps of Eclipse
- JRE, JVM & Eclipse
- Java programming
- Java variables, arrays, if-else, loops, functions
- Sorting algorithms
- File input/output streams in Java

### **Tools and Equipment**

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	Java development kit (JDK)
4.	Eclipse software

### **Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Install Eclipse IDE in PC
- Create and Run “HelloWorld” Program in Java
- Display factorial of input number in console
- Display Output of Even/Odd number in console.
- Display Output of sorted array values in console
- Demonstrate “sample.txt” file is created in working directory



## 061302-G Create and run Graphic User Interface (GUI) program using Java

**Overview:** After this competency standard candidate will be able to create and run GUI program using Java

Competency Unit	Performance Criteria
<b>CU1. Configure java plugin in Eclipse</b>	<b>P1.</b> Open Eclipse IDE <b>P2.</b> Install java plugin in Eclipse <b>P3.</b> Complete the installation of new software <b>P4.</b> Restart eclipse
<b>CU2. Create Java application</b>	<b>P1.</b> Open Eclipse IDE <b>P2.</b> Choose Java Project as instructed <b>P3.</b> Enter the Java project details <b>P4.</b> Write the class name as per instructions
<b>CU3. Run application and test result</b>	<b>P1.</b> Write Java code for "HelloWorld" for GUI application <b>P2.</b> Run project as java application <b>P3.</b> Verify output result in console

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Basic java application development.
- Concept of Graphical user interface
- GUI application using java

### Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	JDK 8+
4.	Java library
5.	Eclipse IDE



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### **Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Create and run GUI program using Java





## 061302-H Create and Run Spring Boot Application

**Overview:** After this competency standard candidate will be able to create and run spring boot application.

Competency Unit	Performance Criteria
<b>CU1. Create Spring boot project</b>	<b>P1.</b> Open Spring Initializer URL <b>P2.</b> Create java spring boot web application <b>P3.</b> Add "spring web" in dependency as instructed <b>P4.</b> Download created spring boot project
<b>CU2. Import project In Eclipse</b>	<b>P1.</b> Extract the downloaded project <b>P2.</b> Launch the Eclipse IDE <b>P3.</b> Import the extracted spring boot project in Eclipse as "Existing Maven Project" <b>P4.</b> Perform Maven update and clean install commands on project.
<b>CU3. Create a Resource Representation Class</b>	<b>P1.</b> Create new class and named it as per instruction <b>P2.</b> Add properties in the class as per instructions <b>P3.</b> Create setter and getter method for class properties <b>P4.</b> Create constructors for Class
<b>CU4. Create a Resource Controller</b>	<b>P1.</b> Create spring boot REST Controller Class as per instructions <b>P2.</b> Add HTTP GET method in REST Controller as per instructions
<b>CU5. Build and compile maven project</b>	<b>P1.</b> Perform maven update command on spring boot project <b>P2.</b> Perform maven clean command on project using eclipse <b>P3.</b> Perform maven install command on project using eclipse <b>P4.</b> Compile project successfully using maven in Eclipse
<b>CU6. Run and test application</b>	<b>P1.</b> Run your spring boot project as java application <b>P2.</b> Test REST API by accessing your HTTP GET method

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:



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- Maven.
- Restful APIs
- Spring boot application
- JSON format Jackson library java
- Dependency Injection
- Design pattern (Singleton)
- Javax Annotation Library

### **Tools and Equipment**

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	API testing tool
4.	Maven
5.	Eclipse IDE for J2EE Developer
6.	JDK

### **Critical Evidence(s) Required**

The candidate needs to produce following **Critical Evidence(s)** in order to be competent in this competency standard:

- Build and compile maven project.
- Run and test API



## 061302-I Work in a Team Environment

**Overview:** This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements. It also identifies role and responsibility as a member of a team. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1. Obtain and convey Workplace information</b>	<b>P1.</b> Assess the specific and relevant information from the appropriate sources <b>P2.</b> Convey the information using the appropriate medium and ideas <b>P3.</b> Use appropriate non- verbal communication <b>P4.</b> Identify appropriate lines of communication with supervisors and colleagues <b>P5.</b> Use the defined workplace procedures for storage of information <b>P6.</b> Inform co-workers and superiors about any deviation
<b>CU2. Participate in workplace meetings and discussions</b>	<b>P1.</b> Express your own opinions <b>P2.</b> Listen other’s point of view without interruption <b>P3.</b> Prepare simple questions about workplace procedures
<b>CU3. Identify own role and responsibility within team</b>	<b>P1.</b> Identify the individual role and responsibilities within the team environment. <b>P2.</b> Recognize the roles and responsibility of other team members. <b>P3.</b> Report relationships within team and external to team <b>P4.</b> Share report with co-workers.
<b>CU4. Support the co-workers</b>	<b>P1.</b> Hand over the required materials and tools timely to interfacing team <b>P2.</b> Work together with co-workers in an effective manner <b>P3.</b> Address the problems of co-worker effectively <b>P4.</b> Report to immediate boss

### Knowledge & Understanding:

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:



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- Importance of effective communication
- Different mode of communication
- Types of non-verbal communication
- Mode of communication while operating machines
- Importance of creating cooperative work environment
- Role and objective of team.
- Different Sources of information
- Risk of failure in team work on the project.
- Importance of resolving the co-worker’s problems
- Plan work and organize required resources in coordination with team
- 7Cs of communications

#### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Prepare minutes of meeting
- Prepare questions for meeting
- Prepare a report about daily workplace tasks